

# TEACHING DEPRECIATION TECHNIQUES IN PRINCIPLES OF ACCOUNTING: RECONCILING ACCOUNTING PROCEDURES TO THE INTERNAL REVENUE CODE

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## ABSTRACT

In most principles of accounting textbooks, there is little, if any, information available to reconcile the depreciation calculations shown in the textbooks to the Internal Revenue Code's provisions for depreciation of fixed assets. This can be a disservice to principles students, many of whom are not accounting majors. These students will most likely first encounter depreciation calculations in their personal lives through an activity such as owning rental property or starting a sole proprietorship business. In such cases, the Tax Code, not the accounting techniques shown in most principles of accounting textbooks will govern the calculations for depreciation deductions. Accordingly, the Tax Code's depreciation provisions should be shown and discussed (even if not tested) and connection points where treatments by textbooks and the Tax Code are the same should be pointed out. This will not only alert students to the fact that accounting depreciation procedures in textbooks are not the accepted Tax Code treatment, it will also highlight the relevance of methods used in the textbooks by showing the tie-ins to the current Tax Code's provisions.

## ORGANIZATIONAL SUSTAINABILITY REPORTING AND EFFECT OF GOING GREEN ON SHAREHOLDER VALUE

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Organizational sustainability has seen increased prominence as strategy organizations formulate to enhance overall stakeholder value. "Sustainability" is a term that historically has been included in organization vision statements, but without significant substantive measures to achieve it. With issues beyond bottom line profitability driving organizational culture shifts, the relationships between overall organization sustainability and stakeholder value are worthy of renewed examination.

Sustainability has become a vital part of competitive business strategies for more organizations as they invest in resources to embrace measures which could lead to long-term competitive advantage. Responsiveness to factors which benefit the environment and social performance has been shown to also create stakeholder value, including Deloitte's 2007 White Paper, where "Companies must undertake sustainability-driven enterprise transformation efforts in order to improve financial, environmental, and social performance." Deloitte writes of the concept of the "Wholly Sustainable Enterprise" in which an entity drives stakeholder value throughout the entirety of its activities, including products and services, workforce, workplace functions/processes, and management/governance. In order to create consistent long-term value, the traditional definition of "green principles" is extended to incorporate the entire activity base of the organization.

This "green" approach was expected to promote a longer-term profit perspective compatible with a long-term strategic enterprise sustainability planning approach for the organization, rather than a strictly short-term profit perspective—which may neglect maintenance and jeopardize the firm's human and other resources. Companies that do not pay attention to sustainability issues on multiple dimensions may run the risk of losing a competitive advantage. As noted by Deloitte, companies that are "sustainable" across the entirety of their activity base will drive improved short-term profitability and long-term stakeholder value, while contributing to permanent betterment of social and environmental issues. The argument proceeds further: with the fulfillment of this win-win proposition, these companies will then sustain themselves indefinitely.

According to Burnett, Skousen and Wright (2011) achieving corporate sustainability requires the implementation of management practices that create long-term shareholder value by embracing opportunities and managing economic, environmental, and social development risks. The authors examined the extent to which investors incrementally value the long-run benefits from adoption of eco-effective management. Their results supported their hypothesis that adoption of ecoeffective management results in increases in firms' market valuation, and that those increases persist beyond the current accounting period. As these authors indicate, their study has broad public policy implications with the shift by accountants, managers, and government

policymakers forward to sustainability-- and the reliance on market-based mechanisms to further environmental goals.

Gupta and Benson (2011) examined whether sustainable companies are able to compete effectively in terms of financial performance and attractiveness to investors. They used a sample of firms appearing in the Innovest "Global 100" rankings released annually at the World Economic Forum in Davos, Switzerland. Their empirical results indicated that sustainable companies do not significantly underperform the stock market as a whole. In addition the authors found that these companies are viewed as highly competitive within their industries. We provide a theoretical basis for these results by linking classic corporate strategy and competitive advantage theories to the performance of sustainable enterprises.

Heffes (2010) reported on a survey conducted by Robert Half Management Resources in the fourth-quarter last year which asked financial executives whether they expect their companies' emphasis on green initiatives to increase, decrease or remain the same in the next 12 month. As reported by Heffes, even in an economic downturn the survey found that 68 percent of chief financial officers said they anticipate no changes. Heffes noted that the survey included responses from 1,400 CFOs from a stratified random sample of United States' companies with 20 or more employees. Heffes also reported on another survey, co-sponsored by accounting and consulting firm Crowe Horwath LLP and the Center for Business Excellence (CBE) at Miami University's Farmer School of Business. According to Heffe, this survey found that sustainability initiatives are seen as having significant strategic value to organizations. However the reporting on these initiatives is challenging.

This paper investigates the core concepts of sustainability and the reporting of sustainability in organizations, and analyzes the emerging trends over the past decade. Implications suggest that in paths toward future prosperity, organizations can realize even greater returns following an organization's commitment to sustainability for stakeholder value.

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#### A MODEL FOR SUSTAINABILITY TAXATION

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#### **ABSTRACT**

Creating a sustainable environment has become one of the important issues in the world today. A viable sustainability policy will involve individual, businesses, and nations as they pursue this goal. One component of the sustainability mix is the area of sustainability, or environmental, taxation. This paper outlines seven characteristics of what an effective sustainability taxation model should contain – neutrality, comprehensiveness, coordination, a Pigovian approach, removal of subsidies, social equity, and visibility.

The Tax Code as an Instrument of Economic and Social Policy

When Adam Smith postulated his principles of good tax policy he probably had no conception of the extent to which taxes would be utilized as instruments of economic and social policy. He was of the opinion that the tax system should not attempt "social engineering." According to Smith, a tax system should not attempt to encourage or discourage certain types of behavior. Today, most lists of good tax policy go far beyond Smith's principles of equity, certainty, convenience, and efficiency.

Today, the tax code as an instrument of economic and social policy is taken as a given. Often, these social and economic policies form the overriding factors in tax policy, while the raising of revenues is seen as secondary. In the arena of environmental taxation, credits or deductions for energy-efficient expenditures are commonplace. Congestion fees are levied to discourage use of highways during periods of heavy use. Taxes on natural resources have been levied to help reduce consumption. Carbon and sulfur emissions have been the subject of tax levies. The term "taxes" is not normally restricted to the classic definition of a tax in reference to sustainability taxation, but encompasses any charge or fine levied by a governing authority that seeks to promote a sustainable lifestyle in society. Taxes, fines, charges, and tariffs all come under this umbrella.

## Voluntary Efforts and Government Regulation

In his landmark book, *The Necessary Revolution*, Peter Senge makes a strong case for the fact that our society cannot continue on its present course. Our world, and particularly the United States, is consuming resources at a rate that will not sustain this planet over the long run. Senge, however, is a strong advocate of voluntary initiatives on the part of individuals and organizations to create a sustainable world. He cites a number of instances where environmental organizations and capitalistic corporations have come together to work for the common goal of sustainability. Senge cites, among other situations, a partnership between Coca-Cola and the World Wildlife Fund as they sought to reduce the amount of water consumed by Coca-Cola in its worldwide operations. In

2004, it took 2.7 liters of water to produce a liter of Coke. By 2009, this had been reduced to 2.36 and continues to decrease. [11]

Senge states that partnering across all sectors will be crucial in dealing creatively with all the core sustainability issues. Companies offer market clout and financial resources. NGO's can offer credibility and knowledge of the larger system.

Governments have regulatory power. All will be needed to make any real progress. [11]

Although one can make much of private efforts such as the Coke-WWF partnership, these will never be enough. In order to build a sustainable future, the regulatory power of the government is required. But beyond that, cooperation between nations is essential.

Sustainability is both local and worldwide. Or, to echo a popular phrase, "Think globally, act locally." In one sense, we can all contribute to a sustainable future by our actions. Do we use recyclable grocery bags, reducing the amount of plastic bags consumed? Do we use electricity efficiently in our homes and offices? Do we participate in the local recycling efforts (if such a program is available in your area)? All of this will help assure a sustainable future. But it is not enough. Many communities lack recycling efforts; many individuals continue as if there were an unlimited amount of resources available. Sustainability requires global awareness and action.

We live in a global society where national borders are easily and frequently transcended. Any tax that seeks to promote sustainability in one nation will only be as effective as taxes enacted in other nations. Companies faced with some aspect of environmental tax regulation will be forced to do a cost-benefit analysis. "Is it more advantageous for the company to remain in its present location and pay the tax, or can the company benefit from moving its operations to another nation where there is a lower level of environmental regulation?" Obviously, one partial solution to promote sustainability would be for the "taxing" nation to include tariffs on imports of products manufactured in nations lacking the level of environmental regulation of the "taxing" country. This approach, however, is likely to result in a sustainable tax policy that is a patchwork of assorted laws and regulations, needing adjustment whenever one nation amends its sustainable tax policy. It would likely result in an ineffective global sustainable tax policy with resultant gaps and distortions.

## Components of a Model Sustainability Tax Regime

What is needed for an effective sustainable tax policy is a global approach not unlike the existing Kyoto Protocol. A treaty similar to the Kyoto Protocol could be implemented to coordinate a global approach to sustainable tax policy. The future of the current Kyoto Protocol is in serious doubt as it expired in 2012. Of note is that this treaty lacks the participation of the United States and China, two of the largest producers of greenhouse gases. Canada has withdrawn while Japan and Russia has made no commitments beyond the end of 2012. This leaves only 34 industrialized nations who have signed a second commitment period beyond 2012. It is of note that emerging

economies such as Brazil, China, and India are exempt. However, the accounting rules, mechanisms, and markets developed as a part of the Kyoto Prtocol remain as effective sustainability tools and as models for future agreements. [9] However, this can be an opportunity to craft a new, comprehensive approach to sustainability, incorporating the taxation tool.

Whether a part of a new Kyoto Protocol or some other approach, any such agreement must have certain characteristics to effectively promote sustainability worldwide. No matter what provisions are included in the treaty, or how effectively they are seen to promote sustainability, the effectiveness of the treaty will suffer without fullscale participation by all major nations.

There are seven characteristics that must be addressed in a global tax sustainability effort – neutrality, comprehensiveness, coordination, a Pigovian approach, removal of subsidies, social equity, and visibility.

## 1. Neutrality

Neutrality will be addressed first, as it is a characteristic that should not be present in seeking to achieve a sustainable tax policy. The most common usage of the term "tax neutrality" refers to provisions that conform to an ideal tax system. [7] This is obviously an elusive goal as one cannot expect to obtain agreement on what represents an ideal tax system.

A second meaning of tax neutrality is defined as a tax that does not cause entities to shift economic choice among alternatives. Policymakers frequently depart from this concept in order to achieve specific goals. In promulgating taxes to encourage sustainability, the objective is to alter behavior to achieve sustainability. Therefore, sustainable tax policy should not be neutral. Furman makes the point that these "encouragements" are generally more effective through the use of refundable tax credits rather than deductions" [3]. In this respect, the lack of neutrality is being utilized to encourage desirable activities. In a sustainable tax system, this aspect of tax neutrality is an essential component, as the goal is to encourage sustainable activities.

For example, incentives could be offered for the development of automobiles utilizing a renewable source of fuel. Giving refundable tax credits would encourage startup companies that have no current tax liability. Established companies could utilize the credit to help fund the research and development efforts, reducing their cash flow strain.

Taking this a step further, credits could be offered to consumers to purchase such vehicles. This would have the intent of boosting the sustainable-fuel market to a profitable level.

The concept of revenue neutrality can also come into play in a sustainable tax policy. Many who promote sustainability advocate such an approach. Part of this is the widely publicized double dividend. The double divided is based on the premise that, in addition to an increase in sustainability, environmental taxes generate revenue that could be utilized to reduce other distortionary taxes, improving the overall efficiency of the tax system. A second effect is that non-sustainable activities are reduced. [16]

Although some tax-shifting appears to occur the double dividend does not hold up to a close analysis. Morgenstern states that while environmental taxes do not provide a free lunch, they are a relatively economical approach to addressing sustainability. Environmental benefits associated with a tax shift are generally not costless. [10] The premise of sustainability is to reduce or eliminate the undesirable activities and the externalities. Therefore, taxes from undesirable activities cannot be counted on as a continuing revenue source.

## 2. Comprehensiveness

While the need for a comprehensive sustainable tax policy has been addressed in relation to the need to have all major industrialized nations as participants, there is a second aspect to comprehensiveness. This is probably the most difficult of the characteristics to obtain. A comprehensive sustainable tax policy approach must address all major aspects of sustainability. Failure to do so will result in gaps that nations, companies, and individuals may exploit. There are at least six considerations outlined by Stancil [12] in forming a comprehensive sustainable tax policy.

First, the policy should contain a commitment to raising awareness of sustainability issues. If the public is aware of the purpose for these policies, there is more likely to be a buy-in. This is related to the visibility aspect discussed later, but also involves an educational effort to promote sustainable actions. Oftentimes, we may be unaware that an action is harmful to the environment, or lack knowledge of a viable alternative. In his memoir chronicling his climb to Mt. Everest, Edmund Hillary remarks on actions taken on his expeditions with the comment that "we were not aware of environmental concerns in those years." [6]

Second, the policy should promote efficient use of and conservation of energy, water, and other resources. Elements of this portion of the policy could include incentives for the use of conservation measures, construction of energy-efficient buildings and machinery, and the use of renewable energy resources. Likewise, the policy could contain penalties for non-sustainable use of such natural resources. These incentives and penalties should be of sufficient magnitude to motivate entities to take the desired actions. For example the United States income tax code has provided for certain "residential energy credits." However, they are very limited in dollar amounts, are not permanent parts of the code, and are confusing to the average taxpayer in terms of what is available. As a result, vast numbers of taxpayers have not availed themselves of this credit. Additionally the tax benefit is not sufficient to motivate a change in behavior on a large scale.

Third, the policy should encourage the minimization of solid waste production. This could include incentives to implement the three "R's" – reduce, reuse, and recycle. While many communities have recycling programs, many do not. In addition, those communities that have recycling programs are frequently limited in terms of what can be recycled. In other cases, there is a broad recycling program, but it is not made convenient for individuals to recycle certain types of waste. In Polk County, Florida, there is a fairly comprehensive curbside residential recycling program for cardboard and paper, plastic, metal, and styrofoam. However, hazardous waste must be taken to specific drop-off points and there are limits to the amount that will be accepted. There is a small business hazardous waste recycling program, but the business is charged for the waste being recycled. [15] No incentive exists to encourage recycling.

Closely related is the fourth consideration, that of minimizing hazardous waste and toxic materials. Industries and individuals can take actions that reduce the impact of such materials. Recycling oil, batteries, and other household products can go a long way toward creating a more sustainable future. However, there needs to be both an awareness of the environmental impact of improper use of such waste and a convenient, viable means for disposal.

A related aspect is the management of natural resources. Coca-Cola serves as an example of what can be done in this area. Traditionally little attention was paid by Coke regarding how or where bottling plants got their water with a focus on operational performance efficiency. When their focus shifted to water conservation, they found that it took over 200 liters of water to grow the ingredients that go into a liter of Coke. [11] Through a strategic partnership with the World Wildlife Fund, Coke brought the awareness of water quality issues from the executive suite to the local bottlers. As a result, Coke has reduced its use of water by 20 percent and is still improving. In addition, they are now using a higher percentage of recycled water in their operations. [14]

Comprehensive participation is a fifth factor. As mentioned previously, business, non-government organizations, and government each bring something different to the table. All three are needed to make real progress.

Finally, the policy should provide tax incentives to encourage incorporation of sustainable design and planning principles in development, construction, and operation of infrastructure, grounds, and building. In addition to the more obvious tenet of designing sustainability into buildings, sustainable landscaping practices could be included. Additionally, planning could include a commitment to pedestrian travel, bicycle use and other modes of transportation that promote a sustainable environment. This can include tax incentives for the purchase and use of bicycles, implementing environmentally-friendly transit, and making the use of theses modes of transportation convenient to the public.

#### 3. Coordination

As has been observed, we live in a global society. From a sustainable tax view, the characteristic of coordination has two implications. Companies who are not environmentally responsible may seek to relocate to an area with fewer environmental restrictions. One only needs to take a look at various nations across the globe to realize that there are governments with restrictive environmental policies at one extreme and those with little or no environmental regulation at the other extreme. Those who seek to

avoid environmental restrictions will seek out an area in which they can operate without being "constrained" by the regulations.

Additionally, those areas with fewer environmental restrictions do not exist in isolation. Non-sustainable activities carried on in these areas will have a spillover effect, creating environmental and other difficulties that extend beyond their borders. The wind carries pollution to all parts of the globe. Water pollution impacts the groundwater and downstream areas.

A global sustainable tax agreement, coupled with other global sustainable agreements is the most effective manner to isolate and eliminate non-cooperating nations. When all major industrialized nations have ratified the agreement, the opportunity to shop for a "better" venue will be eliminated or greatly reduced. Tariffs can be levied on exported goods produced through non-sustainable processes in non-participating nations.

Hartzok, et.al. have called for a "Global Resource Agency" to collect user fees for transnational commons – areas outside national boundries including the use of the electromagnetic spectrum. This agency could also be responsible for monitoring these common areas. [5]

Admittedly, there are those who will seek to circumvent environmental restrictions that exist in their locale. Rigid enforcement and severe penalties must be put into effect, or the regulations serve no effect and create a defacto lack of environmental restrictions.

## 4. The Pigovian Approach

The concept of sustainability taxation probably originated in 1920 by the economist A. C. Pigou. Pigou drew a distinction between the private and the social value of economic activities. A modern illustration of this principle would be the construction of a new toll road. The users of the highway enjoy the private benefits of the new road – reduced congestion, quicker trips, and the like. The benefits are reflected in the price users pay to travel the new route. But at the same time, there are social costs. People are displaced as the new road cuts through their neighborhoods. There is an increase in noise from the traffic. Pollution increases. These social costs, or externalities, do not enter into the calculations of the cost of the road but must be included in determining the ultimate worth of any economic activity.

To correct these problems, Pigou advocated government intervention. When the social value of an activity was less than its private value, the authorities should introduce "extraordinary restraints" in the form of user taxes. Pigou also realized that some activities have a social value exceeding the private value. Recreational parks, street lamps, and other "public goods" are difficult projects to charge for, so the free market would not ensure an adequate supply. Pigou suggested "extraordinary encouragements" in the form of government subsidies to help assure an adequate supply of these "public goods" [1]. Pigou's theories form the foundation of today's concept of sustainability taxation.

Pigovian taxes are designed to correct negative externalities that arise in the marketplace. There is no question that negative sustainable actions occur in an open economy. Often, these externalities arise not from malice, but from ignorance or lack of the availability of a sustainable alternative. The issue of plastic bags is a prime example. Consumers have used these bags by the billions, primarily due to the lack of any alternatives. Once other alternatives became available, and the consumer was made aware of the problems created by plastic bags, their use declined. However, their use did not drop to levels most would consider acceptable. Therefore, a Pigovian solution was called for. When governments levied taxes on the use of plastic bags, their use declined significantly. Ireland introduced a thirty-three cent tax per bag and consumption decreased 94 percent in a matter of weeks [9]. Businesses were caught between the issue of paying the bag tax themselves, or passing it on to the consumer. Neither was seen as a workable solution, so alternatives to plastic bags were made available.

## 5. Removal of Subsidies

In somewhat of a "reverse Pigovian" approach there are many tax subsidies in place that damage the environment and hamper sustainability efforts. One study indicated that U. S. Federal subsidies for fossil fuels was \$72.8 billion in the seven-year span beginning in 2002. An additional \$16.8 billion was spent in corn ethanol research. [2] While a step in the right direction, the widespread use of corn as a fuel will have the unintended consequence of creating price distortions as corn becomes an expensive, scarce resource.

These subsidies should be eliminated. Often, they are not seen as harmful, but a careful analysis will indicate that the subsidy does not promote sustainability. Among the culprits in this area are tax preferences for oil, mining, and timber. In the United States, certain vehicles, such as a large sport utility vehicle, are eligible for tax breaks not available for passenger vehicles weighing less than 6,000 pounds. The mortgage interest deduction is even at fault, as it subsidizes home ownership and makes second and larger homes more affordable. Removal of such subsidies and adoption of the Pigovian approach would have the effect of requiring polluters to pay taxes on activities that are not environmentally friendly.

On the other hand subsidies should be given to encourage sustainability. In the same seven-year period cited above, U. S. subsidies for renewal energy amounted to \$29.0 billion, including \$16.8 billion for corn ethanol research. [2] Many of these subsidies are slated for expiration by 2014. While a step in the right direction, the widespread use of corn as a fuel will have the unintended consequence of creating price distortions as corn becomes an expensive, scarce resource. Subsidies to promote environmentally-friendly actions must be undertaken carefully, with attention to any collateral effects.

#### 6. Social Equity

Social equity is another difficult issue in relation to sustainability. Any public policy will affect some members of society more than others. Steps must be taken to

assure that the burden of sustainable taxation does not fall unjustly on low-income households. One suggestion has been to implement sustainable taxes and pay a lump-sum subsidy to certain qualified households. Another approach would apply different rate structures based on household income or exempt some groups from the tax measure. While these approaches are admirable, they do not reach the heart of the matter.

Sustainability taxation is by nature not intended to be a revenue-raising venture. The purpose is to help create a more sustainable society. As environmentally harmful activity decreases, so does the revenue from these sources. If the subsidies are maintained, they become a revenue drain on the government, which will then need to seek a new revenue source. The second suggestion sounds good in theory, but would likely be difficult to implement fairly.

A second aspect of social equity is dealing with third-world nations that are poverty-stricken. In one sense, this is the first aspect of social equity, moved to a national level. These nations are struggling with issues not faced by other, industrialized nations. In the United States, for example, clean water is a given. However, over one billion people in the world do not have clean water. Open fires are common, simply as a means to cook and to stay warm. But the fires still pollute the atmosphere. When survival is an issue, environmental concerns are relegated to lesser importance. In many third world areas, environmentalism is an unknown factor. These problems can be addressed with aid from industrialized nations that will assist these countries in improving their economy through the use of sustainable measures.

## 7. Visibility

Visibility means that taxpayers are aware of what they are pay in a tax. Normally, opponents of big government prefer that taxes be highly visible so that the taxpayer can weigh the tax against the benefits to be received. Others argue that low visibility is desirable because many government services are low visibility. [13] There is some logic to this approach. Looking at the federal government, it is difficult for our minds to apply our payment of a tax to benefits received due to the scope and size of the federal government. Bring it down to a local level and the property tax becomes more visible as we see the purpose of that tax. For example, the property tax bills in Polk County, Florida are itemized. A home with a tax valuation of \$90,000 will pay \$37.93 in county parks taxes. Most taxpayers would probably conclude that the county parks system is worth that amount to them, so the tax is acceptable. On the other hand, tariffs, excise taxes and value-added taxes are embedded in the price of the merchandise and the consumer is unaware of the amount of taxes being paid. Little specific objection is made in regard to these taxes once they are in place.

A tax that is not visible is at a tax that is not understood. As a result, it will not achieve a high level of support. In order to make sustainable taxes visible they should be distinct, non-discriminatory, and defensibly quantified. A tax is distinct when the basis for setting the tax is clear and it is distinguished from other taxes. A non-discriminatory tax should be applied to all similar sources of environmental and social damage. For example, coal, heating oil, and gas should all bear their share of the environmental tax as

each is a source of carbon dioxide and other pollutants. A tax is defensibly quantified if the proceeds from the tax are utilized to combat environmentally harmful activities rather than being viewed as a revenue measure.

With such visibility, the purpose of the taxes as well as the use of the funds is readily apparent. As environmentally-friendly activities are pursued, the incidence of the tax will be reduced for individual entities. Those who persist in environmentally harmful actions will continue to be penalized with the tax.

#### Conclusion

In developing a system of sustainability taxation there are six principles that should guide policy-makers to help assure that the objective is reached:

- 1. Have a clear purpose and definition. What is the objective of the tax?
- 2. Design the tax to complement existing policy instruments, avoiding policy overlap.
- 3. Design the tax with simplicity at its core. It should be more than visible, it should be simple.
- 4. Offer comprehensive communication and advice. Explain it in simple terms.
- 5. Provide certainty to businesses with ample lead time, known rates, and end outcomes specified.
- 6. Ensure a strong ongoing justification. Monitor the tax to ensure that it is having its originally intended effect. [4]

Peter Senge states that we are at the dawn of a new revolution. Organizations, government, and individuals must change how they think and act. We are all responsible for our core sustainability issue of food, water, energy, waste, and toxicity. We all must be part of the solution. Failure to adopt sustainability measures will result in the decline of the world as we now know it. [11] The tax aspect of sustainability is only one cog in the sustainability wheel, but an important one.

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# A Cross-Functional View of Inventory Management, Why Collaboration among Marketing, Finance/Accounting and Operations **Management is Necessary**

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#### **ABSTRACT**

Inventory is a critical asset for most companies, especially those that sell or move finished goods, such as retail stores and distribution centers. Even pure service companies, such as law firms or consulting companies, have inventories of information (data bases) and supplies. Good inventory planning requires a cross-functional approach, involving especially marketing, operations and finance/accounting, the three primary functions of most businesses. Although inventory appears as a single gross dollar amount in a company's Balance Sheet, it has a number of components, as we hope to demonstrate through a series of examples.

#### INTRODUCTION

This paper will illustrate some of the techniques that production planners and inventory mangers use to determine their inventory requirements. The critical link in a company's total planning and budgeting is that marketing provide accurate demand forecasts and accounting incorporate the inventory plan into their cash flow planning. All of the exhibits in this paper are drawn from active spreadsheet models. If this paper is accepted, all of the models will be demonstrated in the presentation at the conference

#### TYPES OF INVENTORY

To illustrate the variety in inventory, several classifications are needed. Inventory can be classified as raw materials (RM), work-in-process (WIP), and finished goods (FG). Raw materials are the purchased items or extracted materials that are converted via the manufacturing process into components and products. Work in process is a good or goods in various stages of completion throughout the manufacturing, or assembly, process. Finished goods are those items on which all manufacturing operations have been completed, and are available for shipment to the customer (APICS Dictionary)

Inventory is sometimes classified as independent items or dependent items. Independent items are usually finished goods and composed of multiple parts, such as an automobile or a computer. Dependent items are those component parts that are used to assemble into a finished unit, or independent item. This classification is used in Material Requirements Planning (MRP) systems, and will be described more fully

Another distinction can be purchased items vs. manufactured items. While this distinction may not be obvious in the final product, it involves different handling for both the production and accounting functions in their planning and costing.

#### **INVENTORY MODELS**

As a general objective, organizations would like to carry enough inventory to meet the demand for their products, but no more than needed because of the cost of carrying inventory. Consequently, there are two basic decisions in managing inventory – how much to order (purchase or manufacturing order quantity) and when to order. We will illustrate some of the more common methods used to make these decisions.

## **Order Quantity**

One of the most widely publicized methods of determining order quantity is the Economic Order Quantity (EOQ) developed by F. W. Harris in 1913 as a means of applying a mathematical approach to the question. The EOQ formula considers two kinds of cost – the cost of placing an order and the cost of carrying, or holding, inventory. As the order quantity increases, the average inventory carried increases, but the cost of placing orders decreases. Conversely, as order quantity decreases, the average inventory carried decreases, but the cost of placing more orders increases. The EOQ is used to find the order quantity that minimizes the sum of ordering and holding costs.

Table 1 shows how the EOQ works. The information needed is shown in cells I1:L3. It includes the annual demand for the item (D), the cost for placing an individual order (S) and the cost for holding a unit of inventory for a year (must be the same period as the demand period). The EOQ is calculated using the formula shown in cells I6:J7, and displayed in cell L4. Formulas for additional calculations are shown in cells I8:L16. The figures on the left-hand side of the table (cells A1:H20) illustrate a systematic search for the EOQ. The order quantity, shown in Column A, is incrementally increased. For each order quantity, average inventory (Column B), holding costs (Column C), number of orders (Column D), ordering costs (Column E), and total costs (Column F) are calculated. In the example, the total costs decrease until the order quantity reaches 160 and then begin to increase. The order quantity of 160 found in the search corresponds to the calculated EOQ. Column H is used to illustrate that the total cost amount is relatively flat near the EOQ. This robustness provides some flexibility in choosing the actual order quantity. For example, if the standard order quantity is in dozens, or a gross of 144, the added cost would be less than 4% more, probably considerably less than trying to get the supplier to send a non-standard quantity.

There is continuing pressure to reduce inventories. The level of cycle inventory is a function of the order quantity. The EOQ equation can be used to focus attention on ways to reduce the EOQ quantity, while retaining the integrity of the model. The equation shows a reduction in demand or ordering costs will reduce the EOQ. Reducing demand is not a realistic option, unless some of the demand is unprofitable. Reducing ordering cost is a more logical objective. Many companies are doing this through computerization of ordering, using blanket orders for ongoing purchases and other forms of simplification. The EOQ equation also shows that an increase in holding costs would also reduce EOQ. While this also may appear illogical, there is one cost element in holding costs that may be reconsidered – that of the cost of obsolescence. If inventory becomes obsolete or unusable quickly, this is a cost to be avoided.

**Table 1. Economic Order Quantity** 

	Economic Order Quantity Example											
		Average	Holding	No. of	Ordering	Total	Minimum	% of				
	Q	Inventory	Costs	Orders	Costs	Costs	Cost	Minimum				
	Α	В	С	D	Е	F	G	Н	I	J	K	L
1	20	10	250	200	16000	16250		406%	Demand	ł	D =	4000
2	40	20	500	100	8000	8500		213%	Orderin	g costs	S =	80
3	60	30	750	67	5333	6083		152%	Holding	costs	H =	25
4	80	40	1000	50	4000	5000		125%			EOQ =	160
5	100	50	1250	40	3200	4450		111%			Total cost:	\$4,000
6	120	60	1500	33	2667	4167		104%	EOQ =	$=\sqrt{\frac{2DS}{H}}$		
7	140	70	1750	29	2286	4036		101%	LOQ -	<sup>−</sup> <b>V</b> H		
8	160	80	2000	25	2000	4000	Minimum	100%	Average	Inventory	Q/2	Col. B
9	180	90	2250	22	1778	4028		101%				
10	200	100	2500	20	1600	4100		103%	No. of Or	ders =	D/Q	Col. D
11	220	110	2750	18	1455	4205		105%				
12	240	120	3000	17	1333	4333		108%	Holding (	Costs =	Q/2*H	Col. C
13	260	130	3250	15	1231	4481		112%				
14	280	140	3500	14	1143	4643		116%	Ordering	cost =	D/Q*S	Col. E
15	300	150	3750	13	1067	4817		120%				
16	320	160	4000	13	1000	5000		125%	Total cos	ts = Q/2*H	+ D/Q*S	Col. F
17	340	170	4250	12	941	5191		130%				
18	360	180	4500	11	889	5389		135%				
19	380	190	4750	11	842	5592		140%				
20	400	200	5000	10	800	5800		145%				

The EOQ calculation does make some assumptions that may preclude its use:

- Only one product is involved
- Annual demand requirements are known
- Demand is spread evenly throughout the year
- Lean time is known and constant
- Each order is received in a single delivery
- There are no quantity discounts (Stevenson 2012, p. 566)

While these assumptions may initially appear restrictive, they apply to a number of products, especially those fitting the JIT, or lean production, environment. In addition, the EOQ can be easily adapted to computerized monitoring and automatic reordering for a large number of items.

## **Order Replenishment**

Table 2 shows another way of arriving at an order quantity and, at the same time, deciding when to reorder. This is a simulation that uses random demand numbers to trigger reorders of a given quantity. For a given order quantity, it is possible to see the number of stock outs that could result. The simulation model makes it possible to vary order quantities and reorder points to minimize stock outs. This simulation model also makes it possible to examine alternatives in order quantity, reorder point, and order lead time. The value of this model is more apparent when demonstrated, which the authors will do at the conference.

**Table 2. Ordering Simulation** 

GIVEN D	ATA				Order Perio			3
					Beginning Ir			100
Demand/I	Period		50		Average Dai	•		51
Periods/Y			365		Average En	•	ry	88
Order Qua	antity (Q)		200	40	Number of C		ORDER	7
Lead Time			1	60	Number of S	Stockouts	STKOUT	2
	Point (ROP)		100		Type of Sys	tem		REORDER
	BEGIN	ORDERS	DAILY	ENDING	INVEN	ORDER	ORDER	
DAY	INVEN	REC'D	DEMAND	INVEN	POSITION	R SYS	P SYS	COMM
1	100		56	44	44	200		ORDER
2	44		47	-3	197			STKOUT
3	-3	200	50	147	147			
4	147		41	107	107			
5	107		53	54	54	200		ORDER
6	54		42	12	212			
7	12	200	56	156	156			
8	156		50	106	106			
9	106		52	54	54	200		ORDER
10	54		58	-4	196			STKOUT
11	-4	200	58	138	138			
12	138		52	86	86	200		ORDER
13	86		50	37	237			
14	37	200	49	188	188			
15	188		55	132	132			
16	132		55	77	77	200		ORDER
17	77		49	28	228			
18	28	200	52	175	175			
19	175		43	133	133			
20	133		51	82	82	200		ORDER
21	82		48	34	234			
22	34	200	52	182	182			
23	182		43	138	138			
24	138		59	79	79	200		ORDER
25	79		55	24	224			
Total		1200	1276	2206	3606	1400		
Average			51	88	144			
Number of orders							7	
Number o	umber of stockouts			2				2

## **Materials Requirements Planning (MRP)**

One of the most widely used planning methodologies is Materials Requirements Planning (MRP). Developed in the 1960s, it is a method of determining when component parts (the dependent items mentioned above) need to be ordered, and how many are needed, in order to complete the final product (the independent item) on time. Table 3 shows an MRP schedule for a simple product (a stool) with six component parts. The demand is irregular – 80 units in Period 7 and 120 units in Period 10. The bottom

part of the table shows when the orders would have to be placed for each component item in order to be able to complete the orders for the stools in the periods desired. Table 3 illustrates an irregular demand pattern. Table 4 shows the result when the demand is regular, 20 units each period, a more desirable situation for the production department.

Table 3. MRP Plan (Irregular Demand)

		PERIOD NUMBER										
		1	2	3	4	5	6	7	8	9	10	TOTAL
Item No.	Stool				On Hand	t			Size Rule	<b>:</b> :	L4L	
Parents:					Lead tim	ne	2		Lot Size:			
					Safety S	Stock			Action:			
Gross Requ	uirements							80			120	200
Scheduled	Receipts											
On hand - N	No action							-80	-80	-80	-200	
Net Require	ements						7	80	r r		120	
Plan Order	Receipt							80			120	200
Plan Order	Release					80			120			200
Projected o	n Hand											
<b>Demand</b>												
Planned O	rder Rel. (units)	1	2	3	4	5	6	7	8	9	10	Total
L4L	Stool					80			120			200
L4L	Frame				80			120				200
L4L	Seat				80			120				200
FOQ	Legs			600			600					1200
FOQ	Cushion			400								400
L4L	Raw Frame		80			120						200
FOQ	Material	1000										1000
	Total	1000	80	1000	160	200	600	240	120			1800
<b>Total Hour</b>	rs Required											
Hours/un	it Item	1	2	3	4	5	6	7	8	9	10	Total
10	Stool					800			1200			2000
7	7 Frame				560			840				1400
5	Seat				400			600				1000
1	Legs			600			600					1200
2	2 Cushion			800								800
2	Raw Frame		160			240						400
1	Material Material	1000										1000
	Total	1000	160	1400	960	1040	600	1440	1200			5600

Table 4. MRP Demand (Regular Demand)

						PERIOD	NUMBER	}				
		1	2	3	4	5	6	7	8	9	10	TOTAL
Item No.	Stool				On Hand	t			Size Rul	le:	L4L	
Parents:					Lead tim	ne	2		Lot Size	:		
					Safety S	Stock			Action:			
Gross Requi	rements	20	20	20	20	20	20	20	20	20	20	200
Scheduled R	teceipts	20	20									40
On hand - No	o action			-20	-40	-60	-80	-100	-120	-140	-160	
Net Requiren	nents			20	20	20	20	20	20	20	20	
Plan Order R	teceipt			20	20	20	20	20	20	20	20	160
Plan Order R	telease	20	20	20	20	20	20	20	20			160
Projected on	Hand											
Demand												
Planned Or	der Rel. (units)	1	2	3	4	5	6	7	8	9	10	Total
L4L	Stool	20	20	20	20	20	20	20	20			160
L4L	Frame	20	20	20	20	20	20	20				140
L4L	Seat	20	20	20	20	20	20	20				140
L4L	Legs	80	80	80	80	80	80					480
L4L	Cushion	20	20	20	20	20	20					120
L4L	Raw Frame	20	20	20	20	20						100
L4L	Material	20	20	20	20							80
	Total	200	200	200	200	180	160	60	20			920
Total Hours	Required											
Hours/unit	ltem	1	2	3	4	5	6	7	8	9	10	Total
10	Stool	200	200	200	200	200	200	200	200			1600
7	Frame	140	140	140	140	140	140	140				980
5	Seat	100	100	100	100	100	100	100				700
1	Legs	80	80	80	80	80	80					480
2	Cushion	40	40	40	40	40	40					240
2	Raw Frame	40	40	40	40	40						200
1	Material	20	20	20	20							80
	Total	620	620	620	620	600	560	440	200			3760

As with the simulation model described in Table 2, the MRP model has more meaning when it can be demonstrated.

## PRODUCTION PLAN

Another approach that is used to determine how much to produce each period is called production planning. Often this would be used for finished assemblies, such as an automobile. This is illustrated in Table 5. The upper part of the table shows a variety of variables to be considered in putting a production plan together.

Starting with a forecast, the production plan is determined and the resultant beginning and ending inventories for each period. Table 5 shows a level production plan (constant amount each period), which results in both backorders (Period 1), a buildup of inventory in Period 3 through 8, and a sell-off of inventory during the remainder of the year.

The Production Plan offers another opportunity of using a "What-If" analysis by varying the production amounts each period to search for the best combination of costs, which include hiring and layoff costs when production varies, as well as inventory carrying and backorder costs. As with previous models, this has more meaning when demonstrated.

**Table 5. Production Plan** 

Input Data															
				Torget o	nding in	(ontor)			Hiring of	note per	w orkor		\$400		
Beginning inventory				Target e	ending in	ventory			ning co	osts per	worker		\$400		
Beginning no. of workers	8	20		Target e	nding w	orkers	20		Firing co	osts per	w orker		\$500		
Hours/w orker/month		160							Regular	w ages ¡	oer hour		\$10		
Overtime hrs/w orker/mo.		20		Machine	capacit	y - units	200		Overtim	e w ages	per hou	ır	\$15		
Labor hours/unit		80		Storage	capacity	/ - units	200		Inventor	y carryir	ng/unit/m	onth	\$20		
									Backord	ler cost/i	unit		\$60		
Trial Solution											Total Co	sts			\$14,300
		1	2	3	4	5	6	7	8	9	10	11	12	1	Total
Beginning inventory	1		-35		10	30	50	85	105	125	115	65	25		
Production	1	50	50	50	50	50	50	50	50	50	50	50	50		600
Demand		85	15	40	30	30	15	30	30	60	100	90	75		600
Ending inventory		-35		10	30	50	85	105	125	115	65	25			
Inventory carrying costs				200	600	1000	1700	2100	2500	2300	1300	500			12200
Backorder costs		2100													2100
Total costs		2100		200	600	1000	1700	2100	2500	2300	1300	500			14300

Production plans, of the type shown in Table 5, can be designed to search for the optimum solution, using tools such as linear programming. This makes it possible to quickly evaluate the negative effects of imposing constraints on the plan, such as no stock outs, maximum inventory level because of storage capacity, tolerable variation in production to avoid layoffs and rehiring, and the like. This type of plan requires the convergence of marketing, finance/accounting and operations if it is to truly reflect the corporate plan.

#### Safety stock

The models described above all assume that demand is known; however, as most companies find out, demand varies and sometimes exceeds the demand forecast. Consequently, most organizations carry some extra inventory, referred to as safety stock. Table 6 shows the effect of demand variability on the quantity of safety stock needed to satisfy different service levels. The left-hand side of the table shows the amount of safety stock increases as the variability of demand increases (from left to right in the table). The right-hand side of the table shows the effect of a single catastrophic demand period (Day 20) in which the demand increases by a multiple of 5, 10, 15, and 20 times the normal demand. In this case, there is no amount of safety stock that will cover the catastrophic demand. An example could be the emergency room of a hospital is faced with a train wreck that requires large amounts of blood. They cannot carry much extra blood in anticipation of a train wreck because of limited shelf life of the blood; therefore, they must arrange for access to quick replenishment of blood from neighboring hospitals or blood banks. Normally, however, companies can rely on the situation on the left-hand side of Table 6 as being representative of their demand patterns. Obviously, if they can reduce demand variability, they can reduce the need for extra safety stock inventory.

**Table 6. Safety Stock Analysis** 

	Dema	and Range	(Units per d	lay)		Dema	22 16 25 19 25 21 19 22 29 20 28 8 19 27 16			
Days	15-25	10-30	5-35	0-40	Days	15-25	10-30	5-35	0-40	
1	20	26	26	4	1	22	16	25	14	
2	23	20	13	3	2	19	25	21	19	
3	24	27	13	20	3	19	22	29	38	
4	22	23	26	26	4	20		8	7	
5	16	14	25	18	5	19	27	16	1	
6	19	19	20	37	6	18	13	6	1	
7	18	22	11	31	7	19	18	10	27	
8	16	20	18	15	8	16	20	31	31	
9	18	15	27	4	9	17	12	12	33	
10	24	11	20	13	10	23	30	28	28	
11	16	13	7	34	11	18	22	24	27	
12	16	28	30	36	12	18	15	21	37	
13	19	19	16	18	13	21	14	20	13	
14	24	19	18	2	14	24	28	34	23	
15	20	27	32	40	15	16	11	10	21	
16	17	11	24	2	16	24	19	17	0	
17	17	18	28	0	17	18	12	19	36	
18	19	26	31	35	18	21	20	29	16	
19	18	11	17	28	19	20	26	10	33	
20	16	25	7	20	20	100	200	300	400	
Average	19	20	20	19	Average	24	29	34	40	
Std Dev.	3	6	8	14	Std Dev.	18	41	63	86	
	Sa	afety Stock	Required			S	afety Stock	Required		
85% SL	3	6	8	14	85% SL	18	41	63	86	
97% SL	6	11	16	27	97% SL	36	81	127	171	
99+%SL	9	17	23	41	99+%SL	54	122	190	257	

#### MICRO-MACTO INVENTORY PLAN

The approaches described above can be used by production planners and inventory managers. At some point, they must develop a plan that can be integrated into a total company plan. Table 7 illustrates a way they could plan, at least for the normal replenishment and safety stock levels of inventory. Table 8 shows a way that Accounting, or Finance, could determine the gross amount of inventory allowable under the total company cash flow plan.

Differences between the two approaches have to be reconciled, if the groups are to proceed with a meaningful plan. This is critical if the plans are to have meaning. This plan provides for cycle inventory and safety stock; other special demands have to be handled separately, as shown in Table 8.

**Table 7. Inventory Plan from Operations** 

		Product 1	Product 2	Product 3	Total	
		TV	Circuit board	Fuse	All Products	
Build-up of Inventory from I	ndividua	al Items				
Sales per Year (units)		500	1,600	6,400	8,500	
Purchase price per unit		\$200.00	\$40.00	\$1.60	\$20.50	Average
Total cost of purchases/year		\$100,000	\$64,000	\$10,240	\$174,240	
Carrying cost/unit/year	25%	\$50.00	\$10.00	\$0.40	\$5.12	Average
Ordering cost per order	20	20.0	20.0	20.0	\$20.00	
Sales per Week (units)	50	10	32	128		
Economic order quantity	EOQ	20	80	800		
Weeks of supply per order		2.0	2.5	6.3		
Safety Stock (weeks)	1	1.0	2.0	4.0		
Safety Stock (units)		10	64	512		
Average Cycle Inventory	2	10	40	400		
Total Average Inventory (units)		20	104	912		
Average Turns		25	15	7	18	
Total Inventory (\$)		\$4,000	\$4,160	\$1,459	\$9,619	By operations

**Table 8. Inventory Plan from Accounting** 

Total Target									
Mark-up on Cost	50%	100%	150%	74%					
Selling Price	\$300.00	\$80.00	\$4.00	\$35.72	Average				
Total Sales per Year	\$150,000	\$128,000	\$25,600	\$303,600					
Cost of Sales	\$100,000	\$64,000	\$10,240	\$174,240					
Gross Margin	\$50,000	\$64,000	\$15,360	\$129,360					
% Gross Margin	33%	50%	60%	43%	Average				
Target Inventory Turns				25.0					
Target Inventory Dollars				\$6,970	By accounting				
Calculated minus Target Inventory				\$2,650					
Inventory turns (units) = annual sales in units / total average inventory in units									
Inventory turns (dollars) = annual cost of sales / total average inventory in dollars									

If the amount of inventory requested by Operations exceeds that considered available by Finance/Accounting (as shown in Table 8, the two possibilities to reduce the amount requested are to reduce the order quantity or to reduce the safety stock.

## OTHER TYPES OF INVENTORY REQUIREMENTS

In addition to the need to plan for normal inventory replenishment, there are at least three additional types of inventory requirements to be considered – seasonal, promotional and hedging. Seasonal inventory is the amount required to satisfy seasonal demand requirements. Promotional inventory is required for new product introductions or major sales promotions. Examples of hedging inventory are the amount required to buy ahead of price increases or phase out of a product.

Table 9 summarizes the inventory categories discussed so far. The Transit inventory is the amount on order but not yet received. Figure 1 shows the information in Table 9 as a graph. The graph displays the fluctuations in inventory level, as different drivers of inventory rise and fall during the year.

**Table 9. Summary of Inventory Requirements** 

	1	2	3	4	5	6	7	8	9	10	11	12
Cycle	20	10	0	20	10	0	20	10	0	20	10	0
Safety	10	10	10	10	10	10	10	10	10	10	10	10
Transit			20			20			20			20
Seasonal					10	20	30	20	10			
Promotion	20	20	0									
Hedging										10	20	30
	50	40	30	30	30	50	60	40	40	40	40	60

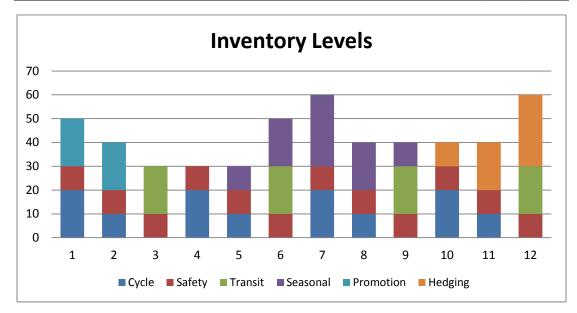


Figure 1. Inventory Levels throughout the Year (data in Table 9)

Figure 1 shows fluctuations in inventory levels throughout the year. Marketing should carefully review the amounts available for promotions, seasonal and safety stock to form their own opinion as to the adequacy of the amounts. Accounting should also review the projections to see that an increase in inventory does not signal a problem, but a preparation for seasonal sales. AT the end of the year, the increase in inventory may mean reduced costs resulting from an "early buy" or protection against a potential shortage at a supplier who will be shifting production to a new facility.

## **CONCLUSIONS**

Inventory is an important asset for most companies. Good inventory planning is critical for retail and wholesale businesses in order to maximize their sales revenue. It is equally important for manufacturing businesses in order to be able to produce the specific products their customers need. Inventory planning should be the result of a systematic and logical approach and not just an arbitrary estimate of the overall needs.

We have shown a number of techniques that operations managers use to plan the amount of inventory they consider necessary. Marketing must provide meaningful forecasts and collaborate with operations management to update and adapt the forecasts with the capability to supply. Finance/accounting must also participate so they recognize the changes in inventory level as necessary for the operations managers to meet the demand forecasts from Marketing. Finance/accounting also must incorporate the inventory plans in their cash flow forecasts.

As previously noted, the examples used in this paper will become more meaningful when they can be demonstrated with live spreadsheets.

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## INVESTIGATION OF THE IMPACT OF USE OF WILEYPLUS ON STUDENTS' LEARNING IN INTRODUCTORY ACCOUNTING COURSES

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#### **ABSTRACT**

This study has investigated the impact of use of WileyPLUS on students' learning in introductory accounting courses through survey of students at the end of the course. The results show a mixed impact, but mostly positive.

#### INTRODUCTION

The introductory accounting courses are important courses for business majors. These courses familiarize students with the process by which accounting information is prepared and used in making business decisions. Due to the importance of the introductory accounting courses, considerable efforts have been devoted to the enrichment of the content of introductory accounting courses (See, for example, Baldwin and Ingram 1991; David et al. 2003; Dreike et al. 1998; Mastilak 2012; Rankine and Stice 1994; and Saudagaran 1996).

In pursuit of enrichment of the learning environment in introductory accounting courses, the author adopted WileyPLUS in order to facilitate the process of collecting, grading, and providing feedback on students' homework. When homework is graded students have more incentive to work the assigned homework and engage in learning process.

WileyPLUS could be setup to allow for one or multiple attempts for working the homework problems. After each attempt the student is informed which part of a problem is answered correctly and which part is not, then allows for a new attempt if the answer is incorrect. The options available to the instructor are as follows:

- 1) Use the same values for all attempts under which numbers in the homework for each attempt stay the same, but each student gets different numbers.
- 2) Use new values for all attempts under which numbers in the problems change for each attempt and each student.
- 3) Use static values for all attempts under which numbers in the problems stay the same for every attempt and every student.

The author used option 2 in the above with three attempts allowed during his experiment of WileyPLUS in two of his introductory accounting courses during the summer of 2012. Students could have access to the solution to the homework after the third attempt.

In addition to collecting and grading homework capability, WileyPLUS has other useful tools for enhancing students' learning that are available to students on a "24 hours a day, 7 days a week" basis. Among those are tutorial videos explaining how to work selected problems, interactive

tutorials, power point slides, access to full online version of the textbook, online grade book accessible to students.

WileyPLUS is developed by John Wiley publishing company for selected textbooks. Access to WileyPLUS requires purchase of a code and registration. Students can purchase the access code directly from Wiley at \$95.00 or from bookstore at \$110 for use in two semesters (accounting one and accounting two). WileyPLUS provides technical support on a 24/7 basis to both the students and the instructors. When it deals with homework and self-evaluation quizzes, WileyPLUS try to facilitate the student's learning by telling the student "what to do", "how to do it", and whether the student is doing it right.

## RESEARCH OBJECTIVE AND METHOD

The author used WileyPLUS in his Principles of Financial Accounting and Principles of Managerial Accounting courses during the summer of 2012. Students were required to work the assigned homework and submit their answers through WileyPLUS. At the end of semester, a survey was administered to investigate the impact of WileyPLUS on students' learning. Fortyseven (47) students completed the survey - 26 students in Financial Accounting and 21 students in Managerial Accounting.

#### RESEARCH RESULTS

The following section displays students' responses to the several of the questions in the survey instrument.

**Q.** How would you rate the impact of completing, submitting, grading, and receiving feedback on your homework by WileyPLUS on your learning in the course?

No Impact at All	13%
Somewhat Positive Impact	34%
Considerable Positive Impact	34%
Significant Positive Impact	11%
Very Significant Positive Impact	9%

Some of the cited reasons for positive impact were as follows:

- 1) The repetition that the student has to go through because of allowing multiple attempts for getting correct answers
- 2) The link to textbook within problems that takes the student to the part of the textbook that is related to the problem
- 3) Shows solutions to homework at the end
- 4) Immediate feedback when the student is wrong while working on the homework problem and allowing the student to learn from mistakes
- 5) It helped to retain what is learned by providing good practice problems

Q. Overall, how would you rate the operational aspects of WileyPLUS in completing, submitting, grading, and receiving feedback on your homework?

Very Poor	<u>Poor</u>	<u>Adequate</u>	Good	Very Good
9%	21%	26%	32%	13%

Some of the cited reasons for "Very Poor" and "Poor" ratings were as follows:

- 1) It makes the student to do problem all over again with new numbers even if student messes up only one part of the problem.
- 2) It does not show step-by-step how to get the right answer using step-by-step examples and practice problems.
- 3) When an answer is wrong no explanation is given. No feedback, you have absolutely no idea what or why you are wrong. By the time you figure it out, you have spent too much time on one problem.
- 4) Inputting answers was difficult, because if you were putting them in wrong, you had NO way of knowing until you have to use all your tries before given an example of how to submit and work the problem.
- Q. Did you use any of the other resources available on WileyPLUS beside homework completion and submission part?

Yes: 74% No: 26%

- Q. What Students Liked the Most about WileyPLUS? Responses in order of priority were as follows:
  - 1) Having access to the textbook online
  - 2) Ease and flexibility for submitting homework
  - 3) Tutorial Videos
  - 4) Interactive Tutorials
  - 5) Link to textbook from homework (by clicking the link the student can view the section of the textbook that deals with topic in the problem)
  - 6) Multiple attempts allowed for homework problems
  - 7) Having access to grade book
  - 8) Access to solution of homework problems after attempts
  - 9) Having access to Power Point Slides
  - 10) Availability of multimedia resources for each chapter
  - 11) Availability of Practice questions
  - 12) Availability of note/flash cards for review
- **Q.** What Students Disliked the Most About WileyPLUS?
  - 1) Changing the numbers in the problems for new attempts
  - 2) Format for submitting answers for certain problems were confusing—rounding issues, ambiguity about how to submit answer, etc.

Q. Overall, how would you rate the resources available on WileyPLUS?

Very Poor	<u>Poor</u>	<u>Adequate</u>	Good	Very Good
0%	11%	32%	28%	30%

Q. Would you recommend the adoption of "WileyPLUS" for completing, submitting, and grading of homework for this course by University?

Additional analysis of the data along with a display of features of WileyPLUS will be provided during the presentation at the conference.

## **LIMITATIONS**

As with most research, the results of this study must be interpreted within the constraints particular to the study. For example, in this study, the author had allowed for three attempts for working the homework problems where the numbers in the problems were changing for each new attempt and each student. This decision appears having significant impact on the students' responses. Furthermore, the result of this study is limited to one university with its particular student body.

#### CONCLUSION

This study has investigated the students' perceptions in regard to the merits of WileyPLUS for students' learning in two introductory accounting courses after using WileyPLUS for one semester during the summer of 2012. The results suggest a mixed experience and viewpoints, but mostly positive. Per students' responses, WileyPLUS has many useful tools for learning such as Tutorial Videos and Interactive Tutorials. In addition, WileyPLUS allows instructors to collect homework online, grade, and report the results to students with minimal work on the instructor. At the same time, responses suggest a need for the improvement of the system in order to make it more user-friendly. The negative experience by some of the students was due to the instructor's selection of multiple attempts option where the numbers in the problems were changing for each new attempt and each student. These types of problems could be avoided easily by the instructor if needed.

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# STUDENT MOTIVATORS AND CONTRIBUTORS TO SUCCESS IN UNDERGRADUATE ACCOUNTING COURSES

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Faculty in B-Schools, generally, and in accounting departments, specifically, are falling under increasing pressures to explain student performance variances, both with respect to longitudinal analysis and also in current cross sections. This paper reviews the recent history of the efforts of university faculty to experiment with various motivators, and also to identify those features which seem to work in application of course learning outcomes in the BBA-Accounting curriculum.

Contrasting the traditional techniques of standard quizzes, homework, and testing with the more recent advent of computerized platforms accompanying leading textbooks is one of several threads. The authors are also interested in examining the underlying psychological and demographic features of the typical student in today's classroom and compare that to those of earlier generations. Finally, the authors propose a package approach that may provide some enlightenment to those faculty who are dealing with difficulties of engaging the student in appropriate ways and striving toward greater assurance of learning and knowledge retention.

## CHALLENGES OF TEACHING BUSINESS INTELLIGENCE

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## **ABSTRACT**

As volume of data increases there is a need to manage and make "sense" out of this voluminous data. In many cases an organization's survival may depend on how a company can differentiate their product and gain competitive advantage. This requires competent people who can manage data and explore it for useful purpose. Universities are offering many courses that can address these issues. Business intelligence (BI) is one such course. BI is a hybrid course which takes contexts from many disciplines, notably information systems, management science and statistics. However teaching BI course to business students is a challenge due to the somewhat technical/analytical nature of the course. Based on our experience we provide some insights that maybe useful for professors planning to teach a BI course to business students.

## **INTRODUCTION**

As competition intensifies it is becoming mandatory for business students to have in-depth knowledge of managing data and extracting information which can be used for decision making. Universities are meeting these demands by including courses like database management, system analysis, business intelligence and information assurance. Database helps with data organization by reducing redundancy and making it more efficient for transactional processing. System analysis explains the techniques of designing systems efficiently by tracking data flow through the processes. Business intelligence course looks for "hidden" treasures in data by exploring data using various management/analytical techniques. Information assurance looks at quality of data. In this paper we focus on BI as part of the MIS curriculum. The paper presents resources and pedagogy used to develop and teach a BI course. In addition it discusses resulting challenges. We provide insights for instructors who are or maybe interested in teaching this course. The next section describes the course and the following section discusses the challenges of developing and teaching this course.

#### **BUSINEE INTELLIGENCE**

defines 1996 ΒI was as early as by Gartner group. Their report said: "By 2000, Information Democracy will emerge in forward-thinking enterprises, with Business Intelligence information and applications available broadly to employees, consultants, customers, suppliers, and the public. The key to thriving in a competitive marketplace is staying ahead of the competition. Making sound business decisions based on accurate and current information takes more than intuition. Data analysis, reporting, and query tools can help business users wade through a sea of data to synthesize valuable information from it - today these tools collectively fall into a category called "Business Intelligence."

Since then many authors, organizations and researchers have provided definitions of BI. According to, searchdatamanagement.techtarget.com, BI is defined as: "Business intelligence (BI) is a broad category of applications and technologies for gathering, storing, analyzing, and providing access to data to help enterprise users make better business decisions" According to Ryan, BI is "... an umbrella term that refers to a variety of software applications used to analyze an organization's raw data. BI as a discipline is made up of several related activities, including data mining, online analytical processing, querying and reporting..." Irrespective of various definitions used they all have following in common:

• BI looks for intelligence in corporate data

- BI, typically uses data mining techniques
- BI, is used for performance enhancement

Data mining techniques are used to extract intelligence from data. BI is outcome of data mining. Data mining and BI are sometimes used synonymously. Before going any further, we will also provide definition of data mining. Many authors have provided definitions of data mining. According to Kurt Thearling, data mining is the "...the extraction of hidden predictive information from large databases, is a powerful new technology with great potential to help companies focus on the most important information in their data warehouses. Data mining tools predict future trends and behaviors, allowing businesses to make proactive, knowledge-driven decisions. The automated, prospective analyses offered by data mining move beyond the analyses of past events provided by retrospective tools typical of decision support systems. Data mining tools can answer business questions that traditionally were too time consuming to resolve. They scour databases for hidden patterns, finding predictive information that experts may miss because it lies outside their expectations". According to SAS institute, data mining is, "...an iterative process of selecting, exploring and modeling large amounts of data to identify meaningful, logical patterns and relationships among key variables. Data mining is used to uncover trends, predict future events and assess the merits of various courses of action...". Once again, we can summarize different definitions as:

- Looking for meaningful reporting and relation
- Typically in data warehouses
- Using management techniques like regression, TREES, Neural networks etc.

#### **BI Course Definition**

Based on above resources and discussions with our advisory board, a workable definition of BI course was developed as, "... the use of information technology to analyze complex information about an organization and its competitors for use in business planning and decision-making. This course details the components of BI systems, important techniques and the critical variables needed to implement an effective BI program. The course takes a managerial approach to Business intelligence, emphasizing BI applications and implementations. The course will involve use of industry standard software packages…".

As evidenced by the above course definition, BI includes database systems with data mining techniques. In addition to knowledge of statistics and information technology (IT), the BI course requires competency in several software. At a minimum it would require following software competencies:

- Database
- Statistical packages
- BI packages

Next section describes the BI course development and experiment at the university and discusses desirable competencies that will prepare students for a successful BI course.

## The BI Course Development

Since BI course goes beyond the norms of traditional MIS courses, it creates a challenge in terms of level of analytical rigor in the course. Many business students are not competent in analytical skills making this a challenging course to teach. In addition, there are numerous challenges in designing a BI course. We summarize some of them as:

- Selection of text book
- Selection of software
- Business student's background

## ANALYSIS AND RESULTS

We experienced numerous challenges in teaching BI course. We summarize our findings as: First, students were not fully prepared for a combination of trio software usage. This would imply better prerequisite requirements.

Second, Students were learning concepts but could not see their real life applications using a proper BI tool.

As is evident from Student performance table 1, students, on the average, performed better on the data warehouse (77%) part compared to data mining part (70%).

Table 1: Student Performance

Topic	Average Out of 100
Data warehouse	77%
Data Mining	70%

Bi is a challenging course to teach to business students and we intend to continue improvements based on student's inputs.

## **CONCLUSION**

Advance in information technology is generating voluminous data which can be tapped for strategic advantage. In the next century only corporations that have the hindsight and intelligence will survive. Everybody will have to be a visionary like Steve job to compete in the next century. One way of getting intelligence is to look at what is already available, the corporate data. Data is generated from many sources, internal or external and must be mined for useful information. Universities are meeting this challenge by offering many courses to business majors that can help in this endeavor. This paper present challenges of developing and teaching such a course to business students.

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Provided on request

# MAXIMIZE THE POTENTIAL PERFORMANCE OF COLLECTIVE INTELLIGENCE

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#### ABSTRACT

By reviewing the history of the field, this paper shows that it can be separated into two distinct time periods, pre and post the last decade in the twentieth century. The divergent event between these two time periods is the technological advancements made during the 1990's. This paper then presents various current research projects that have been recently completed within the field. Through this review of current research projects, the wide range of the field is demonstrated. Then briefly the some of the future directions of research within the field are examined.

#### INTRODUCTION

What do the following groups, the U.S. Army Research Laboratory, Massachusetts Institute of Technology, and Google all have in common? All of these organizations are launching research into Collective Intelligence. The motivations behind each group's research into the field are as varied as the groups themselves. Some are hoping to learn more about sociology and or psychology. Others are attempting to learn how to use the knowledge gained to enhance group productivity, marketing or even advertising schemes. Regardless of each group's individual reasons for studying Collective Intelligence, one thing is clear. A deeper understanding of Collective Intelligence can benefit everyone by helping us to understand how groups of people can work more efficiently together.

Before we begin our discussion about current research and the future direction of the field, we first must understand exactly what Collective Intelligence is. According to Thomas W. Malone, Director of the Massachusetts Institute of Technology Center for Collective Intelligence, the most basic definition is that "collective intelligence is groups of individuals doing things collectively that seem intelligent (Malone, 2006, p. 1)". This however is a very broad definition by anyone's standards. To really understand what exactly collective intelligence is, we have to start our investigation in the history of our civilization.

## Collective Intelligence pre 1999

The human race uses collective intelligence, perhaps better than any other form of life on our planet. Human beings first started to use Collective Intelligence as means merely to survive. The first example of this is the basic family, where parents work together to raise children. This initial group grew when multiple families joined together, at which point they formed the first hunter/gather groups. Eventually these groups joined other groups to form tribes, clans, kingdoms, countries, etc. At each stage in history we can see Collective Intelligence at work, groups of individuals working together doing things collectively that seem intelligent. The two most important historical milestones in Collective Intelligence up until the late 20th century were the formation of governments and companies. Both are groups of individuals working together with group intelligence, which is greater than the sum intelligence of its individual members.

The first scholarly ideas on the subject can be found in William Morton Wheeler's work as an entomologist. In his 1911 book, 'Ants of the American Museum Congo Expedition', he observed that ants can work so closely together that they begin to act as one single organism; he called a "superorganism" (Wheeler, Bequaert, Lang, & Chapin, 1911, p. 7). The next contributor to the topic came only one year later in 1912. Emile Durkheim published the first real findings on Collective Intelligence in humans in his book 'The Elementary Forms of Religious Life'.

"Collective representations are the result of an immense co-operation, which stretches out not only into space but into time as well; to make them, a multitude of minds have associated, united and combined their ideas and sentiments; for them, long generations have accumulated their experience and their knowledge. A special intellectual activity is therefore concentrated in them which is infinitely richer and more complex than that of the individual. (Émile, 1912, p. 14)"

Other academics, scholars, researchers, etc... from all fields of work have contributed to the notion of Collective Intelligence, however their contributions where ancillary. The field was never their primary area of study, nor was it the main focus in their publications. The term Collective Intelligence in fact only emerged recently in 1999. The phrase was coined in Pierre Levy's book, "Collective Intelligence: Mankind's Emerging World in Cyberspace". Pierre Levy defined Collective Intelligence as:

"What is collective intelligence? It is a form of universally distributed intelligence, constantly enhanced, coordinated in real time, and resulting in the effective mobilization of skills. I'll add the following indispensable characteristic to this definition: The basis and goal of collective intelligence is the mutual recognition and enrichment of individuals rather than the cult of fetishized or hypostatized communities. (Levy, 1999, p. 17)"

#### Collective Intelligence post 1999

The fact that the term was coined in 1999 is very important, because during this time period the internet and personal computers were becoming widely adopted by the general public. This drastically accelerated research into Collective Intelligence for two main reasons. The first reason was because the new technology caused an increase in the amount of interaction between people. Another effect was the new ways people were beginning to interact with each other. Of course people have always interacted with each other; however it was now being done more than ever before and in new ways. This gave researchers the added benefit of having definitive data and new forms of interactions to study.

The Massachusetts Institute of Technology has in fact created a whole new department to study the topic. The new department, aptly named the Center for Collective Intelligence, has launched a large array of research projects into the field. All of the projects however are geared towards attempting to help answer the following question on which the department was founded, "How can people and computers be connected so that—collectively—they act more intelligently than any individuals, groups, or computers have ever done before?" (The MIT Center for Collective Intelligence, 2012, p. 1).

Some of the new areas Collective Intelligence manifested in after the technology boom of the late 1990's include business organizations, computer science and artificial intelligence, biology, computer-supported collaborative work and prediction markets. Specifically one of the best examples in business is YourEncore. YourEncore is an e-business, which was started by Eli Lilly and Proctor & Gamble in 2003 as a joint-venture. The joint-venture would earn revenue by helping customers solve complex mathematical, scientific, and engineering problems. Some of the clients who are publicly known to have

benefited from this Collective Intelligence include Boeing, Proctor & Gamble, DuPont, General Mills and Eli Lilly, HSBC, etc.

YourEncore is a perfect example of Collective Intelligence post 1999. It essentially operates as a thinktank; however the company itself does not solve problems. Instead they publish their clients' problems on the YourEncore forums for members to solve. Members consist of individuals who are mainly retired scientists, engineers, mathematicians, market research experts, product developers, etc... Since members are not full-time employees they do not draw a regular paycheck, instead they would be compensated in the form of rewards if their online response solved the client's problems. Rewards range from hundreds to hundreds of thousands of dollars.

What makes YourEncore a perfect example of Collective Intelligence after the technology boom of the 1990's, is because of the way its members collaborate to solve problems. Members are invited to join together through online "Project Communities" which then allows them to collaborate on a sub-forum within the YourEncore website. Group members then collaborate with each other through their Project Community page, wiki's, chat rooms, bulletin boards, etc. (YourEncore, 2012).

The second modern example of Collective Intelligence is in the field of computer science and artificial intelligence. An excellent example of this is that of the NASA "Participatory Exploration" program which had two objectives. The first was to educate the public about the work that NASA is involved in, which they hoped would enhance public support for their other programs. The second objective was to enlist individuals to help them analyze and quantify large volumes of data. This data analysis required only basic common sense, something computers lack, and would save NASA an enormous amount of employee time. The first phase of the program ran from 2000 to 2001 and was dubbed "clickworkers". The Clickworkers project used public volunteers online to help count craters on celestial bodies. These volunteers were not trained scientist but they didn't need to be, this task simply required human perception and common sense. Volunteers were shown images primarily of the Moon and Mars as well as many other celestial bodies. When the volunteer spotted a crater they would outline it in the web based interface. After volunteers finished an image it would be uploaded into NASA database where it would undergo, "statistical corrections aggregate the input into a format of scientific utility for researchers" (NASA, 2010).

Another phase of the project was run in 2007, in which NASA worked with Microsoft to enhance the cartography of the planet Mars. Volunteers in this project did almost the same tasks as they did in the 2001 phase of the project. This time however they were analyzing images of Mars taken from the Mars Reconnaissance Orbiter. These new images not only needed impact craters identified, but also mountain ranges, volcanoes, etc. This project took advantage of the Collective Intelligence of the volunteers by utilizing "crowd sourcing" to accomplish Microwork. Crowd sourcing is a distributed problem-solving and production model. In this model tasks are distributed to groups of both online and offline users. The key fact that distinguishes this technique is that the tasks are outsourced to the general public. In this example NASA used "crowd sourcing" to accomplish Microwork. Microwork is defined as a crowdsourcing technique that involves human users to accomplish tasks that computers cannot do well for a relatively low cost (NASA, 2010).

#### **CURRENT RESEARCH**

Thus far we have addressed what Collective Intelligence is and how it's used in conjunction with advances in modern technology. It's obviously a powerful factor which is used in almost every area of our society. To maximize its benefits, researchers are currently conducting a wide array of research projects. Although the goals of each individual project may seem quite different, they are all working toward developing a deeper understanding of Collective Intelligence. Through which, as mentioned in the

introduction of this report, we can gain a better understanding of how groups can work more efficiently together.

#### Measuring Collective Intelligence

One of the most important projects currently being conducted is by the Massachusetts Institute of Technology Center for Collective Intelligence. The research project entitled 'Measuring Collective Intelligence' is being conducted by members of MIT, Carnegie Mello and Union Collage. The goal of the project, according to its home page is to, "find out whether such an instrument is feasible, and if so, to develop and test it, and then to use it to assess the effectiveness of interventions designed to enhance performance." To accomplish this objective the group plans to, use what's already known about measuring individual intelligence, to then hypothesize ways to measure Collective Intelligence. In order to test these hypotheses, they gathered volunteers and first measured each individual's IQ (Intelligence Quotient). Second, they grouped the volunteers in teams where they completed performance based tasks. After analyzing the data to, "determine whether the striking pattern of correlation in individuals' performance across a wide range of tasks even exists for human-machine groups. Then we will develop statistically validated tests for measuring the key components of collective intelligence in human-machine groups" (Malone, Woolley, Chabris, & Hashmi, 2006).

The second area of focus for this project will be to understand the "active ingredients" that comprise Collective Intelligence. They will use new models, in conjunction with their prior knowledge of group interaction, to examine how human-machine groups process information. Their goal in this area of focus will be to determine the critical components that affect human-machine group performance. To do this they will observe multiple human-machine groups and modify certain critical factors such as the size of the group, the capabilities of the individuals within the group and the communication medium or patterns used by the groups.

In a paper the group submitted in entitled, 'Evidence for a Collective Intelligence Factor in the Performance of Human Groups', they published their results. In total between the two studies, 699 volunteers participated in groups of two to five people. After analyzing the results of the group's performance based tasks, the researchers identified a measure which they claim is representative of a group's general collective intelligence factor. This factor identified as C, surprisingly didn't strongly correlate to the average or maximum intelligence of individual group members. Instead they state that it directly correlates to the, "average social sensitivity of group members, the equality in distribution of conversational turn-taking, and the proportion of females in the group" (Woolley, Chabris, Pentland, Hashmi, & Malone, 2010, p. 5).

#### Collaboration in Wikipedia

Thus far we have talked extensively about how Collective Intelligence has been affected by developments in new technology. Specifically, we have considered the new applications in which Collective Intelligence is used when it's combined with computers and the internet. A new research project on this topic was recently completed in 2012 by Gerald C. Kane and Sam Ransbotham. Both of Boston College, they suggest that the mere presence of IT-enabled collaborative tools such as wikis, blog communities and social networks, "does not ensure effective collaboration or the creation of valuable knowledge. People and organizations must use these tools effectively to generate valuable outcomes" (Kane & Ransbotham, 2012, p. 4).

To prove their hypothesis, the researchers used 16,068 articles written through the collaboration of 40,479 members from the Wikipedia's Medicine Wiki Project. They studied the relationship between the member's collaboration and the quality of articles the members produced. In their examination of the

articles, the pair of researchers also examined whether the quality of the articles produced was associated with the level of group collaboration among its members. Then they investigated whether there was a recursive relationship between the quality levels of the articles in relation to the amount of contributions each article received (Kane & Ransbotham, 2012, p. 6).

The results of the project were quite interesting. They did indeed confirm that the quality of the articles written and the collaboration methods used to write them, were not independent of each other. This proves that information technology is a factor in determining the quantity of Collective Intelligence. They also found a "recursive relationship between information quality and collaboration" (Kane & Ransbotham, 2012, p. 8). Their research also showed that the quality of the articles were affected by the work that members did on other articles in the Wikipedia Medicine Wiki Project database. Furthermore, they found a correlation between articles written with a large number of contributors and the quality of the article. They did also find that the relationship attenuates as time increases.

#### **Collective Creativity**

Another project that is currently underway is being researched by Lixiu Yu of Carnegie Mellon University as well as by Jeffrey Nickerson and Yasuaki Sakamoto, both of The Stevens Institute of Technology. Their project focuses on one aspect of Collective Intelligence, Collective Creativity. The group states that up until the recently, there were only two categories of creativity: individual creativity and group creativity. However, as a result of technological advances during the late 1990's, which led to the emergence of the Collective Intelligence field, a new category called Collective Creativity emerged. Collective Creativity is different from the previous two categories both qualitatively and quantitatively. Furthermore, this new category also differs from the previous two since it occurs in the crowd, which means it is also geographically distributed. This makes it hard organize and analyze. The researchers published the initial findings of their research in a paper entitled, 'Collective Creativity: Where we are and where we might go'. In which they have defined Collective Creativity as the actions of a crowd of individuals, "involving non-routine tasks out of which new ideas emerge" (Yu, Nickerson, & Sakamoto, 2012, p. 1). They also show that this new category occurs in three types of systems: games, contests and networks. Their results also show that there are ways to enhance the products of Collective Creativity, by improving the systems on which it occurs.

One way they state that Collective Creative Systems can be improved is "if tasks that are routine can be automated so that people's attention can be devoted to more complex activities: the system then becomes more powerful" (Yu, Nickerson, & Sakamoto, 2012, p. 6)". They go on to conclude that there is a large amount of design space for Collective Creativity and most of it remains unexplored.

#### **Motivations for Participating**

So why do people participate in all these different types of online systems such as social networks, blogs and wiki's? A research project that was recently completed in 2012 attempted to answer this question. It was conducted by Jon Chamberlain, Udo Kruschwitz and Massimo Poesio, from the University of Essex, School of Computer Science and Electronic Engineering. To answer this question the group choose to study a game called *Phrase Detectives*, which is an online game known as a GWAP or Game with a Purpose. Most GWAPs', including *Phrase Detectives*, is operated on social networking platforms such as Facebook. The purpose of this game is for users to help create an annotated language resource. The motivations for creating games like this are to aggregate data from non-expert players and to get them to make collective decisions. These collective decisions often turn out to be very similar to the decisions that would be made by paid experts (Chamberlain, Kruschwitz, & Poesio, 2012). So why are people motivated to participate?

The group from the University of Essex published the results of their research in a paper entitled, 'Motivations for Participation in Socially Networked Collective Intelligence Systems'. The researchers identified three incentives which motivated people to participate in the game. The first was personal incentives. People were found to have played for personal incentives simply because it was entertaining and interesting. The second motivation for participation was Social Incentives. These incentives were fulfilled by allowing players to compete for the highest scores amongst their friends. Players were found to use their friend's high score records as benchmarks for goal of their next segment of play. Financial Incentives were the third and last motivational factor which encouraged players to participate in the game. Money was rewarded to those who held the top five best scores of the month. This caused the most active tiers of players to participate more and also encouraged other users to start playing the game for the first time. Other results of the group's research found that most of the workload was being completed by only a handful of the thousands of players. This handful of players completed a staggering 70% of the workload. The more casual players only completed about 30% of the workload; however they made up more than 90% of the total number of players. The researchers also found that women are more likely to participate and accounted for 65% of the players (Chamberlain, Kruschwitz, & Poesio, 2012, p. 7).

#### **Crowd Memory**

As discussed earlier in the modern example of Collective Intelligence concerning the NASA "Clickworkers" project, Crowd sourcing is a distributed problem-solving and production model. In this model, tasks are distributed to groups of both online and offline users. The key fact that distinguishes this technique is that the tasks are outsourced to the general public (NASA, 2010). The inherent problem with crowdsourcing is that workers are unreliable since the tasks they accomplish are unpaid, or on a volunteer basis. What this means is that the algorithms that are used in designing crowdsourcing programs are designed in such a way, that they don't take into account the ability of the crowd to learn over time. This results in a limitation of the types of tasks that these crowdsourcing programs can be used on. The main reason why algorithms haven't been designed to take into account this learning factor is simply because researchers don't understand how crowds learn.

In an effort to understand how crowds learn research was recently undertaken by Lasecki, White, Murray, and Bigham, all from The University of Rochester, Department of Computer Science. Their recently published paper entitled, 'Crowd Memory: Learning in the Collective', demonstrated that crowds can and do in fact learn overtime. Most crowd workers learned basic patterns in as quickly as two rounds. Their research then showed that workers retained this knowledge for the duration of the testing, which was greater than 12 hours. Further results also showed that crowds do in fact teach each other. Knowledge is passed from initial workers to second and third generation workers (Lasecki, White, Murray, & Bigham, 2012, p. 7).

The results of this research are quite simple to put into use. First the researchers suggest that crowdsourcing software should be designed to use both an instant messaging system and some sort of automatic recording module. Workers were found to teach each other at a higher rate when there was an instant messaging system in place that facilitated communication between them. Furthermore, this type of instant massager software is very easy to incorporate. Workers were also found to be able to learn extremely quickly, when given the opportunity to view a recorded sequence of tasks that could be replayed at an accelerated speed (Lasecki, White, Murray, & Bigham, 2012, p. 1).

#### Social Influence Effects on the Wisdom of Crowds

Thus far we have established that groups of individuals working together may exhibit Collective Intelligence and we have established that crowd sourcing is a technique to utilize this Collective Intelligence. We have also established that crowds can in fact learn and they teach each other if given the

proper tools. But what affect does social influence have on the wisdom of crowds? In 2012 several Chairs of Systems Designs from ETH Zurich, embarked on a research project to investigate this question. The researchers: Pavlin Mavrodiev, Claudio J. Tessone and Frank Schweitzer decided to "build a minimalist representation of individuals as Brownian particles coupled by means of social influence" (Mavrodiev, Tessone, & Schweitzer, 2012, p. 1). This model was used instead of actual volunteers to study the topic because it would "allow them to draw more fundamental conclusions about the role of social influence" (Mavrodiev, Tessone, & Schweitzer, 2012, p. 2).

The project proved to yield some rather interesting initial results. They found that the best decisions made by groups occurred when, over time, the group aggregated multiple heterogeneous opinions. They also discovered that certain key factors affected the wisdom of the group. For instance, the diversity among the individual makeup of group members has a strong affect. If diversity is to low, the group members tended to all yield to one another's opinions. In contrast if the degree of diversity was large, group member's incorrect opinions would cancel each other out and eventually the correct or a more correct choice was made. Another important factor the group discovered was the independence of opinions (Mavrodiev, Tessone, & Schweitzer, 2012, p. 2). If the degree of independence of decisions was too low, it had the potential to limit: communication, learning and the general social influence process. Another finding of the group's research was rather disappointing. They found that if individual group members learned about the social aspects of other members, they would simply submit to the other member's opinion.

By the end of the project the team of researchers came up with some rather interesting conclusions. They had set out to determine if social influence affected the wisdom of crowds in a negative or positive way. There end result was that in the long run, it depends on a variety of factors. Statistically they determined that if a group's initial opinion was very far from the correct one, the group would benefit from social influence. The opposite is true however for groups that start out with an initial opinion that is accurate. The more social influence in these scenarios, the more detrimental the effect is on the accuracy of the group's decisions (Mavrodiev, Tessone, & Schweitzer, 2012, p. 6).

#### **FUTURE DIRECTIONS**

#### Collective Intelligence in Humans

Juho Salminen of The Lappeenranta University of Technology recently published a paper detailing his research entitled, 'Collective Intelligence in Humans: A literature Review'. In this paper the author recognizes that due to the broad nature of the field, combined with the lack of a common framework used to study it, the field is at risk of becoming fragmented. Salminen further recognizes that "a lack of overarching structure could make the field appear confusing and make it challenging to tie the efforts of different disciplines together in a coherent way" (Salminen, 2012, p. 1). Due to the lack of a common framework or an overarching structure, researchers within the field also may have difficulty understanding what is already known. This problem is compounded when researchers attempt to assess what research has already been done, outside of their area of specialty.

Further study of the completed research projects and various papers led the Salminen to attempt to define a conceptual framework for studying Collective Intelligence in humans. Through extensive study on the research produced within the field, a pattern was recognized. This pattern resulted in Salminen recognizing three distinct levels of abstraction. These levels are the micro-level, macro-level and level of emergence. At the micro-level, the author defines collective intelligence as a combination of three elements of study: psychological, cognitive and behavioral. The macro-level is defined as one that is largely a statistical phenomenon. Finally the 'level of emergence', is identified as a third level that exists between the micro and macro levels (Salminen, 2012, p. 2).

Salminen states that his proposed framework should be used merely as a starting point. He explicitly states that further research is required to fully encompass the field under one unifying framework. Specifically, he points to the fact that more research is required to understand "how micro level actives lead to macro-level behavior in human contexts" (Salminen, 2012, p. 5). An additional area of future research is required to further examine how a multidisciplinary approach and simulations can be used to identify other mechanisms of the cognitive process. Another possible direction future research could take, would be to determine what effect violations of factors that facilitate Collective Intelligence have on systems.

#### **Army Research Laboratory**

As indicated in the introduction of this paper, the Department of Defense is also interested in studying Collective Intelligence. A Future research project will be conducted by the (ARL) Army Research Laboratory under the direction of Dr. Joseph Myers. Although currently in the planning stages, Dr. Joseph Myers has publicized areas in which he intends to conduct research and how it will benefit the United States Military.

The goal of Myers's research will be to "predict performance of an existing group or organization on new and different tasks, to predict performance of a not-yet assembled group on a variety of tasks, to select group members from a population in order to form maximally-functional teams, and eventually to do all of the above for human-machine groups as well" (Myers, 2011). This research will be conducted by funding projects from both The Massachusetts Institute of Technology and Carnage Mellon University. These projects will conduct trials that include soldiers from the Air Defense Artillery group which operates out of The United States Army Fires Center of Excellence in Fort Sill, Oklahoma.

This research indicates an entirely new future direction for the field of Collective Intelligence for two reasons. The first reason is because Collective Intelligence has never been studied in the unique hierarchical social structure that exists in the military. The new dimension of rank and seniority will certainly present new facets of study for each trial. The second reason is because the United States Military is one of the largest users of artificial intelligence, for example the current robotic aircraft drones. If research on Collective Intelligence is applied to robotic drones of this nature, it will open up an entirely new sub-field of research and application. Collective Intelligence is already applied to the field of artificial intelligence but not on the scale the United States military uses.

#### Language Endangerment

Another and quite different future direction for Collective Intelligence is to apply the technique to prevent endangered languages from becoming extinct. Christopher Horsethief from Gonzaga University has embarked on this type of research project. His goal is to determine how Collective Intelligence may be applied to prevent the extinction of the Native American Ktunaxa Language. In a paper recently published he documented how Collective Intelligence has so far been implemented through an online language community. This online language community not only keeps the language alive among its geographically dispersed users, but it also is being used to teach others the language (Horsethief, 2012, p. 1).

Members of this online language community collaborate through the use of common online tools such as blogs, postings, and wiki's as well as member recorded audio files. Horsethief observes that as the members continued to interact with each other, a new network intelligence emerged. This network intelligence enabled components of the network to blueprint themselves and then encouraged self-replication. This result then led to the generated knowledge being passed on to future iterations. This attribute allows a collective memory to develop through the implemented collective intelligence of the online group of members (Horsethief, 2012).

The future direction of research into Collective Intelligence being applied in this application will be to "focus on specific aspects of collective network intelligence" (Horsethief, 2012, p. 7). Specific aspects include the necessity of focusing on identifying the network leaders, small world architectures, and ways to coordinate micro-motives. Furthermore, future directions will also include the necessary investigation of instances where members negotiate cultural identities online as well as how to maximize access to other members of this small community.

#### Predicting the Wisdom of Crowds

An interesting future direction for the field of Collective Intelligence is learning to predict the wisdom of a crowd of online collaborators. A research project currently underway on the topic is being conducted by Haym Hirsh of the Rutgers University Department of Computer Science. The project was started because the only current method to determine the wisdom of an online crowd is to use Crowdsourcing systems. Crowdsourcing systems use votes by crowd members to determine the crowd's wisdom. This type of system has its limitations because it requires the participation of almost every member of the crowd. Due to this large sample size needed it can lead to exceedingly high costs. The difficulty in solving this problem lies in the fact that labelers, or voting crowd members, have a range of "capabilities, motives, knowledge, views personalities, etc." (Ertekin, Hirsh, & Rudin, 2012, p. 1).

In an attempt to overcome this limitation, the researchers are investigating the development of a new algorithm. This algorithm called *CrowdSense* will be able to use previously collected data on the crowd members to determine which members are representative of most other members of the crowd. It will then use dynamic samples of subset labelers to calculate whether it has enough votes to make a decision. If this not be the case, the algorithm will then request more information and continuously update the labeler's level of diversity. Since each individual member of the crowd is assigned a quantified value representative of their similarity to the overall crowd, each members vote cannot be calculated with the same weight. To overcome this problem the algorithm will use a weighted majority vote multiplied by the labelers quality estimate. By doing this the algorithm will place a greater emphasis on the votes of higher quality members (Ertekin, Hirsh, & Rudin, 2012, p. 7).

The initial results showed that *CrowdSense* was in fact able to at times approximate the crowd by using a subset of labelers. *CrowSense* however did show some limitations and further development was recommended by its programmers. The future direction of projects like this, are likely to result in variations of the algorithm. Further results point to the fact that variations of the next generation of algorithms will need to incorporate certain assumptions pertaining to the joint distribution of the crowd members. The statistical independence of labelers is a factor that will need to be incorporated to model larger crowds (Ertekin, Hirsh, & Rudin, 2012, p. 8).

#### **CONCLUSION**

Collective Intelligence is a field that addresses an aspect of cooperation which has been in existence since the first individuals joined together in groups. It deals primarily with the intelligence that is displayed by groups which is greater than the sum intelligence of all individual group members. This paper has defined two distinct periods of Collective Intelligence. The first period was prior to the late 1990's. During this time, study within the field was largely ancillary in nature. Collective Intelligence existed only when people physically came together in groups and was hampered by slow and cumbersome technology. The most prevalent examples in the past include groups comprising families, companies and governments.

Technological advancements in the late 1990's ushered in the second period of Collective Intelligence. During this period, the widespread adoption of personal computers and use of the internet by the general

public created many new facets and dimensions of Collective Intelligence. These new facets and dimensions manifest themselves primarily in technology driven online interactions amongst individuals. Tools provided by the advances in information technology, allowed individuals of vastly different geographies, cultures, languages, specializations, fields of study, etc. to collaborate on a wide array of projects. These new manifestations are responsible for sparking the current explosion of research into various aspects of Collective Intelligence.

The field itself has become so vast and all-encompassing that there is an obvious need to develop a framework for researchers within the field to use. The problem is further compounded by the fact that so many different researchers from varying backgrounds are currently studying Collective Intelligence. If a framework is adopted research into various areas of Collective Intelligence will likely become more efficient. This is largely due to the fact that contributors will be able to clearly asses which areas have already been studied and which have not. Without some sort of framework, the field risks becoming further fragmented than it already is.

Research in the field however is likely to yield a great number of benefits. The potential benefactors from such research include corporations, non-profit organizations, governments, militaries, grass roots organizations, universities, etc. All of these groups can benefit from a greater understanding of Collective Intelligence. By understanding the factors that drive Collective Intelligence it will enable predictions to be made about how well certain groups of individuals will perform. Another benefit will be realized by existing groups. By understanding what factors impact Collective Intelligence the composition of groups can be modified to maximize the potential performance.

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# USE OF INTEGRATED MEDICAL ANALYTICS TO CHARACTERIZE AND QUANTIFY THE COSTS OF UNNECESSARY THYROID FUNCTION TESTING

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"The vast majority of healthcare organizations are data rich and information poor." [1]

#### **ABSTRACT**

The rate of growth in health care expenses experienced over the past several decades cannot be sustained economically in the long term [2]. Analyses of published studies from a large systematic review of the medical literature demonstrated that almost 19% of all clinical laboratory tests were unnecessary [3]. Integrated analytics using medical, operational, and financial data permits identification and quantification of unnecessary medical laboratory testing patterns. We queried multiple large medical data sets combined with operational data and detailed cost information to examine several specific patterns of unnecessary test utilization by health care providers. Medical evidence supports ordering a thyroid stimulating hormone (TSH) test alone as the first test in evaluating thyroid disease followed by other thyroid tests (free thyroxine [FT4] or free triiodothyronine [FT3]) if the original TSH test result is abnormal. However, the TSH test is frequently ordered concurrently with an order for a FT4 and/or FT3 test. There is considerable variation in ordering patterns between health care providers (e.g., at one large hospital system 9% of providers always ordered a TSH and FT4 together, while 46% never ordered the two tests together) as well as notable geographic and provider specialty differences. At one large hospital system, the additional annual cost of concurrently ordering two or more tests is \$24,304; the additional cost at a larger regional hospital system is \$200,208 (variable materials plus direct labor costs). We calculate the cost of additional testing to a large US health care insurance payer to be between \$1.85 million and \$1.91 million per year. Based upon our findings we issued an evidence-based coverage policy recommendation for thyroid function testing for health plan clients to reduce unnecessary laboratory test utilization.

#### **INTRODUCTION**

Health care spending in the United States has increased by almost 100 fold over the last half century. Health care spending was \$27.5 billion in 1960 and \$2,593.5 billion in 2010. Health care expenses now represent 17.9% of gross domestic product compared with 5.2% fifty years earlier. Just over the decade from 2000 through 2010, health care costs have almost doubled and have come to comprise an additional 4% of the US economy [4]. Both government and private sector experts concede that the rate of growth in health care expenses experienced over the past several decades cannot be sustained economically in the long term [2]. For example, at recent annual rates of growth in health care costs and gross domestic product one could project that health care would account for 100% of the US economy sometime around the year 2100 (projection based on data published by CMS) [4].

Annual expenditures for clinical laboratory testing in the United States are approximately \$69.5 billion (projected for 2012) [5]. Clinical laboratory testing represents approximately 2.4% of all health care expenditures (calculated) [4][6]. Perhaps of even greater importance, the results of clinical laboratory testing contribute significantly to medical decision making. Therefore, clinical laboratory results also drive downstream costs of follow-up diagnostic and prognostic testing as well as medications and other therapeutic interventions [7][8]. In recent years there has been a significant increase in labor productivity in the clinical laboratory. Nevertheless the cost of laboratory testing has continued to increase due to rising unit costs for reagents, materials, and labor [9]. The overutilization of diagnostic tests, however, is the more important driver of higher costs [10].

Notwithstanding the informational value of laboratory testing, many pathologists and other physicians have suspected for quite some time that a significant number of laboratory tests contribute very little, if any, value to patient diagnosis or therapy. Patient-weighted analyses of published studies from one large systematic review of the medical literature (>40 studies meeting inclusion criteria) demonstrated conservatively that almost 19% of all tests were unnecessary based on explicit *a priori* criteria. Using implicit criteria (e.g., group of cardiologists determining the need for cardiac marker testing based on information available to the ordering

physician at the time the test was ordered) the percentage of unnecessary tests jumped to 58% [3].

Addressing the causes of laboratory test overutilization is complicated by two factors. First, there are thousands of tests, test combinations, and clinical scenarios in which tests may be ordered. For example, a typical large hospital laboratory offers between 500 and 1,000 different tests. Regional and national reference laboratories usually have a larger test menu of more than 1,500 tests. The number of relevant test combinations would be even larger. Furthermore, since the same tests are often ordered to address different diagnostic questions depending on the clinical scenario, the number of clinical scenario-test combinations would also be very large. Second, most health care institutions do not have adequate cost accounting systems to determine the financial impact of overutilization. Accurate cost accounting, such as activity-based cost accounting, is necessary to carry out medical cost-effectiveness analyses (CEA) allowing decision makers to optimize patient outcomes at the lowest cost [11]. Unfortunately, most US health care systems still do not fully employ the best cost accounting methods. For example, a 2005 survey of health care chief financial officers found that 52% of respondents reported using any cost accounting system; furthermore, while 71.8% of hospital financial executives were aware of activity-based cost accounting, only 4.7% reported its implementation in their health care system [12].

There are many different clinical testing scenarios that one might evaluate to optimize potential cost effectiveness. An analysis of thyroid function testing would be particularly useful because, 1) it is one of the more common testing scenarios encountered in the clinical laboratory, and 2) functional diagnoses are essentially defined by the test results [13][14]. Medical evidence supports ordering a thyroid stimulating hormone (TSH) test alone as the first test in evaluating thyroid disease followed by other thyroid tests (free thyroxine [FT4] or free triiodothyronine [FT3]) if the original TSH test result is abnormal (Figure 1) [15][16][17][18]. Nevertheless, the TSH test is frequently ordered concurrently with an order for a FT4 and/or FT3 test. Medical data mining combined with granular cost accounting data would identify testing patterns and quantify the cost of unnecessary thyroid function testing. Such integrated

medical analytics (IMA) would be important for health care decision makers to prioritize and address problems of unnecessary test utilization.

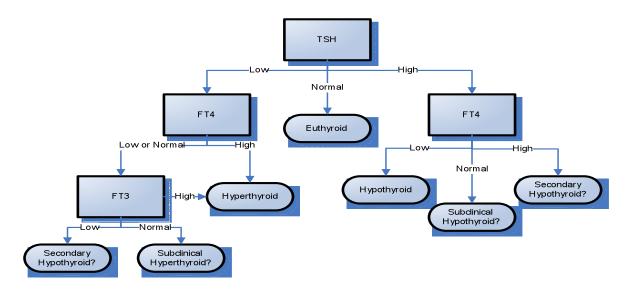


FIGURE 1: Proposed thyroid function testing algorithm.

#### **METHODS**

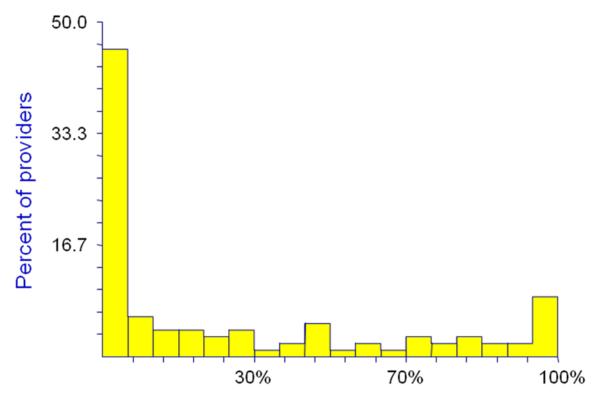
We queried relational data marts that include medical, operational, and cost information from hospital systems in Mississippi and New Mexico. To supplement query findings, we also obtained aggregate utilization parameters obtained using similar queries from a hospital system in Utah. Finally, we also queried the claims and billing database of a large private national health care insurer.

We first determined the number of FT4 tests carried out when the TSH test result was normal (within the established reference range). We stratified query results by ordering health care provider as well as provider medical specialty. We calculated variable throughput (reagents, controls, calibrators) cost, labor cost, as well as allocated overhead costs for FT4 testing at each hospital system. Claims payments for TSH and FT4/ FT3 were obtained from the large private insurer database.

#### **RESULTS**

There was considerable variation in ordering patterns among individual health care providers. For example, in one large health care network 9% of providers always ordered TSH and FT4 tests on the same patient sample, while 46% never ordered the two tests together (Figure 2). There was considerable variability among physicians with different specialty training. For example, endocrinologists in one hospital system ordered the two tests together 34% of the time while pediatricians submitted concurrent orders 80% of the time (Table 1). In a different hospital system, the percentage of concurrent orders ranged from 1% (emergency medicine) to 61% (endocrinology).

FIGURE 2. Breakdown by Provider Ordering Patterns. Proportion of all requisitions for TSH with concurrent order for free T4 by individual provider. Percent of all individual providers never ordering the two tests together (leftmost bar, 46% of providers), always ordering the two tests together (rightmost bar, 9% of providers), or some proportion in between (45% of providers).



Proportion of time TSH and FT4 are ordered together

In addition, there is variability between providers of the same specialty working in different health care systems that are geographically separated. The greatest specialty differences between providers in two geographically-separated multi-hospital systems were family medicine (45% vs. 18%), emergency medicine (50% vs. 1%), and endocrinology (34% vs. 61%). It is worth noting that system 2 has an option for the provider to order a TSH with reflex FT4 (FT4 only if the TSH is abnormal). Consequently, the lower percentage of concurrent test ordering for hospital system 2 likely reflects this additional option that is unavailable in system 1.

<u>TABLE 1. Proportion of TSH and free T4 concurrent orders for two multi-hospital</u> <u>systems stratified by provider specialty.</u>

Specialty (Type of Practitioner)	System 1*	System 2*
Family Practice	45%	18%
General Internal Medicine	37%	16%
Emergency Medicine	50%	1%
Physician Assistant	N/A	26%
OB/GYN	56%	21%
Endocrinology	34%	61%
Nurse Midwife	64%	N/A
Family Medicine Nurse Practitioner	N/A	26%
Pediatrics	80%	N/A
Other	48%	28%
Unknown	37%	29%

<sup>\*</sup> Each hospital system has > 10 hospitals (ranging from 35 beds to > 500 beds) and multiple clinics. The systems are located in different US states

At one large hospital system, the additional total annual cost for unnecessary FT4 testing was \$37,391; the additional total annual cost at a larger regional hospital system was \$293,650. When limited to variable and technical labor costs, annual savings are \$24,304 and \$200,208, respectively. The latter figures are probably more representative of cost savings that could be realized in the short term given the propensity of fixed overhead costs to remain unchanged with small changes in total test volume. At the individual health care provider level, annual costs (throughput plus technical labor cost) for unnecessary FT4 testing among the 20 highest cost providers in one hospital system ranged from \$1,451 to \$4,160 (Table 2). These additional costs are largely borne as claims payments by health care insurers (government and private).

Using the percentage of all TSH test results that are abnormal at two hospital systems we calculated payments to cover unnecessary FT4 testing for a large US health care insurance company to be between \$1.85 million and \$1.91 million per year.

TABLE 2. Cost breakdown of thyroid function testing for the 20 highest cost providers.

Provider	TSH <sup>1</sup>	FT4 nl TSH <sup>2</sup>	Pct	Throughput <sup>3</sup>	Vbl + Labor <sup>4</sup>	Total cost <sup>5</sup>
Α	2,416	1,594	65.98%	\$3,323	\$4,160	\$6,102
В	1,708	1,300	76.11%	\$2,711	\$3,393	\$4,977
С	1,918	1,260	65.69%	\$2,627	\$3,289	\$4,823
D	1,352	1,138	84.17%	\$2,373	\$2,970	\$4,356
E	6,024	1,126	18.69%	\$2,348	\$2,939	\$4,310
F	1,284	1,030	80.22%	\$2,148	\$2,688	\$3,943
G	1,758	998	56.77%	\$2,081	\$2,605	\$3,820
Н	1,304	846	64.88%	\$1,764	\$2,208	\$3,239
1	1,232	798	64.77%	\$1,664	\$2,083	\$3,055
J	878	760	86.56%	\$1,585	\$1,984	\$2,909
K	818	734	89.73%	\$1,530	\$1,916	\$2,810
L	866	686	79.21%	\$1,430	\$1,790	\$2,626
M	796	676	84.92%	\$1,409	\$1,764	\$2,588
N	772	664	86.01%	\$1,384	\$1,733	\$2,542
0	872	656	75.23%	\$1,368	\$1,712	\$2,511
Р	732	612	83.61%	\$1,276	\$1,597	\$2,343
Q	792	610	77.02%	\$1,272	\$1,592	\$2,335
R	708	592	83.62%	\$1,234	\$1,545	\$2,266
S	724	560	77.35%	\$1,168	\$1,462	\$2,144
Т	640	556	86.88%	\$1,159	\$1,451	\$2,128
•••	•••	•••				
All Provide	ers228,818	76,708	33.52%	\$159,936	\$200,208	\$293,650

<sup>&</sup>lt;sup>1</sup>Total TSH orders

#### **DISCUSSION**

The cost of unnecessary testing is substantial to the U.S. health care system. Integrated analytics using medical, operational, and financial data permits identification and quantification of unnecessary medical laboratory testing patterns. Knowledge obtained through integrated medical analyses allows providers, hospitals, clinics, and payers to focus on strategies to reduce unnecessary resource utilization and quantify the cost effectiveness of diagnostic testing [19].

<sup>&</sup>lt;sup>2</sup>FT4 ordered given that the TSH test result was normal (i.e., within the reference range)

<sup>&</sup>lt;sup>3</sup>Throughput costs (variable materials, controls, calibrators)

<sup>&</sup>lt;sup>4</sup>Variable throughput costs plus labor costs

<sup>&</sup>lt;sup>5</sup>Total costs including overhead costs

Within the narrow confines of thyroid function testing, we identified considerable variability in test ordering patterns among health care providers, provider specialties, and geographically-separated health care systems. Another European study also found significant differences in laboratory test utilization between hospitals [20]. While other studies have estimated the extent of unnecessary testing, none have calculated detailed cost information and used specific laboratory test results to accurately estimate costs of specific testing patterns [2]. Additional costs from unnecessary thyroid function tests can be substantial within a hospital system; in fact, test ordering patterns of individual providers can add well over \$1,000 per year in unnecessary thyroid testing costs (excluding fixed overhead costs). Naturally, as other tests and clinical scenarios are evaluated the potential cost savings are likely to be much higher.

A recent survey of 95 providers asked their motivation to promote business intelligence (BI) initiatives within their organization; 80% of respondents said BI was needed to manage rising costs and 46% said it was needed to improve medical outcomes [1]. Integrated medical analytics includes and builds upon customary BI activities through joining more traditional financial, operational, and marketing data with diagnostic, prognostic, and therapeutic data.

Identification of some unnecessary utilization patterns has already led to efforts to reduce costs [21][22][23]. Based upon our findings we drafted and issued an evidence-based coverage policy recommendation for thyroid function testing to health plan clients to reduce unnecessary laboratory test utilization [24].

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### A FRONTIER ANALYSIS APPROACH TO DYNAMIC CONCEPTUAL CORPORATE COMPETITIVE MAPS

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#### **ABSTRACT**

A framework for developing conceptual corporate competitive maps by using overall company financial performance to firstly assess its position within an industrial landscape, and then identifying opportunities for competitive advantages and/or threats is presented. The methodology of *frontier analysis* or *data envelopment analysis* is used in order to measure the performance effectiveness of each firm. Insights into potential disruptive strategies and effective barrier of entries are finally provided through the visualization that the competitive map offers. This study was based on the analysis of the financial results of fifty seven Fortune500 companies for the preliminary work.

#### INTRODUCTION

The need for ranking and benchmarking commercial firms is a trade mark of the contemporary competitive market economy. Companies are evaluated on their performance in relation to their peers. Such approach affects every aspect of the firms' activities and behavior in the society that achieving desirable ranking took a primordial place on the firm's agenda. In parallel, several ranking schemes were elaborated by academics and industry consortia. A diverse range of methodologies are used in those ranking systems. Most of them are based on third party assessment and public perception. This paper offers a different approach by mapping such performances with the objective of identifying each firm within its competitive landscape and suggesting the dynamic strategic changes that should/may occur if firms want to improve their current situation. This paper proposal describes the model briefly, then presents the preliminary results, and concludes with a very brief discussion of the significance of those results.

#### THE MODEL

While several options are available for conducting an objective comparison of firms performance as a basis of a competitive mapping, this study has deliberately chosen to use the non-parametric, mathematical programming-based technique of Data Envelopment Analysis as a benchmarking model. The chosen model is also based on the economics concept of Pareto optimality, which considers a given decision making unit (DMU) to be Pareto efficient if it can yield a higher level of output compared to other DMUs, which require more input for the same results. The first formal development of DEA was proposed Charnes et al (1978) to evaluate a productivity model, based on the traditional single input/output measure of efficiency. Later developments allowed an extensive and more effective application of DEA analyses, such as studies on supply

chain management, banking, vendor selection, hospital performance, which all proved to be highly useful in making improvement decisions.

The specific benchmarking DEA model proposed herein is based on firms performance. As DEA affords the use of end of the year financial performance to assess the efficiency of those firms, The analysis was conducted on a sample population where the input (managerial decisions) and the output (financial performance/outcome) are clear. The model follows the traditional approach in DEA; ie. The objective is to assess the comparative technical efficiency of the DMUs. DEA is a technique that measures the relative efficiency of DMUs with multiple inputs and outputs with no obvious production function to aggregate the data in its entirety. It is a mathematical programming technique that constructs frontiers and measurement of efficiency relative to the constructed frontiers. In practice, it looks at a cohort and compares the productivity of individual members of that cohort against the expected aggregate productivity of the set. This helps uncover the relative efficiency of individual unit. As a benchmarking tool, DEA technique provides valuable information on the overall unit performance. It has been widely used in many areas for the purpose of developing comparative metrics.

In this study, our DMU is the individual firm, which uses inputs  $x \in R^{N_+}$  to produce outputs  $y \in R^{M_+}$ . The resulting outcome will be used as a benchmark measure against similar DMUs deemed the best in a sample of i = 1, ..., i DMUs. Given that each firm is different from each other in term of size and other managerial factors, weights  $w_i$  will be attached to each of them in order to solve the following general model:

$$\begin{aligned} & \operatorname{Min}_{v,\mu} v^{\mathsf{T}} \mathbf{x}_0 / \mu^{\mathsf{T}} \mathbf{y}_0 \\ & \operatorname{Subject} \text{ to } v^{\mathsf{T}} \mathbf{x}_i / \mu^{\mathsf{T}} \mathbf{y}_i {\geq} 1, \, \mathbf{i} {=} 1, \, \dots, \mathbf{i} \\ & v, \mu \geq 0 \end{aligned}$$

General data envelopment analysis model, adapted from Charnes et al, 1978

The above model was adapted to focus on firm efficiency (E). In the proposed model, E is defined as the efficiency index, which is based on the firm's financial signature (Prince, 2005). Specifically, it represents its ability to (1) utilize available resources (=input), to (2) generate values for the firm or its products (=output). Therefore, in the proposed model, E is algebreaically defined as:

It is important to note that in using E for the purpose of benchmarking through DEA model, the logic of the optimization model is to determine whether a cohort of firms can achieve the same or even more financial results as the targeted firm while requiring less resource. If better results are obtained with less resources, then the firm being assessed is judged to be relatively inefficient and ranks lower than the members of the cohort. Therefore, the objective function for the benchmarking DEA can be finally written as:

#### Minimize E

While the constraint function will be based on (1) input, (2) output, and (3) weight requirements. The general form of each constraint function will be written as:

The following types of input and output were identified for the purpose of integrating the financial signature measure into the optimization model:

Input	Output
Current ratio (CR) as a traditional measure of	Revenue per share (RPS): calculated as (Net
short-term liquidity	income – Preferred Dividend +
Cash coverage ratio (CCR): calculated as	Depreciation)/Shares outstanding
(EBDIT+Depreciation)/Interest	Profit Margin (PM): calculated as the ratio of
Inventory turnover ratio (ITR): calculated as	Sales and Net Income
the ratio of the Cost of Goods Sold and the	Return on Assets (ROA): calculated as the ratio
Inventory	of Net Income and Sales
Capital Intensity Ratio (CIR): calculated as the ratio of the Total Assets and Sales, and measuring the ability to generate sales from all available assets	Return on Equity (ROE): calculated as the ratio of Net Income and Total Equity

The final model, which is used as the engine of the mapping process is written as:

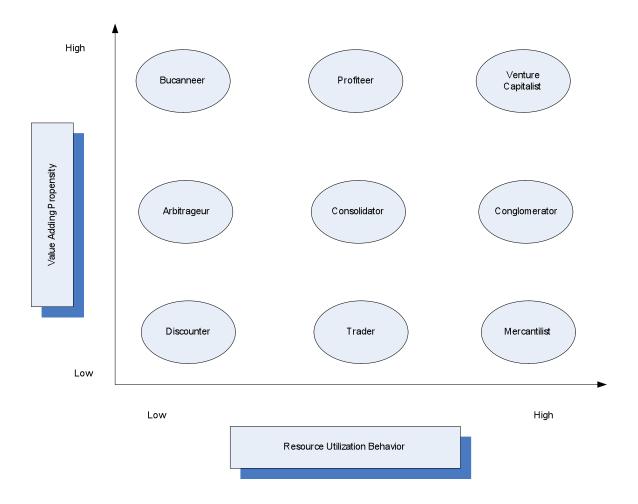
```
E
Min
Subject to:
          \sum w_i
                                                               1
                                                    \geq
                                                               RPS<sub>i</sub>
          \Sigma (RPS_i)(w_i)
                                                     \Sigma (PM_i)(w_i)
                                                               PM_i
          \Sigma (ROA_i)(w_i)
                                                               ROA<sub>i</sub>
          \Sigma (ROE_i)(w_i)
                                                               ROE<sub>i</sub>
          \Sigma (CR_i)(w_i) - (CR_i)E
                                                               0
          \Sigma (CCR_i)(w_i) - (CCR_i)E
                                                               0
                                                     \Sigma (ITR_i)(w_i) - (ITR_i)E
                                                               0
                                                               0
          \Sigma (CIR_i)(w_i) - (CIR_i)E
          E, w_i \ge 0
```

Where  $w_i$  is a weight applied to the input and output of each member of the cohort, to take into accounts the difference in firm size.

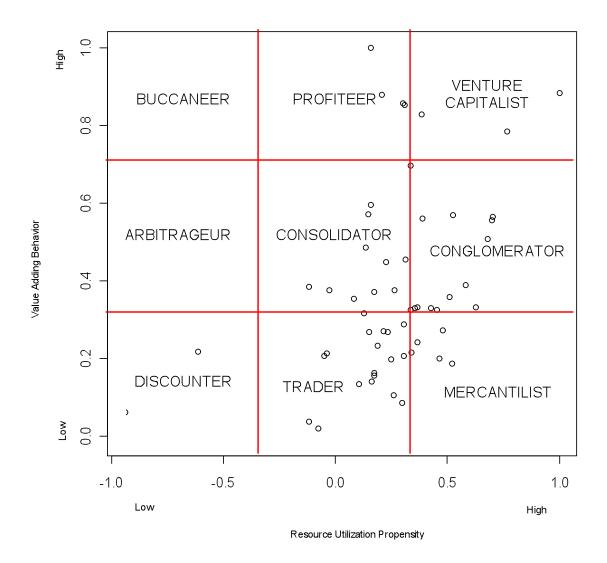
The value of E is computed for each firm while running the above model. It is then mapped into a matrix that shows how each firm's financial signature. The result is shown in the next section.

#### **RESULTS**

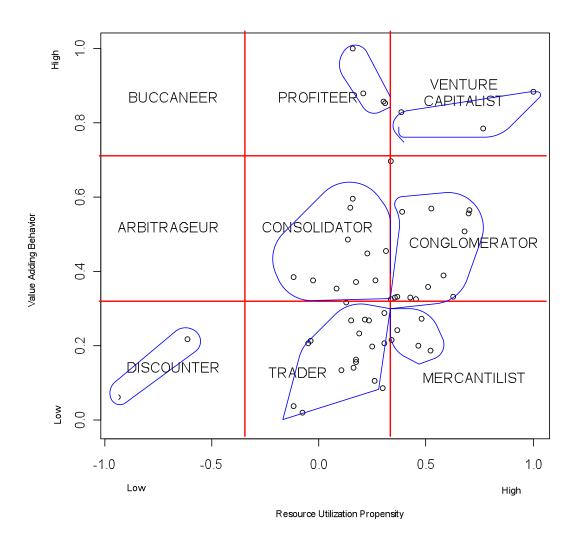
Once a performance effectiveness, or financial signature, is attributed to each firm from the value of E, it is plotted on a matrix that was developed based on the firm's resource utilization vs. value adding activities (See graph below). While resource utilization is the measure of how resources are allocated and spent, value adding is an indication of degrees at which firms improve products and services towards higher profits. These activities are ever changing, making it possible to build a dynamic mapping of the industrial landscape once a cohort of firms are mapped together. The map is however divided into nine zones that are determined based on the typology of firms as per their resource utilization and value adding as shown in the graph below:



The results are summarized in the graph below, where each dot represents a firm from the data set.



Preliminary analysis of the map shows that within each zone, firms tend to cluster within a certain area, suggesting the delimitation of frontiers. Such limits can be interpreted two ways: the barrier of entry and the limiting factors (or direction of the opportunity for disruption). The next map shows such frontiers



#### **DISCUSSION**

Firms may improve their competitive position several ways by moving from one zone to another by alteration of their products (ie. Changing their value adding behavior) or their resource utilization. Moving from one zone to another however requires firms to move out of their current frontier/limitation by disrupting it. Reading the map can therefore afford firms the opportunity to formulate their disruptive strategies by focusing on which aspect of their strategies need to be altered (product features vs. resources).

#### References available upon request

## WORKSHOP: HOW TO DRAW AND RECOGNIZE MISLEADING GRAPHS

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Graphs are great tools for data visualization and exploration. At the same time, graphs can be drawn in such a way that they are deceptive, confusing or misleading. How do we draw or recognize misleading graphs? The purpose of this workshop is to demonstrate some of the ways misleading graphs can be drawn. The examples are not exhaustive, as it is difficult to anticipate the different ways one can use available technology to construct deceptive graphs. The hope is that these examples will open your eyes and those of your students to the fact that a graph in front of you might not accurately depict the situation under which the data were collected.

#### PROPOSAL FOR SPECIAL SESSION: INCREASING RETENTION AND STUDENT SUCCESS WITH MYITLAB

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#### **ABSTRACT**

Educational institutions of all types continually strive to improve the quality of education they provide and to measure the extent to which that objective is being accomplished. This special session provides information and results of an initiative at one education institution of higher learning to improve student retention and success through the use of MyITLab.

#### INTRODUCTION

The Computer Technologies Department at a regional community college was charged with improving student success and retention rates found within the introduction to computers course. This course was selected based upon previous performance levels and due to the impact among the entire student body. With a large number of students taking this course (approximately 1,500 per semester), it was determined that increasing success in this particular class would have the most positive impact for the institution.

Resultant data from this project implementation improved student success rates in this particular course by roughly 30% (achieving a C or better in the class). In addition, student retention in this course also improved by nearly 35%. Future considerations to improve the educational environment will also be presented based upon the evidence gathered during this process.

#### **OUTLINE OF SPECIAL SESSION**

Initial Class Concerns Surrounding Existing Course Content and Delivery

- Inconsistent Assessment of Student Learning Outcomes and Course Content o Low Success Rates
- Low Retention Rates
- Teacher-Centered Paradigm versus Student-Centered Paradigm
- Knowledge Transfer Model
  - Lifelong Learner Approach
- Deficiencies for Students Who Cannot Afford Office Software
- Integrity Concerns Regarding Student Submissions

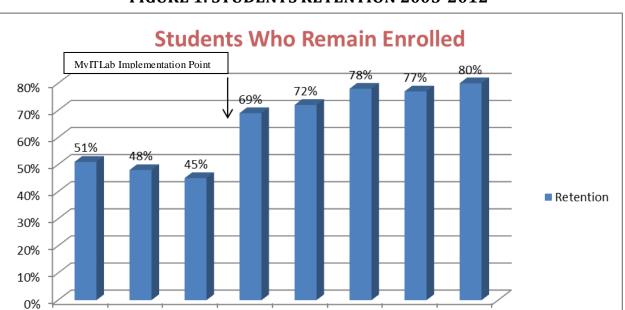
#### **Issues That Must Be Addressed**

- Provide standardized content to insure outcomes are authentically assessed and scored with similarity
- Do not require students to purchase expensive software (think about those online students as well)

- If using a 3rd party simulation environment, it must "really" simulate a true environment (e.g. "get lost" approach)
- Provide an environment where students can develop critical thinking skills and "learn how to be an active learner"
- Students must learn the application intended, not the 3rd party software component
- Provide an environment that checks the validity of student submissions against classmates' work

#### Results and Findings

- Consistency in data and assignments
  - Same assignment expectations
    - Apples to apples comparative data
- Faculty experience is more "hit the ground running"
  - o Recommend an initial training session requirement for all faculty
- Assignments with objective analytical rubrics
  - Students and faculty are both aware of expectations and consequences of missing those expectations
- Students learn how to be active versus passive learners
  - o Develop critical thinking skills
- Lifelong learners with problem solving skills
  - o Instructors are no longer the sole purveyor of knowledge
- Cost of purchasing expensive software is unnecessary
- The integrity of student submissions are now higher



Fall 2005 Fall 2006 Fall 2007 Fall 2008 Fall 2009 Fall 2010 Fall 2011 Fall 2012

FIGURE 1: STUDENTS RETENTION 2005-2012

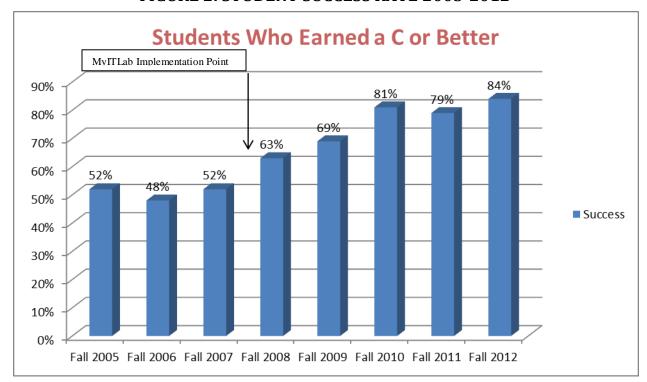


FIGURE 2: STUDENT SUCCESS RATE 2005-2012

#### **Future Considerations**

- Two distinct teaching models
- Online course will rely solely upon MyITLab
  - Less expensive to students
  - o Integrity of individual work
  - o 24/7 Help
- Traditional and hybrid courses will use less MyITLab
  - o Use MyITLab as a training tool only
  - o Give more flexibility to instructors for creativity and scheduling
  - o Continue to improve the learner-centered approach

## TEN TEACHABLE MOMENTS: NOVEL APPLICATIONS OF OPERATIONS MANAGEMENT THROUGH AN INTERNATIONAL STUDY PROGRAM

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#### **ABSTRACT**

This paper focuses on the development of a novel approach to teaching operations management outcomes through a experiential learning in a study abroad program in which students traveled to France, Germany, and Spain in May 2012 and engaged in company visits, collaboration with partnering universities, and participated in active self-reflection. The program responds to the critiques posed by authors such as Feinberg (2002) who pose the superficiality of some study abroad programs and incorporates novel approaches to engage student appreciation for the implications and context of operations management contexts. Ten teachable moments are elaborated for operations management courses.

#### INTRODUCTION

Experiential and active learning processes have increased in their adoption by colleges of business as they seek to develop individuals capable of functioning effectively in globally competitive business settings. Harsell and O'Neill (2010) have defined experiential learning as "the process of learning by experience." Experiential learning has been applied through such educational approaches as internships (cf. Dillon, McCaskey, & Blazer, 2011), to consulting projects (Maskulka, Stout, & Massad, 2011), and student-run businesses (Tompkins & Schlesinger, 2010). The commonly accepted advantage of experiential learning processes is that students, by means of being actively involved in the *context* of the business concepts under study (whether the workplace in an internship, the company setting for a consulting project, or the running of a firm whether virtually through simulation or actually through student-run firms) will more fully appreciate not only the key concepts being considered, but also the fit of their own functional roles with those also present in the context. The benefits of this learning is clear in that it delivers on stakeholder-valued competencies such as analytical thinking, people and task management, and self-management (Maskulka et al., 2011).

Furthermore, AACSB International recognizes both the need for student engagement in the learning process as well as the need for diversity and global awareness as a part of the business curriculum of accredited institutions (AACSB International, 2012). Experiential learning in the global environment is also helpful to raising awareness of business practices, intercultural management differences, and institutional environments within which business practices occur. Such experiential learning practice requires either in-depth and focused seminars on-campus or the participation in study or travel abroad programs. According to Open Doors (Institute of International Education, 2011), by 2009/2010 the latest year for which data is available, the number of US students studying abroad increased 3.9% over the previous year, reaching over 270,000. In 2010/11, according to Open Doors, 1.4% of all US university students studied abroad, of which 56.6% studied abroad for short-term programs of 8 weeks or less in duration (Institute for International Education, 2011).

The goal of internationalization is present in many universities' stated plans, though separating the rhetoric of its benefits from its real outcomes is sometimes challenging (Forsey, Broomhall, & Davis, 2012). Nunan (2006) notes the long-term benefit of study abroad to students as including enhanced

personal skills, sustained greater interest in further study, and intercultural competence and employability, but Feinberg (2002) noted that US students tend to be able to learn about themselves on study abroad programs, but doubted that they learned much about other areas. At the same time, Vande Berg (2007) noted that criticality of intervening pre-departure, intra-experience, and post-return to generate optimal learning benefits for students on study abroad programs.

One area in which experiential learning activities appear to have been limited is that of Operations Management. Polito, Kros, and Watson (2004) tested OM concept recognition via the use of the Zarco manufacturing experiential learning activity. Fish (2008) reported on graduate students' application of operations management processes to their employers. Bardati (2006) reported on the use of the campus environmental audit as an operations planning tool. The authors identified no instances of cases in which experiential learning activities were being conducted in international settings. As such, the current program reports on the development and implementation of a novel experiential learning approach to engender appreciation of operations management concepts within the global context.

#### EXPERIENTIAL LEARNING APPLIED TO A STUDY ABROAD OPERATIONS MANAGEMENT COURSE

The present program developed as an extension of an existing study abroad program called Business in Europe that had been in existence for 11 years at a medium-sized AACSB accredited college of business in the Southeastern United States. The purpose of that study abroad program was to expose students to the economic, socio-cultural, and political-legal environments of the France, Germany, and Spain with an emphasis on how business practices differ from those used by companies here in the United States. The addition of the Production Operations Management course to Business in Europe study abroad program in May 2012 was targeted for several reasons: (1) it was a required course for graduation for all B.S. Business Administration majors, thus creating a large potential market; (2) it fit well with the range of activities generally conceptualized on the program; and (3) it had been tested in a study abroad program in a new study abroad program in a previous year.

In addition, it is clear that aspects and key concepts of operations management are present in many ways within the development and management of a study abroad program since from the basic concept, attributes of project management are applied. Each study abroad program is essentially a new project, each with its own start and target finish dates, scope in terms of travel areas, time at each destination or step and size of class. Even if the trip has been completed in a past school session, the dates, airline, environment, housing options are different, and student groups are different. Process issues are applied in the order and time allowed at each country destination, business or event to visit. Scheduling issues are addressed in mode of transportation and its availability (publicly scheduled transport), capacity of chosen transport and business operating hours. Queuing issues arise in moving a group through airports, train stations, and sports events, as well as in the actual encounters that the group has in each business it encounters. Do you keep the group together utilizing a single queue, single server, or single channelmultiple server, or multiple queues with single servers? Constraint applications are encountered in several of the previously mentioned operational topics. How well these are applied directly influences the quality, safety, satisfaction, cost, of each program.

Consideration for including the program was evaluated for its ability to engage students actively on key concepts in operations management to create a similarly rigorous and concept-based exposure to that the students would have received in a traditional on-campus delivery of the course. As such, an evaluation was done of the key concepts in OM covered by three leading undergraduate textbooks in the field (see Table 1). Development of the student assignments and preparation was based on a strong appreciation of David Kolb's (1984) four learning abilities deemed critical to experiential learning: (1) concrete experience to process the stimuli through cognitive memory; (2) reflective observation to recover and consider their memories; (3) abstract conceptualization to apply theoretical principles and concepts to the observed and experienced stimuli; and (4) active experimentation to come to new understandings and problem solving. Elaboration of the appropriate pre-departure preparation and reflection required to provide a baseline experience of theoretical and conceptual learning for students to identify operations management issues. Student assignments were crafted to require double loop journaling to capture what Kolb (1984) noted as reflective observation and abstract conceptualization. Finally, as a result of the experience, faculty members involved developed a set of ten teachable moments in Operations Management.

Table 1. Content Areas Noted Within Leading Operations Management Textbooks

	Content Addressed	Operations Management: Creating Value Along the Supply Chain, 6 <sup>th</sup> ed. Russell & Taylor, Wiley	Operations Management, 11 <sup>th</sup> ed. Stevenson, McGraw-Hill	Operations Management, 10 <sup>th</sup> ed. Heizer, Render, Prentice Hall
1	Intro to Operations  Overview of role of operations  management	X	X	X
2	Quality Management Overview of the quality movement, history, and key individuals involved	X	X	X
3	Statistical Control Presentation and explanation of developing statistical process control charts for monitoring performance	X		X
4	Product Design Types of product design; process or product, characteristics and advantages of each	X	X	X
5	Service Design Characteristics and issues of service operations	X	X	X
6	Process Planning Types of processes, advantages and disadvantages, measuring & monitoring	X	X	X
7	Capacity & Facilities Discussion of capacity as a strategy, and coverage of layout decisions	X	X	X
8	Human Resources Acquiring, motivating and managing employees	X		X
9	Project Management The role of projects in meeting corporate strategy	X	X	X

10	Supply Chain	X	X	X
	The design and improvement	71		11
	of supply chains and tools for			
	monitoring			
1	Global Sourcing	X		
	The role of procurement,			
	outsourcing and distribution			
2	Forecasting	X	X	X
	The role of forecasting in			
	supply chain management			
3	Inventory Control	X	X	X
	Elements of and types of			
	inventory systems			
4	Sales & Operations Planning	X	X	X
	Strategies for demand and			
	capacity decisions			
5	Resources Planning	X	X	X
	Discussion of MRP /ERP			
	issues, dependent &			
	independent planning			
6	Lean Systems	X	X	X
	Elements of lean production,			
	pull vs. push, waste reduction			
7	Scheduling	X	X	X
	Types of scheduling,			
	objectives of and sequencing			
8	Linear Program	X	X	
	Review of mathematical			
	models for optimization			
_	strategy in decision making			
9	Maintenance & Reliability			X
	The steps required to ensure			
	that assets continue to			
	perform as required			

After extensive review of key operations management concepts prior to departure, students left on an 18day study program in France, Germany, and Spain. During this program, they were required to participate in a variety of learning experiences, including company visits, production observations, and/or presentations with firms in banking, chocolate, education, stainless steel, personal care products, retailing, marketing, solar and wind power, professional sports, broadcasting, fast food, and non-governmental public policy groups. In addition to these scheduled experiences, they encountered numerous operations activities in the act of getting to and from these meetings (e.g., public transportation and cafeteria settings in different countries), as well as in daily living during the program (e.g., restaurants, hotels, retail encounters, etc.). Finally, at several of the partner universities with which the group participated, students worked in collaborative virtual and on-site teams to deliver on specific evaluative assessments. As such, each student was asked to focus daily on operations management issues that they observed each day of the program. In daily program journaling, they were asked to identify and elaborate on operations management concepts that this issue identified, to break down the process, to consider the potential explanations (cultural, institutional), and to identify effective and/or ineffective elements of those issues. Each student was also responsible for developing a research paper that integrated his or her learning on operations management throughout the experience. As such, the experience allowed for the comparison

of operations management issues, such as layout, process design, lean systems, queuing theory, and others across multiple cultural and institutional concepts. This benefit was not one that was available in their regular in-class experience on campus.

The ultimate benefits of the program were clear through student reflection in journaling that each completed during the course of the program. Topics that they discussed included process flow, layout and design, and anecdotally, the student group would be walking down the street talking about bottlenecks, process flow issues, and queuing theory as a normal course of discussion. Moreover, in addition to the student benefits from this experience, the project resulted also in the elaboration of a set of key teaching moments that the faculty thought could be transferable to the domestic classroom, such that the richness of operations management abroad could be appreciated. These teaching moments are introduced next.

## TEN TEACHING MOMENTS IN INTERNATIONAL OPERATIONS MANAGEMENT

As a result of experiencing this process with the students, the faculty members involved identified the following teaching moments that are transferable as lessons to the on-campus operations management classroom. The ten teachable moments are displayed in Table 2. The teaching moments are listed here, but each is being developed more comprehensively by its title, the operations management concept focused upon, and the way in which the teaching moments can be explored for their origins and implications. In all cases, the goal is to make available the benefits of experiential learning to the on-campus classroom in an operations management classroom, thereby increasing the derived benefits of both increased diversity and experiential learning in the operations management classroom.

Table 2: Ten Teachable Moments in Operations Management Abroad

Title	Teaching Emphasis	Focal OM Areas
1. It's Not Over Until The Big Bus Leaves	The process of getting a group from point A to point B enables us to evaluate the effects of multiple entry and exit points, push versus pull systems, and queuing.	Queuing, Service Design, Supply Chain, Lean Systems
2. Where's the line?	Queuing systems design differs by the country environment, layout constraints, and institutional expectations.	Queuing, Service Design, Scheduling, Supply Chain, Product Management
3. Hey, they have Fords here.	The development of global supply chains, including sourcing and product design/brand management are affected by the international environment.	Supply Chain, Product Design, Quality Management
4. What letter is my seat on the train?	The elaboration of co-location systems for international trains allows for the development of understandings of key product design issues (train inventory and scheduling) as well as their explanation to the customer (platform and online communications, ticketing systems, etc.).	Process Design, Process Flow, Inventory Management, Resources Planning, Sales and Operations Planning

Title	Teaching Emphasis	Focal OM Areas
5. If you have to ask	The viewing of process systems in a language other than one's own allows us to see the utility of signage that is not language specific, as well as to more clearly see the way in which consumers are introduced to and processed through the respective systems. Experience through encountering public transportation systems, ordering in restaurants, etc. enables one to more clearly view attributes of the process and to identify needed areas for clarification of action/choice for customers.	Process Design, Service Layout, Scheduling, Sales and Operations Planning
6. How many steps does it take to make a chocolate bar?	The experience of touring a chocolate production factory enables viewers to appreciate the challenges of a dispersed supply chain, environmental and sustainability issues, the phases involved in lean production and the connection between inventory, sales and operational planning.	Resources Planning, Sales and Operation Planning, Inventory, Production Design, Product Design, Scheduling, Sequencing.
7. What color is your hamburger chain?	The review and encounter of numerous international brands, compared to the processes of well-known American brands such as McDonalds, allows not only for the identification of layout, service design and product design issues for the American firm, but also a clearer appreciation of competitor overlaps.	Product Design, Service Design, Capacity, Facilities Design
8. What happened to Joey?	When group members are separated from the team, the ability for discussion of the breakdown in process controls to service delivery is possible. The challenge of managing this constraint is enhanced by the linguistic and communications challenges posed by this setting.	Process Planning, Scheduling

Title	Teaching Emphasis	Focal OM Areas
9. How long does it take to get to Madrid?	The experience of breaking down the process requirements for getting groups of assets (people) to and from locations together can be explored in the context of the group transfer between countries. This process allows students to transfer knowledge about forward thinking and backward planning for all Resource Planning issues.	Resource Planning, Scheduling, Process Design
10. Why does it matter how fast Sallie walks?	The movement of a group in the international travel program helps to set up a wonderful discussion about the proximity of arrival between the first and last units, the ability for distractions and bottlenecks to arise, and the needed adjustments to develop in processes to adjust for variations in pace and other factors to arrive at successful outcomes on ongoing basis.	Process Design, Queuing, Scheduling, Lean Systems

## **DISCUSSION AND CONCLUSIONS**

The value of experiential learning has been widely recognized. This paper elaborates the process of applying these concepts to the area of operations management in a study abroad context. Learning about the theories and then actually visiting production and service facilities let students learn and actually *put into practice* the valuable skills. Students experienced learning by doing and then reflecting about the experience. This process allowed them to become more critical consumers, and by extension business leaders, in the delivery of these operations. Ultimately, students began to realize that everything they experienced was a process that could be influenced by businesses or government and that the formalization of this process depended on the cultural and institutional settings within which the process was grounded. The learned to evaluate and assess the attributes of these processes which will enable them to more effectively plan and deliver processes and production experiences in the future.

This experience has enabled the college to focus on a more clearly defined set of learning outcomes for this course in upcoming study abroad programming based on the early indications of the strongly positive outcomes of this program. It also clearly reinforced the clear applicability of the operations management course to a study abroad program setting, as it demonstrates real-world knowledge and skills that are easily transferred to other business situations. In addition to helping each student participant to see how operations practices are both different and similar in settings in different countries, the opportunity also provides the job candidate with increased potential for their association with the businesses after graduation, since all now have direct contacts with leading individuals in the organizations that the group visited.

Suggestions and future research is encouraged to more formally evaluate the outcomes of this experience for applied learning. Additional emphasis in upcoming years can more fully define a broader range of anticipated engagement based on the concepts noted in Table 1 as scheduling with firms and organizations are made. Future focus can also be on engaging and formalizing the teaching moments and to engaging a broader dialogue with university and business partners abroad to bring the benefits of this program to the on-campus classroom environments. In any case, it is clear that this approach is one that

bears further attention and focus as a means of engaging students actively in both the conceptual framework of operations management and the appreciation of cultural and institutional diversity that crafts the global business environment.

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#### **CUTE WILL ONLY GET YOU SO FAR:**

## TEACHING BUSINESS INTELLIGENCE AS CONSULTING

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#### **ABSTRACT**

Business education current practice prepares students for analysis with tools such as Strengths, Weaknesses, Opportunity, and Threats (SWOT Analysis), and use of the TOWS Strategic Matrix to match external factors of threats and opportunities with internal factors of weaknesses and strengths. As faculty show students how to help business organizations, solve real-world problems, they need to understand how to integrate the softer side of consulting including Practical, Social and Emotional Intelligence into consulting practice. These softer skills define Business Intelligence and are immediately transferrable and useful in both academic assignments like internships and on the job after graduation.

#### **BACKGROUND**

Dion, Berschid, and Walster [2] launched a line of research with their thesis that "what is beautiful is good" that has been applied to everything from reviewing resumes [7], to cooperation on tasks [9]. What can transcend physical attractiveness and personality is business intelligence. Without business intelligence, graduates are unlikely to be highly successful no matter how attractive they are, how personable they are, how much content knowledge, and how many technical skills they acquire in pursuing a business degree. This approach to developing business intelligence has been successfully tried in quantitatively oriented degrees such as statistics [15][6] which indicates its potential application in business education. In fact, the President of the American Statistical Association, Sastry Pantula has argued that statisticians need soft skills describing Business Intelligence saying the following [10]:

"To succeed in our careers, we need both hard skills and soft skills. There is no doubt that all our jobs require us to have a strong foundation in statistical theory and methodology and excellent computational skills to manage massive data. Soft skills are not a cover-up for the lack of hard skills; we must have and show our expertise in our field. However, hard skills by themselves are not enough. Soft skills help us work in teams, communicate with other scientists, aid management, and move up the ladder through leadership."

This paper is directed at showing how Business Intelligence is based on three kinds of IQ that are independent of physical attractiveness, personality, quantitative abilities, and technical skills:

- 1. Practical IQ [12]
- 2. Emotional IQ [4]
- 3. Social IQ [5]

## **Practical IQ**

Analytical and creative business knowledge and skills define Practical IQ. Those with Practical IQ know how to collect, prepare, process, and interpret the output of business analysis tools such as SWOT and TOWS. Business consultants convert results of these analytical techniques into information that can be used to improve the operations and strategic position of a business. One author [16] has even offered 54 different tools and techniques business consultants can use as a resource list to call on.

## **Emotional IQ**

The ability to identify, assess, and control their own emotions when others have trouble understanding business problems and solutions is a very important skill [4]. Emotional IQ has components as simple as good listening skills and as complex as managing an irate client. Emotional self-control defines Emotional IQ, a second element to Business Intelligence. This capability means a good business consultant is confident but not arrogant. Listens actively by reflecting what a client says to gain complete understanding. Having a PhD from a top Business School like Wharton or Harvard Business School is nice, but those with Emotional IQ will rely more on the ability to get others to understand business problems and potential solutions than what they learned in business school. Emotional IQ also means being confident is better than simply appearing confident. Being truly confident makes it a lot easier for other people to trust a business consultant with help in solving business problems and running their organization. Being truly confident and having Emotional IQ also means being 'objective.' Neuroscience has shown that in the area of analysis versus emotions, many decisions can be improved by having negative emotions recognized and kept in control [14] before crucial decisions are made. Those who have command and control over their emotions have high Emotional IQ.

#### Social IQ

The capacity to quickly establish rapport and effectively navigate and negotiate complex social relationships and environments defines Social IQ. As described earlier, emotional intelligence deals with managing our personal emotional state, and is contrasted with social intelligence as dealing with managing interpersonal interactions and relationships to positively influence others. Social IQ enables business consultants to establish a relationship and serve clients who are not knowledgeable in organizational development and dynamics. Many examples of the value of Social IQ can be found in Daniel Goleman's work [5], and the foundation of Social IQ is anchored in mirroring neurons in the brain. This approach to Social IQ is based on neuroscience which describes the basis of empathy as the ability to both feel the emotional experiences of others and understand their situation from a rational point of view.

Cloud [1] has described six characteristics of those with high Business Intelligence as follows:

- 1. The ability to gain the complete trust of others.
- 2. Seeing reality without blind-spots.
- 3. Working in a way that produces outcomes that are expected based on their abilities and available resources.
- 4. Dealing effectively with problem people, negative situations, obstacles, failures, setbacks, and losses.
- 5. Creating growth in themselves, their organizations, their clients, and anything else they touch.
- 6. Transcending their own interests and dedicating themselves to a larger purpose or mission.

#### **DISCUSSION**

It is argued here that Business Intelligence comes from developing Practical, Emotional, and Social Intelligence skills and abilities. It begins with the ability to understand why someone wants to engage a business consultant in the first place. The top 10 reasons organizations hire business consultants were identified in a recent survey [3] and include:

- 1. A consultant may be hired because of his or her expertise. This is where it pays to not only be really good in the technical aspects of business consulting, but to have some type of track record that speaks for itself.
- 2. A consultant may be hired to identify problems. Sometimes employees are too close to a problem inside an organization to identify it. That situation is often helped by a naïve outside
- 3. A consultant may be hired to supplement the staff. Sometimes an organization discovers that it can save thousands of dollars by hiring consultants when they are needed, rather than hiring full-time employees. Organizations sometimes realize they save additional money by not having to pay benefits for consultants they hire. Even though a consultant's fees are generally higher than an employee's salary, over a given time period, it simply makes good financial sense to hire a consultant.
- 4. A consultant may be hired to act as a catalyst. In a typical organization few people like change. When change is needed, a consultant may be brought in to 'get the ball rolling.' In other words, the consultant can do things without worrying about the organization's culture, employee morale, or other issues that get in the way when an organization is trying to create change.
- 5. A consultant may be hired to provide much-needed objectivity. Who else is more qualified to identify a problem than a consultant? A good consultant provides an objective, fresh viewpoint-without worrying about what people in the organization might think about the results and how they were achieved.
- 6. A consultant may be hired to teach. These days if you are a business consultant who can show employees how to master a new business aspect like social media, then the telephone probably

- will not stop ringing for a while. A consultant may be asked to teach employees any number of different skills. A consultant must be willing to keep up with new discoveries in their field of expertise--and be ready to teach new clients how to stay competitive.
- 7. A consultant may be hired to do the 'dirty work.' When cuts have to be made or only one point of view can be accepted, someone's feelings are going to be hurt or someone's 'baby' must be declared 'ugly.' When the available information suggests a product should be taken out of production, when years of R&D have been invested in a product that the market just does not want or need, or when the boss's favorite ad is not working, someone has to tell the truth. Managing that conflict is a key skill.
- 8. A consultant may be hired to bring new life to an organization. If you are good at coming up with a new business model that works, then you will not have any trouble finding clients. Sometimes the problem is not really a problem, but an opportunity and a good business consultant can find a way of analyzing and displaying the information that shows a viable opportunity that not only solves a problem, but leads to growth.
- 9. A consultant may be hired to create a new business. There are consultants who have become experts in this field. Not everyone has the ability to conceive an idea, support it with data and expert analysis, and then develop and sell a plan for the future. If students can do all of that, they will be successful.
- 10. A consultant may be hired to influence other people. Asking the question, 'Do you see yourself as a sales person?,' must be answered by the business consultant. Whether students realize it or not, they are always selling. Selling ideas and results of business analysis is a key part of being a business consultant since many business outcomes are grey rather than black and white.

## **An Example**

The Myrtle Beach Area Chamber of Commerce requested help in determining new ways to attract visitors to the Myrtle Beach. A three-person student team was selected from a Marketing Research class to undertake the project under the guidance of the author. These students enthusiastically accepted the invitation.

The process included meetings with the CEO and Marketing Research Department of the Chamber of Commerce and business leaders in the area. From those meetings, the students developed a plan of action. The objective throughout this project was to discover what would entice people to travel to the Myrtle Beach area during the off-season. They submitted a proposal to the CEO and created a milestone schedule to finish the project before the end of the semester. The students displayed Social and Emotional Intelligence in the process of working with the Chamber of Commerce to identify the problem, creating a plan to solve the problem, and selling the plan to the CEO and Marketing Research Department of the Chamber of Commerce.

The field research phase included qualitative methods used to explore questions pertaining to: hotel accommodations, length of stay, attractions or events, and price. A quantitative survey was then designed and implemented to determine how strongly potential visitors felt about these issues. A multimethod approach was used involving face-to-face, telephone, and internet methods. In all cases a Self-Administered Questionnaire was employed. The students analyzed data using Excel Data Analysis ToolPak. They then created tables, graphs, and other material for a formal written report and a PowerPoint presentation. Their interpretation of the analysis indicated the most important issues in the quantitative findings were age and price. The age group 24-39 was found to be the most frequent and most price sensitive tourists visiting the Myrtle Beach area. These findings led them to conclude that the age group 24-39 is the most important segment for future marketing using a price bundling strategy. The field and reporting phases showcased their Practical Intelligence as well as Social and Emotional Intelligence.

The student team presented the project in two venues: 1) at a dinner meeting of members of the Chamber of Commerce, and 2) at a special presentation of undergraduate and graduate student research projects for the Wall College Board of Visitors. In both cases, the team, the project, and its recommendations were well received. Some of the recommendations were adopted as an action plan by the Chamber of Commerce.

Finally, as a tribute to the students' Business Intelligence, the Chamber CEO wrote an extraordinarily complementary letter to the President of Coastal Carolina University and donated \$2,000 to the Marketing Club which has been used to support the students' Club activities.

#### **CONCLUSIONS AND IMPLICATIONS**

On the employer side, the approach of looking for candidates with Business Intelligence has been used in employee selection as outlined in the Handbook of Employee Selection [8]. On the business consulting side, internal and external clients often do not know about such tools and techniques such as SWOT and TOWS. Consultants with high Business Intelligence are able to have an understanding of both their client as people and their client's opportunity or problem. That dual understanding plus a business analysis done by a consultant high in Business Intelligence can lead to effective change and sustainability of the business. Employees in a business needing this kind of assistance also need to have the problem/opportunity and recommendations for action explained in 'street language' which they can understand and which they can then use and communicate to others in the organization.

In summary, students who exhibit Business Intelligence are:

- 1. Able to quickly establish trust and rapport.
- 2. Exude confidence born of experience.
- 3. Able to concentrate on the client's situation and never procrastinate.
- 4. Exhibit understanding all factors that affect the client business.
- 5. Be as committed to the client business as the people who work in it.
- 6. Be effective communicators in very specific rather than vague ways.

7. Be capable of delivering results that have a major impact on the success of the client business thereby justifying their very existence.

Teaching business students the soft skills and abilities defining Business Intelligence exhibited by effective consultants early in their business program of study is a good way to practice what Randy Pausch [11] calls 'head fake learning,' or learning about something without being aware you are being taught. Business Intelligence is a special case of head fake learning that requires the right approach. The student project described here is an example of real world business consulting by students involving head fake learning in tourism marketing. It shows how all three types of IQ are developed, needed, and how to use them.

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## A CONFIRMATORY FACTOR ANALYSIS OF PEER ASSESSMENT SCALE

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## **ABSTRACT**

Both the information technology (IT) industry and the Accreditation Board for Engineering and Technology (ABET) demand soft-skill training in higher education and require IT graduates to demonstrate competence in interpersonal communication, teamwork, and conflict management. Group projects provide teamwork environment for soft-skill training, but their practical success is difficult to assess. Group activities often take place outside of the classroom, and instructors are kept out of communication and interaction loops. Free-rider problems arise when some students are awarded the same grades as others who contribute more than their fair share of the work. Many studies have suggested that, for group projects, peer evaluation is more effective than instructor evaluation. However, most peer assessment scales are ad hoc, neither standardized nor well-structured. This study designed a scale for group peer evaluations, and used a factor analysis to validate the underlying dimensions of the scale. The study will be valuable for educators seeking to use peer evaluations to enhance soft-skill training.

## INTRODUCTION

Group projects have become increasingly important due to two driving forces. First, the Information Technology (IT) industry and Accreditation Board for Engineering and Technology (ABET) require college graduates to attain skills in interpersonal communication, teamwork, and conflict management (Aasheim, Li, & Williams, 2009). Second, colleges and universities are shifting their pedagogical approaches from passive to active learning, from class lecture ("sage on the stage") to cooperative learning ("guide on the side"; Tagg, 2003). However, for group projects to be successful, a validated peer assessment tool is essential. This study aimed to promote group learning by designing and validating a peer assessment scale. This paper describes challenges and demands, reviews literature, and reports the design and the factor analysis.

## CHALLENGES AND DEMANDS

# **Demand for Soft Skills**

In a recent survey, 348 IT managers were asked to rate the importance of various skills (Aasheim, Li, & Williams, 2009). Soft skills were rated high (see Table 1), while hard skills related to knowledge of operating systems, hardware, databases, security, web development languages, telecommunications, and networking were rated much lower.

ABET specified two program outcomes in its Criteria for Accrediting Computing Programs, "ability to function effectively on teams to accomplish a common goal" and "ability to communicate effectively with a range of audiences" (2010, p. 3). The concept of soft skills is not new to higher education. Accrediting agencies have recommended them for over half a century (American Society for Engineering Education, 1950). However, soft-skill training is still particularly weak in science and engineering programs (Schulz, 2008), and this deficit hampers the career progression of today's IT graduates (Williams, 2011). Like engineering programs, IT curricula are loaded with hard-skill courses, and adding a soft-skills course is almost impossible. To meet the demand for soft-skill competence, this study provides a tool for implementing and assessing soft-skill training in a hard-skills course.

Table1: Top 17 Skills Ranked by 348 IT Managers

	Skills and Traits	Scale of 1 to 5
1.	Honesty/integrity	4.62
2.	Communication skills	4.54
3.	Analytical skills	4.51
4.	Ability to work in teams	4.49
5.	Interpersonal skills	4.37
6.	Motivation	4.37
7.	Flexibility/adaptability	4.33
8.	Creative thinking	4.18
9.	Organizational skills	4.13
10.	Relevant work experience	4.06
11.	Awareness of IT technology trends	4.04
12.	Operating systems	3.99
13.	Hardware concepts	3.92
14.	Database	3.92
15.	Security	3.91
16.	Telecommunications/Networking	3.90
17.	Web development languages	3.85

Note: Original table lists 32 skills and traits. Source: Aasheim, Li, & Williams (2009, p. 353).

## **Demand for Active and Deep Learning**

Pedagogical approaches can be classified as passive or active. In passive learning, students merely receive; the instructor designs the learning program, determines assessment criteria, delivers lectures, and evaluates student performance (Falchikov, 1986). In active learning, students participate or take full responsibility for learning.

Learning can also be categorized as surface or deep (Tagg, 2003). Surface learning focuses on information and emphasizes repetition and memorization techniques. According to Tagg (p. 70), "Deep learning is learning that takes root in our apparatus of understanding, in the embedded meanings that define us and that we use to define the world." Students engaged in deep learning have higher levels of intellectual development and satisfaction with college (Laird, Shoup, & Kuh, 2005).

To achieve deep learning, group projects are more effective than such methods as essay tests or multiple choice tests (Figure 1). Numerous studies support the advantages of group projects, such as poster presentations on the use of the biosciences to solve industrial problems (Butcher & Stefani, 1995), group presentations in pharmacology (Hughes & Large, 1993), case studies in production management (Kaimann, 1974), simulated training for groups in hotel management and tourism (Kwan & Leung, 1996), team presentations in American history and literature (Oitzinger & Kallgren, 2004), and team learning in business and organizational communication (Roebuck, 1998).

Compared with other fields, engineering programs are less likely to use deep learning approaches (Laird, Shoup, & Kuh, 2005). Figure 2 compares disciplines in terms of their use of deep learning approaches.

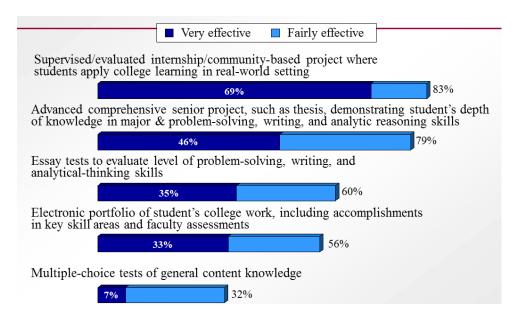


Figure 1: Effectiveness of Deep Learning through Group Projects Source: Association of American Colleges and Universities, www.aacu.org/meetings/effective educational practices/documents/CS6.ppt.

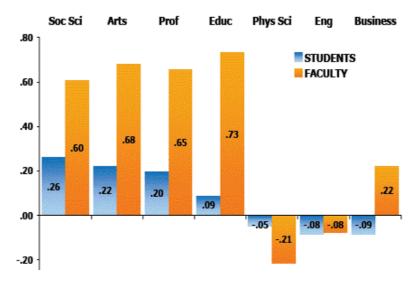


Figure 2: Disciplinary Comparisons of Standardized Means of Deep Learning Approaches Source: Kuh, Laird, & Kinzie (2006).

## **Challenges in Assessing Soft Skills**

In traditional pedagogy, quizzes, exams, and assignments are used to assess individual performance. Students have little input on the assessment criteria and process (Falchikov, 1986). Quizzes or exams cannot accurately measure interpersonal and leadership skills. While group projects provide excellent opportunities for soft-skill training, but individual performance of group members is difficult to assess. Group activities often take place outside of the classroom, and instructors are kept out of communication

and interaction loops. Free-rider problems arise when some students are awarded the same grades as others who contribute more than their fair share of the work.

Tremendous effort has been invested in specifying protocols and designing standardized assessment scales to measure the interpersonal communication skills of doctors, counselors, and nurses (Accreditation Council for Graduate Medical Education, 2005). The importance of this training for doctor and patient interaction during the diagnostic process or surgical team communication during an operation is easy to appreciate. Less effort has been invested in developing assessment scales to measure the soft skills of future IT professionals, who nonetheless must optimize teamwork and communicate effectively with a range of audiences. This study aims to improve IT education by designing and validating an assessment scale.

#### LITERATURE REVIEW

# **Definition and Importance of Assessment**

Assessment is defined as the activities and processes involved in judging performance. In peer assessment, students are involved in assessing the work of others (Reese-Durham, 2005).

Since Skinner's study of human behavior (1953), hundreds of studies have established that human behavior is shaped by intrinsic motivation and extrinsic rewards, and that extrinsic rewards positively influence intrinsic motivation (Deci, Koestner, & Ryan, 1999). The performance assessment is an extrinsic reward that has tremendous influence over what and how students learn (Gibbs & Haveshaw, 1989). It fosters learning habits and inevitably shapes the learning that takes place (Biggs, 1989).

#### **Positive Results of Peer Evaluation**

Many studies confirmed validity and value of peer evaluation. Peer evaluation was shown to be more effective in predicting the success of first-year graduate study than GRE results, biographical and demographic surveys, and the Opinion, Attitude, and Interest Survey (Wiggins & Blackburn, 1969). It is highly correlated with instructor evaluations and produces a typical grade distribution and high degree of internal consistency (Hughes & Large, 1993; Burke, 1969; Pease, 1959; Morton & Macbeth, 1977; Kaimann, 1974). Orpen (1982) showed that there was no difference between peer and instructor evaluations in terms of absolute scores, average scores, variation of scores, and association of scores with final course grades. Kane and Lawler (1978) concluded that peer evaluations provide a unique way to assess students' behaviors and that peers can accurately perceive and interpret each others' behavior and performance.

Peer evaluation also provides a learning opportunity for students to develop the ability to realistically judge the performance of others as well as their own. Boud & Lublin (1983) considered peer assessment one of the most important teaching methodologies in undergraduate education. In a computer sciences course, 84 percent of students believed that evaluating their peers' work enhanced the educational process and reinforced what they had leaned (Rushton, Ramsey, & Rada, 1993). Natriello (1987) reported that peer assessment had a profound effect on student learning. Fry (1990, p.181) validated five advantages of peer evaluation:

- 1. Students are encouraged to tackle problems outside the tutorial session.
- 2. In grading others' work, students appreciate and reinforce the correct solutions;
- 3. Students become aware of the grading scheme and appreciate the reasoning behind points awarded or deducted.
- 4. In grading others' work, students realize the importance of clearly presenting the solution.
- 5. The instructor can act as a facilitator rather than an assessor.

## **Controversial Results of Peer Evaluation**

Not all findings are consistent with this positive view. Some studies reported that peer evaluations were significantly higher than those of either instructor or self (Mowl & Pain, 1995; Fuqua, et al., 1986; Friesen & Dunning, 1973), while others found peer evaluations more stringent (Kwan & Leung, 1996; Stefani, 1994). Rushton, Ramsey, and Rada (1993, p. 76) raised the following concerns:

- 1. Students may not have the same level of understanding of the subject matter as instructors;
- 2. Instructors are more likely to provide useful feedback;
- 3. Students may have to be told what points to look for when assessing others' work;
- 4. Students may be inclined to show bias toward their friends;
- 5. Students may be reluctant to award poor work low marks for fear of offending peers;
- 6. Students may not devote sufficient time and attention to this demanding task;
- 7. Students may be tempted to "borrow" ideas from other students for use in their own work.

## THEORETICAL FOUNDATION

Regardless of whether peer assessment is superior to other assessment methods, the objective of this study is to move forward, and to contribute to the body of research by designing and validating the scale to enable students to evaluate the soft-skill competence of their peers in group projects.

Johnson and Johnson's teamwork model (1997) proposes that group members perform two basic functions: the task and social activities (Levi & Cadiz, 1998). The theoretical framework of this study maps hard-skill training with task activities, such as attending meetings, preparing and delivering quality work, and providing ideas and initiatives. At the same time, it maps soft-skill training with social activities related to cooperation and communication, conflict resolution, trust building, and leadership.

Human behavior theory holds that human behavior is shaped by intrinsic motivation and extrinsic rewards. Merely providing soft- and hard-skills training is not sufficient to induce learning. Providing accurate assessment as an extrinsic reward fosters and shapes the learning that takes place (Biggs, 1989; Skinner 1953; Gibbs & Haveshaw, 1989). Figure 3 shows the theoretical framework of this study. Opportunities for training are independent variables; accurate assessments are moderator variables; and learning is the dependent variable. The model emphasizes both soft- and hard-skills training and the role of assessment in the learning process. The objective of this study is not to prove the proposed theory, but to develop an accurate assessment tool that would provide the needed extrinsic reinforcement.

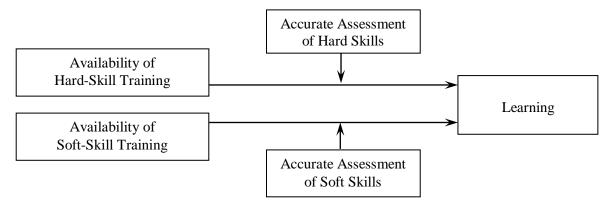


Figure 3. Factors and Moderator for Learning

## DESIGN OF THE ASSESSMENT SCALE

To design the assessment scale, I reviewed the existing tools. Levi and Cadiz (1998) designed a peer assessment scale in which four items measure task activities, and four items measure social activities. Gueldenzoph and May (2002) reviewed several peer evaluation studies and designed a scale for evaluating group presentations in a business communication course. It has 11 items. Table 2 shows the design of the assessment scale for this study and source reference for each item. Items 1 through 8 are designed to measure hard skills; items 9 through 16, soft skills; item 17 is the overall grade, and item 18, the discriminate score. All items except 18 used a 5-point Likert scale.

Table 2: Scale Items and Source References

	Items	Source References
1.	Attends meetings	Chalupa, Chen, & Sormunen-Jones, 2000; Johnson, 1993; Gueldenzoph & May, 2002
2.	Comes to meetings prepared	Odom, Glenn, & Sanner, 2009
3.	Does quality work	Chalupa, Chen, & Sormunen-Jones, 2000; Levi & Cadiz, 1998; Johnson, 1993
4.	Proposes quality ideas and initiatives	Chalupa, Chen, & Sormunen-Jones, 2000; Johnson, 1993
5.	Does more than fair share of work	Chalupa, Chen, & Sormunen-Jones, 2000; Levi & Cadiz, 1998; Odom, Glenn, & Sanner, 2009
6.	Devotes time and effort to the project	Johnson, 1993
7.	Completes work on time	Chalupa, Chen, & Sormunen-Jones, 2000; Levi & Cadiz, 1998; Johnson, 1993; Gueldenzoph & May, 2002
8.	Understands concepts and has knowledge of the project	Goldfinch, 1994
9.	Dependable and responsible	Chalupa, Chen, & Sormunen-Jones, 2000; Johnson, 1993
10.	Communicates with group members	Johnson, 1993; Odom, Glenn, & Sanner, 2009
11.	Cooperates with and supports group members (shares resource, ideas, encouragement, constructive feedback)	Chalupa, Chen, & Sormunen-Jones, 2000; Levi & Cadiz, 1998; Johnson, 1993; Gueldenzoph & May, 2002
12.	Works through conflicts and handles conflicts in a constructive manner	Chalupa, Chen, & Sormunen-Jones, 2000; Levi & Cadiz, 1998; Gueldenzoph & May, 2002
13.	Respectful of others' ideas and stays positive and open-minded	Levi & Cadiz, 1998; Odom, Glenn, & Sanner, 2009
14.	Commits to group goal	Chalupa, Chen, & Sormunen-Jones, 2000; Levi & Cadiz, 1998
15.	Takes a leadership role	Odom, Glenn, & Sanner, 2009; Gueldenzoph & May, 2002
16.	Organizes the group and helps it to function as a team	Goldfinch, 1994
17.	At this point, what grade would you give this group member for the project?  A B C D F	Johnson, 1993

18. Distribute a total of 100 points among your	
group members, including yourself.  Member 1 Member 2 Member 3  Member 4 Member 5	Johnson, 1993

## ASSESSMENT ADMINISTRATION AND DATA COLLECTION

# **Course Background and Setting**

The senior-level IT course involved in this study met 3.5 hours per week for a 16-week semester (see Table 3 for schedule). Prerequisites of the course included HTML, CSS, JavaScript, Java, database management, and server configuration. The class had 24 students, 5 women, 19 men, ranging in age from 20 to 31, majoring in IT or pre-IT. Their total credit hours earned ranged from 43 to 168. Students were randomly assigned to 5 groups: PHP, Ajax, XML, HTML5, or RSS.

The first 3.5 weeks of the semester were a facilitating phase during which the instructor taught JSP, which has characteristics similar to those of PHP. This phase lowered the learning curve for PHP and other topics and established a teaching example for students to follow. During the next 2.5 weeks, each group learned one of the 5 topics: PHP, Ajax, XML, HTML5, or RSS. For each, the instructor provided a set of written program codes and a brief assignment instruction. Each group was responsible for figuring out the codes, learning and preparing to teach the topic to the rest of the class. After the 2.5 weeks of preparation, each group had 1.5 weeks to present a topic, run the labs, tutor students, and grade assignments and tests.

Table 3: Class Schedule

Date	Topic	Activities	
3.5 week	JSP	Instructor teaches JSP with individual assignments	
2.5 week	Group learning	<ul> <li>Textbook (Sebesta, 2010)</li> <li>Instructor provides each group with a set of program codes and a brief assignment instruction</li> <li>Group prepares PPT presentation, assignment instructions, test questions, and suggested reading materials</li> <li>Collect first-round peer evaluations within all group</li> </ul>	
1.5 week	PHP	<ul> <li>5 Groups Teach 5 Topics</li> <li>Each group gives lectures and tours labs</li> <li>The class is given a project assignment, a written test</li> </ul>	
1.5 week	Ajax		
1.5 week	XML	and an online quiz for each topic	
1.5 week	HTML5	<ul><li>The class evaluates each group.</li><li>The instructor collects the second round of peer</li></ul>	
1.5 week	RSS	evaluations.	
Final		Term Paper on Group Teaching	

## **Data Collection**

The assessment scale was presented to the class at the beginning of the semester, so students would have a clear understanding of the evaluation criteria and who would evaluate them. This preparation motivated students to improve their skills when interacting with peers.

Within the groups, each member evaluated the others and him or herself twice during the semester. The first round was administered at the end of group learning; the second, at the end of group teaching (see Table 3 for the data collection schedule). I created the assessment scale using tools at surveymonkey.com. A hyperlink was provided on the Blackboard Learning System, where other course materials were posted. The data were automatically collected at surveymonkey.com.

## **FACTOR ANALYSIS**

Item 18 was a discriminate measurement, not designed for measuring soft or hard skills, so it was eliminated from the factor analysis. Table 4 lists the number of items, number of measurements, and methods used in factor analysis.

Table 4: Factor Analysis

Number of measurements	228
Number of items	17
Extraction Method	Alpha Factoring
Rotation Method	Varimax with Kaiser Normalization

Table 5: Kaiser-Meyer-Olkin (KMO) and Bartlett's Test

Kaiser-Meyer-Olkin Measure	0.948	
	Approx. Chi-Square	3623.616
Bartlett's Test of Sphericity	df	136
	Sig.	0.000

Table 6: Total Variance Explained

	Total			% of Varian	ce
Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
10.553	62.075	62.075	5.810	34.175	34.175
0.838	4.930	67.005	5.581	32.830	67.005

Table 7: Rotated Factor Matrix

	Factor	
	1	2
Item 1		0.575
Item 2		0.777
Item 3		0.867
Item 4		0.698
Item 5		0.759
Item 6	0.539	0.697
Item 7		0.607
Item 8		0.506
Item 9	0.694	0.508

Table 8: Reliability Analysis

	Cronbach's α
Item 1	0.938
Item 2	0.930
Item 3	0.930
Item 4	0.930
Item 5	0.930
Item 6	0.928
Item 7	0.934
Item 8	0.940
Item 9	0.923
Item 10	0.924
	_

Item 10	0.737	
Item 11	0.753	
Item 12	0.712	
Item 13	0.757	
Item 14	0.718	
Item 15	0.656	
Item 16	0.679	
Item 17	0.514	0.621

Item 11	0.922
Item 12	0.926
Item 13	0.931
Item 14	0.928
Item 15	0.929
Item 16	0.927
Item 17	0.935

To measure sampling adequacy, the Kaiser-Meyer-Olkin (KMO) and Bartlett's tests were conducted. The recommended minimum value of KMO is 0.50 (Pett, Lackey, & Sullivan, 2003). The assessment's KMO score of 0.948 was greater than 0.5 (see Table 5), indicating adequate sampling. Bartlett's test examined the null hypothesis of the correlation matrix being an identity matrix. With a degree of freedom of 136 and p value of 0.000, the null hypothesis was rejected.

Table 6 shows that two factors captured 67 percent of variance. Table 7 contains the rotated factor loadings. The option blank was set at 0.5, so SPSS printed blanks for any correlations of 0.5 or less.

Reliability was analyzed by examining Cronbach's α values (1951). A Cronbach α value of 0.70 or higher is sufficient for social studies. All items passed with Cronbach's α values greater than 0.70 (see Table 8).

## **CONCLUSION**

According to the Robbins-Gioia Survey, 51 percent of companies that implemented Enterprise Resource Planning (ERP) considered the implementation unsuccessful ("Failure Rate", 2001). User resistance to change during the deployment stage is a bigger hurdle than designing a system. Conflicts are inevitable when a computer system like ERP must be integrated across functions or divisions. IT education must prepare future IT professionals with hard and soft skills to communicate with end users, to resolve conflicts, and to bring different functions together to work toward the common goal. The study should prove valuable for educators to promote soft-skill training and to use peer evaluations to achieve success in IT education.

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# Development of a Qualifying Exam and its Use in Admission to Teacher Preparation Programs Jerry Neal

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## Introduction

The preparation of education professionals, like most other professions, involves a number of gate-keeping responsibilities on the part of university or college officials to ensure that only the most qualified candidates are admitted to programs and ultimately achieve licensure or certification to teach in the nation's schools. Additionally, state departments of education typically require that the teacher education programs in their state set at least minimal standards for gaining admission to preparation programs for those seeking to become educators.

Furthermore, accreditation entities such as the National Council for Accreditation of Teacher Education (NCATE) and the Interstate New Teacher Assessment and Support Consortium (INTASC) have had established accreditation standards in place for decades. Examples of these standards include how teacher preparation programs induct candidates into their respective programs, what kinds of competencies are expected from the candidates, and what exit examinations or other criteria are used to determine if the program's graduates are ready and able to enter the profession and teach a diverse population of children and youth.

States and universities use a wide assortment of practices to admit candidates to their respective teacher preparation programs. Some states, for example, require that teacher education candidates earn a minimum score on paper-pencil tests such as the PRAXIS 1 or the Measure of Academic Proficiency and Progress (MAPP), both of which are widely-recognized assessment

products of Educational Testing Services (ETS) and essentially measure basic academic abilities in content areas such as mathematics, science, social studies, and written composition skills.

The use of standardized tests to admit candidates to colleges' teacher education programs is not without its detractors. Case law continues to mount supporting the notion that states and university teacher education programs can, and should, establish a variety of gate-keeping measures designed to eliminate candidates that may not be successful in the nation's public school systems (Karanxha & Zirkel, 2008). Levin (2006), in his widely-acclaimed report *Educating School Teachers*, notes that universities with teacher education programs tend to set low admission standards for those programs and further stresses that teacher education programs should bolster these admission standards if the nation's P-12 schools want to obtain higher test scores in elementary and secondary classrooms. Other policy analysts, such as Wakefield (2003), have espoused the belief that most of the extant paper and pencil gate-keeping requirements, which are very similar to the Scholastic Aptitude Test (SAT) or the American College Test (ACT), are both redundant and needlessly discriminate against minority applicants to the programs.

Assessment of content knowledge is not the only consideration when candidates apply for admission to teacher education programs or when they seek initial licensure to teach.

Increasingly, an assessment of a candidate's "disposition" toward the profession of teaching is sought, and even required, by some university teacher preparation programs or by states' licensing entities. However, defining what a "disposition" is, or what set of dispositions should be employed in these instances, is daunting at best and subject to debate among even veteran professionals in the education field. A number of studies and position papers on the topic of teacher dispositions, and how to accurately assess them in teacher education candidates, has

emerged over the last ten years (For excellent discussions of this debate, see the works of Combs, et al 1974; Lewis, et al. 1999; Wascisko, 2002). As such, wide consensus on which particular dispositions constitute a definitive set of attitudes and behaviors has yet to be achieved.

This paper discusses in detail how one teacher education program determined that its teacher preparation program admission procedure was outdated and how a new system was developed and put into place. The new admission process uses assessments of both content knowledge and teacher dispositions. It is the authors' intention to detail step-by-step this process so that others may have an understating of the process and perhaps utilize it in their own institutions.

# Previous Process for Admission

The "Interview" for admission of Special Education majors to the Teacher Education

Program at the university had existed in the same format for more than a decade. Basically, the

Interview process consisted of the following:

- Candidates were seated around a table in a large conference room equipped with
  audio/video recording equipment and a two-way mirror to a control room that would
  permit two faculty members to observe candidates. The candidates could not see the
  faculty. If more than about 8 candidates were involved, the process operated in "batches"
  of candidates consisting of from 5-6 interviewees.
- Candidates were given a "topic question" which was to be discussed by the group as a whole, much as professionals would do at an open forum at a conference breakout session. Examples of "topic questions" would include a "starter item" such as "Corporeal"

punishment has been abolished in your school district. What types of alternative behavior management procedures might be used in place of paddling children, and how can you justify each one?" Or, "Describe how you would go about selecting a paraprofessional for your classroom. What kinds of skills or attributes might you look for in that person?" The faculty members observing the discussion would record the number of times that each candidate added to the discussion (frequency count), and made notes as to the appropriateness of each candidate's responses (qualitative). Candidates were generally given 12-15 minutes to discuss the topic, but if it was obvious after 10-12 minutes that the group had depleted discussion strands, the interview was stopped, and the group proceeded to Phase 2.

- Phase 2 consisted of the candidates watching the video of their Interview and completing a self-reflection of their performances. Items on the self-reflection included things such as "I gave adequate support for my responses" or "I was able to disagree with others in an agreeable manner."
- Candidates were generally recommended for admission to the program if they had
   "meaningfully contributed" to the Interview discussion, had passed a portfolio check and
   had passed a state-mandated content knowledge examination similar to the PRAXIS I or
   MAPP assessments produced by Educational Testing Services (ETS).

Informal discussions with candidates by several faculty members over the years indicated that the students did not perceive the Interview as a valid mechanism for admitting candidates to the final stages of their academic careers as it did not assess their content knowledge of the special education field, did not tap into their understanding of specialized pedagogy, legal issues,

historical development of the field, or how to collaborate with families and other professionals who work with children and youth with special needs on a daily basis. Several graduates of the Program, when asked about their experiences with the process, commented that the entire procedure was "a joke" and that the Program should take immediate steps to increase the rigor of the admission process and ensure that only candidates who demonstrated accurate content knowledge and possessed the appropriate dispositions will be admitted to the Teacher Education Program.

# Revising the Process

In the summer of 2007, the Special Education Faculty determined to revise the Admission Process, and discussed ways to develop an assessment procedure that would be both fair yet rigorous to candidates seeking admission to the University Teacher Education Program as Special Education Majors. The group quickly agreed that the process should use the statemandated dispositions that are a part of the overall assessment for both acceptance into the "professional student teaching semester" and at the completion of the student teaching semester. The dispositions are also used by the university's teacher education program to conduct follow-up studies on graduates of the program, and thus it would be desirable to use the dispositions as the focus of the new admission process as well. The state's disposition statements, loosely based on those espoused by the Interstate New Teachers Assessment and Support Consortium (INTASC), were agreed upon by the faculty members as the foundation for assessment items in the new "Qualifying Examination." These ten Dispositions can be found in Appendix A. Additionally, the faculty members agreed that some measure of special education content

knowledge should also be included in the admission Qualifying Examination. One faculty member agreed to assume the responsibility for selecting items from test banks provided by textbook publishers in core courses required of all special education candidates in the early stages of their programs of study. These courses will be generic courses found in most special education major programs and titled for example as "Psychology/Education of the Exceptional Child," "Collaborating with/Counseling Families of Children with Special Needs," and "Introduction to Special Education Programs."

Two other faculty members agreed to examine the Teacher Education Program's "Disposition Statements" and devise "constructed response" items (written response items) that could capture the extent to which each respondent had developed that particular "attitude" toward teaching children with special needs. The faculty members who assumed this responsibility had a rather daunting task that was two-fold. First, they had to develop a set of questions that they believed would both embody what each disposition was about and would be measureable in objective terms. Second, they would have to devise scoring criteria (rubrics) for each item that would allow for unbiased measurement of the mastery of each disposition. There were few guides in the professional literature to follow in order to construct questions or scoring rubrics for these widely-used indices of professional conduct and attitude. Faculty members also agreed that the scoring rubrics should parallel the other scoring rubrics that were currently being used for other components of the program's overall assessment system. Scoring rubrics included a 4-point scale (0=Does Not Meet; 1=Progressing; 2=Meets Standard; 3=Exceeds the Standard). Because requiring each candidate to address all ten Disposition Statements would prove to be impractical and very time consuming, faculty agreed that candidates must score at least an average of 6 points on a total of three Dispositions Constructed Response items, with not more

than one response being at or below a score of 1(Progressing). Thus, a score of 9 would be a perfect performance on this section of the Qualifying Exam.

After much writing, editing, rewriting, and outside consultation, the ten disposition statement questions and their scoring criteria and the set of objective content knowledge items were finally ready for critique and validation from outside the university. The reader is directed to Appendix B to see one of the 10 Disposition Statement questions and its scoring rubric as well as two objective content knowledge items.

# Validation Process

The state where the university is located has a number of regional advisory groups that consist of directors of special education programs who are members of the Council for Exceptional Children's Council for Administrator's of Special Education (CASE). The principle author is a member of the State's CASE organization and has regular contacts with these seasoned professionals. The CASE group was approached with the request for volunteers to peruse both sections of the Qualifying Exam (Objective Items and Constructed Response), and asked these volunteers to complete a Likert-Type Scale assessment of each item. This assessment asked the respondent to address each item on a 4-point scale (1=Inappropriate; 2=Appropriate; 3=Very Useful; 4=Essential). The respondents were also given the opportunity to provide comments pertaining to each item. Six CASE members agreed to participate in the validation process and were sent the Qualifying Examination Items and the Assessment Protocol via email. All six participants returned the instruments within 10 days as requested by the principle author. The responses from the respondents were highly favorable. It had been pre-determined that any item receiving a response of 1 (Inappropriate) from two or more raters would be eliminated.

Additionally, any item that was perceived as being "Appropriate" or "Very Useful" but tended to be ambiguous would be reworded. Only two items (both multiple-choice items dealing with language impairments) needed to be reworded. No item was deemed "Inappropriate." No constructed response item was targeted for revision. After rewording the two multiple-choice items of concern, and receiving favorable responses to the revisions from the CASE members, the Qualifying Exam was ready to administer to Candidates to the Teacher Education Program.

# Pilot Testing

In late October of 2008, the last of the traditional "Interview" candidates went through the process as they had done for several years, with the exception that this group was told that they also would be confronted with the "new" process. After doing both sections of the "old" format (video-taping of the group discussing the interview 'question' and the self reflection of their performance), the group (N=9) was taken to a computer lab in the same building and instructed to take the "Objective Test" portion of the new Qualifying Exam. They were told that the test would be "counted" as to whether they would be admitted to the program or not, thus ensuring that sufficient effort would be exerted on their part. The candidates were required to log onto the Black Board Learning System that is used as the online course delivery system at their university and is one of the most common methods for online course delivery at many universities nationwide. All candidates were familiar with Black Board and the procedures needed to take an online test. The "Constructed Response" section was not administered to this group. These candidates were administered only the objective (multiple-choice) items. The group was given 60 minutes to complete the test. There were 50 multiple choice items and the group scored a mean of 38 correct responses (76%, range 32-46).

A serendipitous request occurred to the authors when several candidates, for a variety of reasons, could not take the Interview as scheduled. These candidates were told that they had two options: Wait until the next semester to take the Qualifying Exam, which meant waiting an entire year to take advanced "methods courses" and putting off student teaching for perhaps a year, or take the Qualifying Exam in its pilot version, and be admitted (or denied acceptance to the program) based upon their scores. All candidates (N=5) agreed to take both sections of the Qualifying Exam and abide by the scoring procedures set forth by the faculty. This meant that the scoring rubric for the Constructed Response Disposition Items would now be tested. As previously mentioned, each candidate responded to only three of these Disposition Statements. Black Board allows the faculty member to have the program randomly assign three items to each candidate. For example, "Candidate One" may respond to Dispositions 4, 9, and 11, while "Candidate Two" responds to Dispositions 2, 3, and 8. Their results for the multiple-choice section were somewhat lower than the first group (mean correct items=32, range=31-44). The group scored on the Constructed Response section a mean of 6.8 (range 5-8).

In order to further refine both sections of the Qualifying Examination, student volunteers who had already been admitted to the teacher education program were solicited and asked to assist in the piloting process. Four students agreed to do this and were each paid a small honorarium (\$50 each) for their services. As expected, the volunteers, all of whom had been admitted to the teacher education program and were preparing to do student teaching the next semester, fared considerably better than the two earlier pilot groups. They scored much higher on both the multiple-choice section (mean=45, range=42-49) as well as the Constructed Response section (mean=7.3, range=7-9). At the conclusion of this piloting session, the four students were asked to submit comments about their experience with the new process, including providing

suggestions about the appropriateness of the items, wording and difficulty of the items, and any other comments that they cared to make about this process. All four students provided favorable comments and were very enthusiastic about the new process, particularly noting the greater rigor than that which they experienced in the old "traditional interview" process. Additionally, consistent feedback from these students indicated that we needed to change wording on three multiple-choice items and completely eliminate and replace two other items as the content of the items was too advanced for candidates in this stage of their academic programs.

First Session with the New Process

In late March of 2009, the first group of candidates officially went through the new Qualifying Examination process. The group was about average size for this process (N=7 candidates). As had been done in the first piloting session, the candidates were assembled in the computer lab, asked to logon to their Black Board Learning System accounts, and were instructed how to proceed with the two sections of the exam. They could opt to take either the multiple-choice or the constructed response section first. Two program professors, including the first author, were there to proctor the session and assist students should anything go wrong with the technology. Candidates were told that they had 90 minutes to complete both sections of the exam. There was only one minor problem in which one candidate completed the first section of the test, neglected to save her work, and lost that portion of the exam. She was allowed to start over without penalty. All candidates completed both sections of the exam within the time allotted. Table 1 presents the information regarding the performance of this group of candidates on the Qualifying Examination.

[INSERT TABLE 1 ABOUT HERE]

## Additional Refinements

Faculty members, for the most part, were generally pleased with the way that the new assessment process has functioned thus far. Because candidates are to be evaluated by at least two faculty members, the Constructed Response section from the first group of candidates was provided to four of the special education faculty members who agreed to score the responses using the Scoring Rubric that had been developed for this purpose. Inter-rater reliability, using Cohen's Kappa Coefficient, was computed for these faculty members' scoring these responses. Inter-rater reliability coefficient was found to be high (.94), and thus faculty responses in scoring these sections in the future should be very similar.

It was agreed that an "acceptable performance" on the new assessment would be as follows: An average score of 35 on the Multiple Choice section, and an average score of 6 on the Constructed response section. However, during discussions about student performance, faculty were quick to point out that some students perform better on multiple-choice items than they do on essay items, and vice-versa, and so a means of weighting the scores might prove useful in instances where candidates did not meet one of the two acceptable passing scores. It was agreed that one point on the Constructed Response section would be equal to three points on the Multiple Choice section. Thus, if a candidate had only 32 points on the Multiple-Choice section, this could be offset by scoring at least 7 points (1 above mean) on the Constructed Response section. Similarly, a candidate scoring 38 points on the Multiple-Choice section could have a score of 5 on the Constructed Response section and still "pass" the Qualifying Exam as a whole.

**Concluding Thoughts** 

The new Qualifying Examination process for gaining admission to the Teacher Education program at this university appears to be a valid and reliable method of selecting candidates who are likely to become competent, compassionate professional educators. The next step to determine actual validity of the process will be to examine the teaching performance of these individuals in an objective manner during student teaching as well as when they take their places in their own classrooms in the schools where they subsequently will be employed. It is hoped that other institutions will utilize this process in their own programs and view it as a valuable mechanism for the selection of qualified candidates to their teacher education programs.

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Table 1

Qualifying Exam Results for First Group of Candidates (N=7)

	<u>Mean</u>	Range	Possible Score
Test			
Multiple-Choice	37.8	31-44	50
Constructed Response	7.6	1-9	9

#### Appendix A

#### **Disposition Statements**

**Disposition 1:** Commits to high expectations for all students, and values the ability/capacity for each student to learn. (INTASC 1,2,3,4,5,6,7)

**Disposition 2:** Values student ability to apply concepts learned to performance activities. (INTASC 1,2,3,4,5,7)

**Disposition 3:** Commits to the development of critical thinking skills (e.g., problem solving, analysis, etc.). (INTASC 1,2,3,4,6)

**Disposition 4:** Commits to seeking out, developing, and continually refining teaching practices that generate more learning for students. (INTASC 9)

**Disposition 5:** Commits to development of lessons that are interesting and engaging through a variety of instructional strategies to accommodate all learners, including those from diverse backgrounds, experiences, and cultures (e.g., use of technology, grouping, motivating materials). (INTASC 1,2,3,4,5,6)

**Disposition 6:** Commits to making appropriate adaptations and accommodations for students with diverse needs (e.g., use of technology). (INTASC 1,2,3,5,6,8)

**Disposition 7:** Appreciates and promotes acceptance of self-discipline, responsibility, and self-esteem. (INTASC 2,5,6)

**Disposition 8:** Commits to a positive and enthusiastic attitude for teaching and learning to inspire self and others. (INTASC 9)

**Disposition 9:** Believes students and colleagues should be treated and should treat other with kindness, fairness, patience, dignity, and respect. (INTASC 5,6,9,10)

**Disposition 10:** Commits to relationships with school colleagues, parents, and educational partners in the larger community to support student learning and well being. (INTASC 10)

#### Appendix B

#### Sample Constructed Response Item and Related Scoring Rubric

and

#### Samples of Multiple-Choice Items

Disposition 4: Commits to seeking out, developing, and continually refining teaching practices that generate more learning for students.

Describe, in detail, what you would do, the steps you would take, if you had a student who was not learning a specific skill or concept after you had been teaching it for several days.

**ZERO POINTS - Does Not Meet Standard:** Does not offer any specific suggestions, other than continue to teach the skill or concept in the same or slightly different manner. Offers to refer the child to a "specialist" in that particular academic area.

**ONE POINT - Progressing:** Suggests, or alludes to ways to re-teach the skill or concept. States that parental assistance could be solicited. States that collegial help could be obtained.

Two Points – Meets Standard: Describes how alternative teaching methods can be tailored to meet student's needs. Suggests, or specifies, materials modification, alternate lesson plans, or modification of learner expectations. Implies how he or she would consult with colleagues to accomplish the learning skill/objective. Describes how parents/families could become involved in teaching the skill/concept.

Three Points – Exceeds The Standard: Describes how teacher assistance teams can be used to accomplish learning objectives. Alludes to or specifies one or more of the following:

- Doing research in professional literature or methodology texts to find ways to meet learner objectives.
- Communicating with parents to solicit help for the student at home
- Peer tutoring
- Computer-assisted teaching
- Reinforcement techniques
- Attending workshop/class to develop teaching skills
- Taking baselines and exploring effectiveness of alternative teaching methods
- Other specific interventions

#### **Sample Multiple-Choice Items**

Which of the following acronyms best describes the substance of Public Law 94-142 (IDEA)?

- A. LRE
- B. FAPE\*\* (Correct Response)
- C. SQRRR
- D. EHCA

The term for children who once were labeled "mentally retarded" is now which of these?

- A. Mentally Handicapped
- B. Severely Disabled
- C. Trainable Children
- D. Cognitively Impaired\*\* (Correct response)

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#### **ABSTRACT**

This paper discusses the step-by-step process used by a teacher preparation program to develop a more rigorous method for admitting candidates to the program. Through the use of constructed response items focusing on established teacher disposition statements and objective multiple-choice questions, the program produced a validated instrument that can be adapted to a wide variety of teacher education programs seeking to improve gate-keeping responsibilities to the professional education semester or internship/practicum experiences.

# A Quantitative Hybrid Course Model for Addressing the Online Student Success Gap

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#### **Abstract**

Institutions are searching for innovative and creative ways to incorporate technology into online course designs and improve their overall distance education offerings. In this paper, we analyze data at the research institution and compare online vs. traditional course success rates. Based upon the observed differences, we present a distance education course model which incorporates traditional, online, and interactive television (ITV) delivery methods into a single course design. The course model was developed to address reported shortcomings of courses offered exclusively online.

#### Introduction

With increasing transportation costs and technological advances, distance education courses have gained popularity. Extensive experiences with smartphones, mobile internet-enabled tablets and other technologies, make distance education options more appealing to nontraditional students [Dotterweich and Rochelle 2008; Grandzol 2004; Summers et al. 2005]. Distance education includes online, synchronous interactive television (ITV), and blended/hybrid teaching methodologies. Synchronous ITV courses offer live broadcasting of course lectures to remote locations. With ITV technology, students interact with their professors in real-time, by simply raising their hand and speaking to television screens. Blended/hybrid learning course models combine face-to-face instruction with asynchronous and/or synchronous online learning.

Amid our country's ongoing financial crisis and dwindling budgets, many universities are charged with creating innovative ways to increase enrollment, with limited resources for physically expanding campuses to accommodate growth [Sprague et al. 2007]. Increasing online offerings is a cost-effective solution to enrollment growth, while providing educational access to non traditional students. However, many universities have become concerned about reported student success and satisfaction gaps between online and face-to-face (traditional) courses. Moreover, concerns are heightened regarding their ability to effectively deliver quantitative and technical course content exclusively online [Anderson and Jackson 2000].

This study analyzes student performance in courses offered online vs. face-to-face at the research institution. The analysis reveals discrepancies between the pass/fail rates of online vs. traditional and quantitative vs. non-quantitative courses. We propose a hybrid course model to address the observed achievement gap that enhances student learning.

#### **Literature Review**

The National Center for Education Statistics reported that 4.3 million (or approximately 20% of all undergraduates in the US) took at least one distance education course during the 2007-2008 academic year- a 25% increase since 2003-2004 [The Condition of Education 2011]. Statistics also show that 0.8 million (or approximately 4% of all undergraduates) reported taking their entire program online during 2007-2008. The surge in online education programs has prompted considerable research on student success and satisfaction in online vs. traditional courses. Studies reveal higher dropout rates [Farinella 2007; Ferguson and Tryjankowski 2009; Wilson and Allen 2011] and lower student satisfaction ratings [Summers et al. 2005] in online courses.

Numerous studies have been conducted regarding student performance in online quantitative based courses. More specifically, online statistics courses have shown significantly higher dropout rates [Dotterweich and Rochelle 2008; McLaren 2004; Summers et al. 2005] and lower overall performance levels than non-quantitative online courses [Grandzol 2004; Lawrence and Singhania 2004]. Research that analyzes grades of students, who have successfully completed statistics courses, reveals that there is no significant difference in student performance in online vs. traditional courses [McLaren 2004; Summers et al. 2005]. Their studies suggest that determined students who are self-regulated learners, and thus prepared for the online environment, can perform equally as well online as students in traditional quantitative classes. Research on hybrid statistics courses shows no significant difference in student performance when compared to traditional statistics courses [Utts et al. 2003; Ward 2004].

The gap in student success in online vs. traditional courses has lead researchers to investigate potential challenges contributing to this disparity. Students have reported that the lack of face-to-face interaction leaves them feeling isolated and unmotivated. Moreover, they cite problems with learning new technology and their failure to adopt sufficient strategies for self-regulation as factors contributing to their poor online class performance [Summers et al. 2005]. Faculty report that a disproportionate amount of time is required to design and manage an effective online course when compared to traditional courses. Furthermore, they cite that learning new technology to manage online courses and resolving technical difficulties throughout the course requires significant time and commitment [Grandzol 2004; Ocak 2011]. These factors can deter the most qualified and capable instructors from teaching online.

Various models have been proposed to expand online teaching methodologies and address common student and faculty issues regarding online courses. Models presented in research often involve course delivery options which are primarily dependent on web based course management systems such as Blackboard and Web CT [Arbaugh and Rau 2007; Chou and Chou 2011; McLaren 2004; Summers et al. 2005]. Students have criticized these models for being impersonal and having minimal instructor interaction. ITV offers course instruction to students located at distant, remote sites [Dotterweich and Rochelle 2008; Horvath and Mills 2011]. This delivery mode allows distance education learners to interact with their instructors in real-time, eliminating one major challenge associated with online courses. ITV students must meet during designated class periods, thus they do not enjoy the flexibility of online classes. One major drawback associated with ITV technology is the expensive equipment and maintenance costs that are incurred by both the institution delivering the ITV course and the remote site. Hybrid teaching models have gained popularity as an alternative to traditional courses in an effort to

merge the best practices of traditional and online teaching models [Sherrer 2011; Ward 2004]. Hybrid courses allow students to retain the personal interaction with their instructor, while maintaining the convenience and flexibility of online technology [Chou and Chou 2011; Sitter et al. 2009; Ward 2004].

The course delivery model presented in this paper simultaneously incorporates traditional, online and ITV methodologies. The research institution adopted technology to assist with delivering hybrid teaching/learning courses. During a single semester, students are able to alternate between delivery options at their convenience.

#### **Impetus for Current Research**

We sought to explore factors that impact the rate at which students pass/fail courses. There were 2,583 courses offered during the 2009-2010 academic school year at the research institution. With the inclusion of multiple section courses, 46,622 grades were recorded. Descriptive statistics and hypothesis testing were used to analyze the pass/fail rates for graduate vs. undergraduate, spring semester vs. fall semester, online vs. traditional (face-to-face) and quantitative vs. non-quantitative courses.

A summary of the 46,622 grades provided in Table 1 revealed that less than 14.3 (6,646/46,622) percent of the courses offered were quantitative, 13.9 (6,503/46,622) percent were on-line and 4.7 (2,175/46,622) percent were graduate courses. Overall, 73.7 (34,369/46,622) percent of the students enrolled in these courses passed with a C grade or higher during this academic year. For the purpose of our research, we define successful course completion as a C grade or higher.

Table 1: A summary of the pass/fail rates from 46,622 courses offered in 2009-2010.

	Pass	Fail	Total		Pass	Fail	Total
Undergraduate	32498	11949	44447	Online	4538	1965	6503
Graduate	1871	304	2175	Traditional	29831	10288	40119
Total	34369	12253	46622	Total	34369	12253	46622
Fall	18006	6708	24714	Quantitative	4754	1892	6646
Spring	16363	5545	21908	Non-Quantitative	29615	10361	39976
Total	34369	12253	46622	Total	34369	12253	46622

Table 2 displays a cross-tabulation of the students that passed or failed courses, the mode of course administration (online vs. traditional) and the course type (quantitative vs. non-quantitative). Among the 461 students taking quantitative courses online, 282 (61 percent) successfully completed their classes. In contrast, 72 (4472/6185) percent of students passed their quantitative courses administered traditionally.

Table 2: A cross tabulation of the mode of course administration and course type.

	Online			Traditional		
	Passed Course	Failed Course	Total	Passed Course	Failed Course	Total
Non-quantitative course	4256	1786	6042	25359	8575	33934
Quantitative course	282	179	461	4472	1713	6185
Total	4538	1965	6503	29831	10288	40119

Four  $\chi^2$  tests were conducted to determine whether there was a substantive relationship between the pass/fail rates and the course classification (undergraduate vs. graduate), semester of course offering (spring vs. fall), mode of administering the course or the course type. The p-values are less than 0.0001 for each of these  $\chi^2$  tests presented in Table 3. The results show that there are substantive relationships between pass/fail rates and each of these different factors.

Table 3: Results of  $\chi^2$  test for pass/fail rates.

	Course	Semester of Mode of Administerin		g Quantitative	
	Classification	Course	Course	Status	
<b>Test Statistic</b>	178.28	20.12	60.40	19.13	
df	1	1	1	1	
p-value	< 0.0001	< 0.0001	< 0.0001	< 0.0001	

Further exploration of these factors, lead to additional hypotheses testing. Archival data from the literature suggests that quantitative courses are often deemed as more challenging and thus have an increased failure rate as compared to non-quantitative courses. Classes that involve extensive mathematical calculations, scientific or technological methodologies, computer science programming or engineering are viewed as quantitative. Tangentially, we would surmise that quantitative courses offered on-line would be even more daunting for students to successfully complete. The following research hypotheses were explored:

H1: The proportion of students passing non-quantitative classes is greater than the proportion of students passing quantitative classes.

H2: The proportion of students passing traditionally administered (face-to-face) classes is greater than the proportion of students passing online classes.

H3: The proportion of students who pass quantitative classes that are traditionally administered is greater than the proportion of students passing quantitative classes that are online.

Table 4 shows the test statistics and p-values for each of the aforementioned research hypotheses. The p-values are less than 0.0001 for each of these tests and are consistent with existing literature. For H1, a p-value <0.0001 indicates that there is a higher success rate in non-quantitative courses vs. quantitative courses. The results from our second hypothesis test suggest that on-line students have a lower success rate when compared to face-to-face students. For our third hypothesis test, we isolated all student grades from quantitative classes. Within this subgroup, the p-value indicates that the proportion of students who pass traditionally

administered quantitative classes is significantly greater than the proportion of students passing quantitative classes that are online.

Table 4: Results of three hypotheses test for proportions

	H1	H2	Н3
Test Statistic	-4.37	-7.78	-5.11
Sample size (n <sub>1</sub> ,n <sub>2</sub> )	6646, 39976	6503, 40119	461, 6185
p-value	< 0.0001	< 0.0001	< 0.0001

The results support concerns that many researchers have regarding the ability of instructors to effectively offer quantitative courses online. Exploring solutions to this quandary regarding success rates in traditional vs. online quantitative courses served as the impetus behind our research. In the next section, we propose a model that combines multiple delivery modes in an effort to mitigate this student achievement gap.

#### **Proposed Quantitative Course Model**

The disparity between online vs. traditional student performance is apparent in the research population for this paper. As our results indicate, course delivery modes can have a significant impact on student success rates. Typical course delivery models are usually preset and established at the beginning of each course. Students generally enroll in a selected format and the delivery method remains consistent throughout the course. With hybrid courses, a schedule is often set for online and face-to-face lectures/modules at the onset of the class. In this section, we present a course model that was implemented in MBA decision science courses at the research institution. This model allows students to alternate between traditional, online and ITV delivery options at their convenience throughout the semester. Flexible delivery options allow students to adjust their learning strategies based upon their skill level and current progress. The proposed model aims to reduce the shortcomings of preset course delivery models and enhance a student's overall learning experience.

#### School Background

The School of Business at the research institution is accredited by the Association to Advance Collegiate Schools of Business (AACSB). The university is proximally located near one of largest military installations in the country. The MBA program caters to non-traditional (over 24 years of age) students through offering a night and online program. Courses are offered on the main campus and two additional satellite locations. With limited faculty, two possible course delivery modes, and three locations to service, program administrators researched technology options that would accommodate their needs.

The MBA program ultimately invested in Lifesize EXPRESS 220 and Lifesize 220 Teams communications systems by Logitech. This technology allows instructors to broadcast face-toface lectures to satellite locations in real-time using ITV. A large television screen in the rear of the classroom displays a split screen of both satellite classrooms. Students at remote sites simply raise their hands and interact with the instructor -similar to students present in the actual classroom. Electronic recordings of classroom lectures are captured (in real-time) and made available on the class website.

#### Description of course model

The above model has been piloted at the research institution over a two year period in two MBA decision science courses: Statistics and Management Science. Students registered for each class under two sections: one for traditional students attending class primarily on campus, and a second section for students primarily attending satellite campuses or taking the class online. Each course was taught once a week in three hour intervals, where traditional students attended class on the main campus and the lecture was synchronously broadcasted to satellite campuses using the Lifesize systems. The instructor interacted with traditional and satellite students simultaneously throughout course lectures. A university staff member was available to monitor satellite locations and assist with technological issues.

All sections of each class were taught and managed through a single Blackboard course website. The website contained all homework assignments (which were submitted online), lecture notes, and extra practice problems. Conceptual and assignment based discussion boards were set up for all students to voluntarily participate in virtual study group sessions. Ultimately, students utilized the discussion boards to complete course assignments, group projects and prepare for examinations. Additionally, Lifesize broadcasted lectures were recorded and available for students to view (or download) through the course website. Pre-recorded chapter video notes were also prepared and posted on the website to provide students with instructor lectures in the event that technological problems occurred during recorded Lifesize lectures. These video files provided additional learning resources for all students.

Since all course requirements, except examinations were submitted online, students were allowed to go between delivery options (traditional, satellite locations, online) at their convenience. Students were able to attend class or utilize website resources to learn independently. Course requirements consisted of class assignments, group projects, three exams and a comprehensive final exam. The attendance policy for course examinations was rigid. Students were required to specify their primary delivery mode for exams at the beginning of the semester. Traditional and satellite students took all exams during the same time period at one of the three classroom locations. Online students were required to take exams at one of the university class sites or establish an approved proctor location at the beginning of the semester. All test proctoring sites were approved during the first two weeks of class. Exceptions were allowed for military personnel deployed during the semester. Those students were re-classified as online students upon receiving deployment orders and proctoring sites were immediately established. All students were administered the same course exam.

#### Conclusion and/or insights

The proposed course model allows students flexible delivery options throughout the semester. Our model is particularly useful at institutions where there is a documented disparity in student performance in online vs. traditional delivery options and flexible distance education alternatives are desired. Our model allows students to rotate between attending traditional (either on main campus or via ITV at satellite campuses) and online classes. Temporarily deployed military, absent and online students are able to stay connected to a traditional classroom environment. These students have the ability to retrieve and replay parts of lectures to reinforce learning, while benefiting from common student questions asked (and answered) during actual class lectures.

This model provides students with the flexibility of an online environment, while maintaining the guidance and comfort of traditional instructor support.

Future work will involve developing a system for tracking the weekly delivery methods utilized by each student, in order to analyze achievement differences. Currently, since students are allowed to rotate between delivery options, their course enrollment status does not indicate their actual weekly learning preferences. A combination of class attendance rosters and tracking online material viewing will assist with isolating weekly learning trends for students. Additionally, we plan to develop a technology survey for students in an effort to understand how technological abilities and problems impact student learning for our course model.

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#### **EFFECTIVENESS OF THE USE OF PORTABLE ELECTRONIC DEVICES (PEDS)** IN CLASSROOMS ACROSS DISCIPLINES: FACULTY AND STUDENT **PERSPECTIVES**

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#### **ABSTRACT**

Portable Electronic Devices (PEDs) such as laptops, smart phones, tablets etc. have become an integral part of almost every higher education student's learning toolbox. In this study, the faculty and student perspectives on the effectiveness of the use of PEDs during classes, are collected and compared using surveys done at Southern Polytechnic State University. Faculty openness and reservations, policies, student temptations and complaints are discussed. While the PEDs can be a source of distraction, they, if used carefully, can also provide an opportunity for engaging students.

#### **INTRODUCTION**

The effectiveness of the use of PEDs in classes is seen with skepticism by some and optimism by others. Like other campuses across the nation, an increase in the use of laptop and other mobile devices is observed in classes across disciplines at the Southern Polytechnic State University (SPSU). The goal of this study is to determine and compare the faculty and student perceptions of the effectiveness of the use of Portable Electronic Devices (PEDs) in classrooms across disciplines. Student and faculty perspectives on the use of PEDs are gathered, analyzed, and compared using Survey Monkey. For the purpose of this study, PEDs include, but are not limited to, laptops, smart phones, tablets, etc. In the survey of 100 students from five different schools, conducted in spring 2012, over 89% of the students reported bringing their PEDs to at least one or more classes. Some faculty see this trend as an opportunity for more innovative teaching, and are exploring ways to leverage this technology to increase student engagement during classes. However, other faculty members worry about potential distractions that PEDs introduce in their classrooms. In a separate survey of faculty members from various disciplines, it was observed that 76% do not permit the use of PEDs in their classes. In this paper the results of the research study are presented that examined the student and faculty perceptions of how PEDs affect attentiveness, engagement, and learning. A few guidelines for using PEDs effectively in the classroom are explored. As discovered by Zhu et. al [1], PEDs can be an effective tool for promoting student learning if faculty plan carefully how and when they will ask students to use their devices, rather than simply allowing students to bring them to class.

#### RLC SURVEY AT SOUTHERN POLYTECHNIC STATE UNIVERSITY

Several studies have been conducted to analyze the effect of PED usage on student learning and engagement. There is some evidence of both positive and negative impacts. On the positive side, when students can pose questions using their PEDs, the number of questions is higher than in traditional classes [2]. Faculty members at SPSU who favor the use of PEDs in classes argue that students can take better notes and can look information up upon the instructor's request. They also believe that it helps them follow along with material that has been posted. A computer science professor notes that some students are quick and they write code on their machines during the lecture, which the professor believes helps them learn and test their learning on the go. One professor noted that PEDs are currently used in the industry, so students should be allowed to use them in class. Some also argue that the use of PEDs facilitates the ready access to information in discussion courses and helps in the reduction of paper use. Studies that correlate final grades with student use of PEDs have been mixed, with some finding that student with PEDs received slightly higher grades [3], and others findings a negative correlation between the use of PEDs and grades [4, 5]. On the negative side, students have reported that PEDs, both their own and those of their classmates are a distraction [6, 7, 8]. It is important to note that studies showing a positive association between PED usage and student learning or grades involved courses in which the integration of technology had received significant attention from faculty [1].

To investigate the views of the SPSU students and faculty about this issue and the possible impact that PEDs may have on teaching and learning, the Research Learning Community (RLC) conducted a study of student and faculty perceptions of how PEDs affect student attentiveness, engagement, and learning. Undergraduate and graduate students from the schools of sciences, humanities, engineering, computing, business and architecture were surveyed. The majority of the respondents in the campus wide survey were seniors as shown in Figure 1 and most of the responses in this engineering dominated institution came from students majoring in engineering and technology disciplines as shown in Figure 2. The response rate from the 200 faculty members surveyed was over 44% and the response rate was 30% from the 5000 students surveyed.

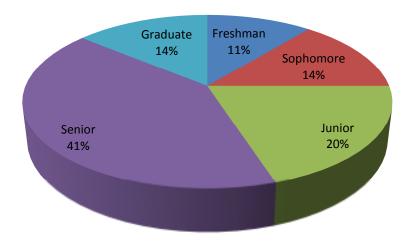


Figure 1: Responding Student Distribution by Year

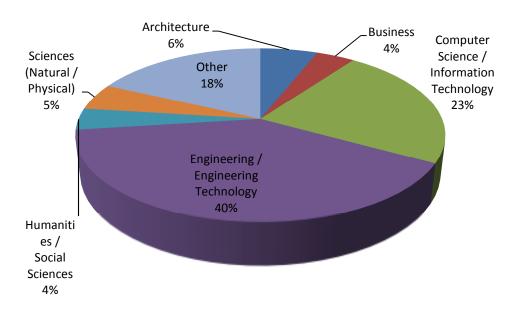


Figure 2: Responding Student Distribution by Major

When asked about the use of PEDs during class, majority (89%) of the student respondents indicated that they used PEDs during one or more classes. Students gave the following reasons for using them during classes:

[If] The teacher is doing a poor job of defining or explaining, it is nice to Google along with the lecture to learn on my own

### The material called for it: like an interactive type deal b/w[between] teacher and students

When faculty members were asked how they felt about the use of PEDs in classes, 76% indicated that they did not permit the use of PEDs during classes because they saw it as a distraction from lecture or other classroom based learning activities as students used them for everything but classwork. It also made it harder for some faculty members to prevent cheating, sharing of information etc. during quizzes and exams as one professor indicated 'if you let them use [PEDs] in class they would say "we learned how to do the classwork using it, so we should be able to use [them] for exams, [and] quizzes". Some of the other responses obtained from the professors are as follows.

Students routinely use devices [during class] for non-class purposes

Most student[s] have little willpower to stay on task with the class material

/There is/ Limited IT support from the SPSU staff

However a few faculty members were open to the idea of students using PEDs during classes and indicated:

1. [I] couldn't stop them if I wanted to 2. [PEDs are] useful for note taking 3. [and] useful for class activities

/I allow PEDs for/ Research and precedent studies

[Student use of PEDs during classes] does not seem to be a problem. [It] may help them learn

I get a great deal of students who need learning accommodations

They can take notes better; they can look stuff up at my request

Students can take notes on any device. My lecture notes are electronic, so they can follow along on a portable device if they like.

More information is better

[...] Because they code on their own machines sometimes

[PEDs are] currently used in industry, so they should use them in class

[PEDs provide] ready access to information in discussion courses; [it helps with the] reduction of paper

#### PEDS - STUDENT ENGAGEMENT DURING CLASS?

Students and faculty were asked whether the use of PEDs helped engage students better in class. 52% of the students indicated that they were better engaged due to their use of PEDs during class and 21% disagreed or strongly disagreed with the statement.

I often will read a book or surf the Internet with it during lectures where the teacher is not very good but requires attendance

[It is] No more or less [engaging] than any other form of note taking

I have to force myself to not stray from the topic at hand. If I fail at that, then the device becomes a distraction and not another tool for well-rounded learning.

Some students admitted that PEDs were useful sometimes and a distraction at others.

It has allowed me to quickly research terms relevant to class lectures and guest speakers. While doing said research, you aren't able to pay full attention to the lecture though

It depends on the class; for the most part, no, they are a distraction. However, they are very engaging and nearly a necessity for me in a couple classes, like my programming classes

Only 7% of the faculty members agreed or strongly agreed that students were better engaged during class when they had a PED open in front of them. Over 55% of the respondents indicated that they disagreed or strongly disagreed with the statement. The response trends received from the students were opposite to those received from the faculty members. Few of the faculty comments are as follows:

These kids are easily distracted and rowdier than any first-grader

I don't wish to feed their gaming desires

A comparison of the difference of opinion is shown in Figure 3.

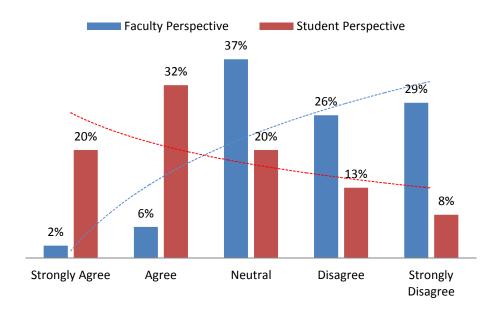


Figure 3: PEDs Help Engage Students during Class

#### PEDS - A DISTRACTION DURING CLASS?

Students and faculty were asked whether the use of PEDs was a distraction during class. 27% of the student respondents either agreed or strongly agreed with PEDs being a distraction during classes. But 45% of the students either disagreed or strongly disagreed with the statement. The response trend was opposite from the faculty perspective as shown in Figure 4.

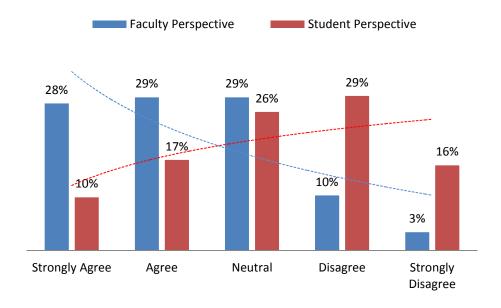


Figure 4: PEDs Cause Distractions during Class

#### Faculty

It has been my experience that many students who use PEDs in the classroom rarely use them for the purpose of educational advancement. They are generally used to check facebook, emails, and I find that after giving a lecture on a subject in which students have spent the entire class using their PED's that they fail the pop quiz because they have not paid attention

#### Student

I believe PEDs can be a distraction if the student using it is not responsible enough to only use it for learning. Most of the time the teacher already uses the projector. But in a lot of cases PEDs are great tools to learn

People who listen to music, text, play games seem to lack respect and consideration to, not just the teacher, but nearby students. Why are they even there? Are they expressing a need for attention, ill-will for bad grades, and or just completely oblivious to their environment? A suggestion that students have the resources of electronics as supplementary learning devices rather than tools of distraction and ultimately inconsiderate in nature, is altruistic and ideal, but can't be regulated except by the individual. So let them waste their attention on slashing fruit or looking at pictures, or playing solitaire, it's their education.

As long as a good Student: Professor relationship is founded, the use of PED's would be a great asset within the classroom environment. Personally, I utilize Khan Academy and Brightstorm for mathematics during study sessions (not during lectures, until it becomes acceptable). While at home I am constantly on specific YouTube channels dedicated to the household education/online learning (mostly computer related materials though: Java, C++, & Khan Academy). If this method could be implemented, it would throw a wide curve-ball to the learning community, but over time, I think SPSU would begin to hit homeruns one after another!

I have found having access to the Internet gives me the advantage over other students, because I can check other sources or find visualizations or other explanations of complex topics. Books can achieve the same thing, but it is not searchable easily and operates on a different timescale.

Competent professors can tell the difference between the student who is wasting time and the student who is engaged. Electronic devices are no more of a distraction for me than a pen and paper.

By restricting the use of PED's in class you will only hurt those who would benefit from their use. If someone is going to abuse their PED during class then chances are they wouldn't pay attention without it. This is college and if a student doesn't want to come to class then they have that option but they pay the price with grades if they want to bring their laptop to class and screw around on it, then let them, they will suffer just like the kid that cut class. But I know I used mine in class many times to help me take better notes or access other tools that I had stored there. Having access to a PowerPoint presentation was also helpful in that I could make note on each slide as the professor covered it and I didn't have to take time writing down something that was already on the screen.

#### PEDS - OPPORTUNITY FOR INNOVATIVE TEACHING?

Faculty members were asked if the use of PEDs during classes provided an opportunity for more innovative teaching. Mixed responses were received, with 36% either agreeing or strongly agreeing with the statement and 26% either disagreeing or strongly dis-agreeing with it. Some faculty members believed that PEDs work better in some classes than others. One professor questioned the need for coming to the class if students were going to use PEDs. In another professor's experience, teaching with the PEDs as an experiment ended up in a disaster. They found out that students wanted to surf the internet instead of attending the class. Some were concerned that not everyone in the class would have access to the PEDs, so some students might have an edge over the others in the class.

A composition professor indicated that 'the students may use the [class] computers for research and writing or use their own devices.' However if students use their own devices, some of them may have invested in the necessary software and / or have suitable technological literacy and others may not. Some professors argued that there was no evidence that using PEDs was better than taking notes by hand; and others were more open to the idea of learning how these electronic devices would help them improve their teaching. One faculty indicated that they used webpages projected for the whole class to see and felt that there was no legitimate need for PEDs in their classes.

The faculty members who support the idea of using PEDs in classes indicated that in most cases, these devices provided new opportunities for innovative teaching. Sometimes students can look up information related to class topics. It can also be used as a device to provide feedback to the instructor or encourage the class discussion. Others who support the use of PEDs indicated:

...The use [of PEDs] by instructors has a greater opportunity for innovation. If not the focus of instruction they can be a distraction

I find them to be helpful when we want "on the spot" clarification of an issue. Students like to look info up and let the rest of the class know what they have found

Sometimes students can look up things related to the class topics.

It sometimes provides interesting feedback and/or augments the discussion in progress.

I have used software to allow students to submit answers online but it "dis-engages" students without appropriate devices. Unless all students have a device and are required to have one I think it does a disservice to students.

#### PEDS - IMPROVED STUDENT LEARNING?

Students were asked if they learned more due to the use of their PEDs during classes. Over 54% of the respondents agree or strongly agree that their learning improved due to the use of PEDs during classes and 20% disagreed or strongly disagreed with the statement. Students indicated that the use of PEDs greatly increased their education when they used them outside the classrooms. One student indicated that 'One class almost requires it so we can follow along with the professor.' Another student reported that:

It has assisted me on a few occasions, especially when I only have an electronic copy of a book

Over 81% of the students indicated that having Power Point slides and other notes available on their PEDs were helpful during classes. 'It is also nice to type notes directly on the Power Point slides while the teacher is talking. It makes for well-organized notes' remarked one student. Students can follow at their own speed rather than trying to keep up with the professor. But 'it comes with a cost of not being able to pay full attention to the lecture, which is sometimes more important' remarked one student. Sometimes professors strictly enforce the no-electronic devices during class policy and students come up with other ways to keep up with the classes as one student objected 'I often have to copy mine and bring them to class because I am not allowed to use my PED in class.' In today's multi-tasking age, some students think that it is almost necessary to have a PED to get the full benefit of attending a face to face on campus class.

The Professor sets the speed of the presentation. If he goes too fast, I can go back and review. This is essential so that I don't trip during the presentation and get lost. It is very hard to regain a foothold, especially during a very technical talk that builds upon itself

Summary of the student responses in terms of improved student learning due to the PED use in classes, is shown in Figure 5.

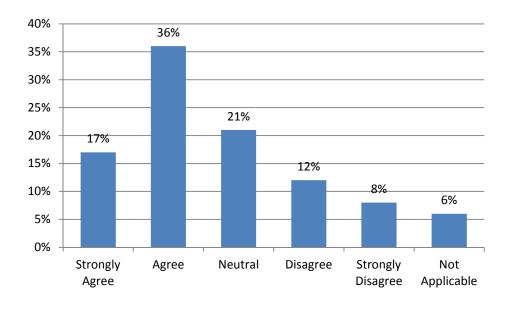


Figure 5: I learn more because of the use of PEDs during class (student responses)

One faculty member pointed out:

... In my courses the need for a mobile learning tool and demonstration aid is becoming more and more critical. I have to rely on student computers and laptops to search for references of detailing, inspiring

volumes, and other multiple references (landscaping, material research, code research, etc.). A mobile device like an iPad or similar with browsing capabilities and a more robust wifi signal in all campus areas would help TREMENDOUSLY to have more fluid and effective learning opportunities for our students.

Students were asked to indicate how much time they spent using PEDs during a class. Less than 8% of the students admitted that they spent more than 10 minutes using a PED during class. The responses are shown in Figure 6.

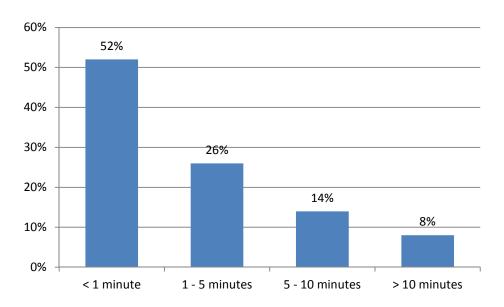


Figure 6: I use \_\_\_\_\_ minutes on non-course related work on my PED during class (student responses)

#### **USE OF PEDS BY FACULTY**

In the survey, less than 14% of the faculty respondents reported using the PEDs on regular basis. Of these, some strongly believed that a tablet device would work perfectly for their course instruction and allow the ideal flexibility for the presentation. These were generally the professor who themselves used the PEDs extensively but cautioned about their careful use during classes. One professor indicated:

As much as I'm all but tethered to my own macbook and iphone, I make sure to not use them inappropriately in the classroom and expect the same from my students. I notice that the students who are pulling out their phones are fragmented in their attention and unengaged.

Some of the faculty members were open but hesitant to use it. One professor hesitated 'I would use it more often if there were a prescribed methodology that requires PED use and has been demonstrated to enhance student learning.' But majority of the professors were reluctant and rarely or never used it. One faculty indicated '...but I am teaching, why would I be on a smart phone or a tablet?'

#### RISK OF ACADEMIC MIS-CONDUCT

Several of the faculty members were concerned that if PEDs were allowed in the classroom, they would provide another opportunity for academic mis-conduct. They were convinced that PEDs were not good 'because students can easily text each other without the knowledge of the proctor.' Some of the faculty responses are listed as follows.

I've had a student use the Wolfram Alpha phone app on my Diff. Eq. quizzes. I know what the software can do. I couldn't care less! I wanted to know what the student could do. Not only had she not mastered the material, she lacked the mathematical competence to distinguish between a human generated and a machine generated expression. After all, someone has to understand the mathematics well enough to build the apps of tomorrow!

Texting opens up a whole new field of cheating. Off-campus "helpers" are as guilty as the student in class and should be subject to penalties. How can we catch them?

We don't allow the use of PEDs on exams. We've found that academically dishonest students "beam" exam problems to awaiting "experts" who solve and return the problems to the waiting examinee.

#### **PED POLICY**

When asked if they had a clear policy on their syllabus about the use of PEDs in classes, over 55% indicated that they did not. Some professors assumed that '...students know the restriction' and while others were of the opinion that 'but I generally get asked this question on the first day of class and explain my policy verbally.' One professor admitted that 'obviously this new cultural activity will require [me to put] one [policy in my syllabus] going forward.' Some of the other responses are as follows:

I physically let my students see me put my cell phone on silent each day as an example

I'm working to be more flexible with these since it's obvious many students use them for a good purpose. It's just the texting that gets on my nerves

When I used to teach a history class, I had to ban calculators. Students were doing their math and science homework in history class. Banning calculators pretty much took care of it.

A PED, like any tool, can be used for both good and bad. A hammer can build a home or be used in an act of violence. Policies should not relate to tools, but rather student behavior. Any student causing a distraction in the classroom should promptly be removed from the learning environment; the tools used during the distraction are largely irrelevant.

#### LOGISTICAL AND INFRASTRUCTURE CONCERNS

Several faculty members, more than the students, highlighted that they did not encourage or allow the use of PEDs in their classes due to the inadequate infrastructure. They were concerned that if they used it as part of their instruction, then the system might fail causing them to lose the precious time of instruction. They were also sometimes hesitant to require the use of PEDs in classes, because not all students might be able to take advantage of it because not everyone has the same gadgets or same updated software for it. The results of our study confirm findings from other similar studies. Zhu et. al [1] assert that when PEDs are used for specific pedagogical purposes, they can have significant benefits for student learning. At the same time, as both subsets of faculty and students confirm, they are also a potential distraction in the classroom. Given that the number of students who own PEDs is increasing steadily, faculty will need to think carefully about their approach to student PED use and how they can maximize the benefits while minimizing the distractions. Options for faculty range from banning the PEDs in class where everyone is required to have and use the PED for class participation, to adopting an intensive approach, or using a variety of intermediate solutions [1].

#### **POLICIES AND PROCEDURES**

Over 76% of the faculty members who responded to the survey indicated that they did not allow the use of PEDs in the class. Over 56% said that they did not have a clear policy in their syllabus about the use of PEDs in class. Whether faculty decide to encourage or discourage student use of PEDs, it is often helpful to have a clear policy statement in the course syllabus about expectations for how and when PEDs are permitted. Such a statement will help manage the use of PEDs in class, and it will act as a guideline to students regarding their expectations. It is not enough to assume that students know by default what the expectations are, or telling them verbally is enough, as some of the responses suggested:

But I generally get asked this question on the first day of class and explain my policy verbally

Students know the restrictions

[I have a] verbal policy that cell phones must be put on silent with an exception for emergencies

These days, with PEDs as ubiquitous as pen and paper, not having a policy is an implied understanding that PEDs are permitted in class. Following are samples of statements that faculty use to set boundaries for PEDs in their classrooms [1, 8].

"Students are not encouraged to bring laptops [or other PEDs] to class. A closed laptop rule during lecture will be enforced and other communication devices will need to be on 'silent' during lecture." (U-M Syllabus)

"When you use laptops [or other PEDs] during class, do not use laptops for entertainment during class and do not display any material on the laptop which may be distracting or offensive to your fellow students." (Northern Michigan University, 2010)

As indicated by Zhu et. al [1], such policies need not entail all-or-nothing approaches. Faculty can specify in the syllabus when PEDs will be permitted in class (e.g. for specific activities, note taking, or research), as well as times when students will not be able to use PEDs because their distracting presences would create problems. During a single class session, an instructor might plan out times when PEDs can and cannot be used and clearly communicate that to students. A simple phrase, such as 'Screens closed, please, for this discussion so I have everyone's full attention' conveys both the policy on the use of PEDs for the activity and a rationale for why the faculty wants the screens closed [1].

Instructors can implement a PED-free zone, reserving the first or first few rows of the classroom for students who do not use laptops. This creates an area where students who are distracted by neighboring screens and nearby typing are free from those distractions [9].

Some classroom structures are better suited for PED use than others. Before telling students to bring their PEDs to class, an instructor should check to see whether the classroom infrastructure and the IT would support their use. For example Zhu et. al suggest that when planning an activity that requires PEDs for entire class, the instructor needs to ensure that the classroom has enough power outlets, or plan to remind students to charge their batteries in advance. If students need to work in groups doing classroom research, the instructor should check to make sure the furniture allows them enough space for typing without having to balance their computers or keyboards on their laps. Similarly the instructor should ensure that the students have the right hardware and software capabilities to connect their equipment to the projector for peer review work. When asking students to view media or download files, the instructor should find out if there are bandwidth limitations that might prevent all students from going online simultaneously. The instructional technology department of the school or college in charge of a classroom building will usually be able to answer these questions [1].

In addition, faculty should consider how they will accommodate students who do not own PEDs so that they are not excluded from important learning activities. One option is to have students work with partners or in teams so that they can participate even if they do not have a PED.

#### INSTRUCTIONAL PRACTICES FOR ACTIVE ENGAGEMENT

Instructors can take advantage of PEDs that students already have to encourage active participation and engagement in classes. This is especially useful for large classes. For example, Zhu et. al [1] suggest that students can participate in class polls and answer questions using either a web browser on their laptops or their cell phone's text messaging capability via web based polling software (e.g. Poll Everywhere). Student answers and opinions can help the professor pace the lecture and shape the class discussion. During lecture, students can also access programs such as Google Moderator or Live Question Tool to post questions and vote on them. Students can even post questions while they are doing the reading (both

inside and outside of class). Once a question is posted, other students can vote on the question to indicate that there is more than one person interested in it. PEDs can also allow students to engage in non-graded assignments. Using PEDs based tools allows for faster instructor response. The instructor does not need to wait for the next class to hand back hard copies. It also provides a convenient way to maintain a permanent electronic record of student's in-class writing [1].

#### PEDS AS TOOLS FOR REFLECTION AND IDEA GENERATION

Faculty may choose to turn some part of their course into studio or laboratory, during which time, students engage in experiential learning with their PEDs. A few Architecture professors in the author's home institution have adopted this methodology and it is also applicable in other disciplines. Students can participate in reflective activities and problem-solving sessions. They can work on design projects as part of larger course assignments e.g. research projects, presentations, papers etc. Such activities can be created in class or the faculty member can state explicitly that students will need to finish part of the task outside of class, where students are allowed the open use of PEDs. Ideally, Zhu et. al [1] assert, tasks build on ideas presented earlier in that class session, so that students are applying, practicing, or reflecting on important topics from material introduced on that day.

#### **CONCLUSION**

As the Portable Electronic Devices (PEDs) become more common, the issues raised with their presence and use during classes will increase. This study confirms that PEDs are like any other classroom tool. They function best when they fulfill a clear instructional goal and when they are used in specific ways that support student learning. Teaching and learning are human efforts. Technology is an excellent supplement to learning and teaching, but should not replace the very valuable direct interaction methods of teaching. From the faculty perspective, it comes down to each individual student and circumstance to how helpful a PED can be. The individual has to be disciplined enough to use it for the appropriate avenues. They must also balance using the PED and listening to the lecture, or participating in other classroom based activities. And while some faculty may decide either to ban such devices or make full use of them during classes, there are intermediate steps that they can use to take advantage of the potential power of PEDs while minimizing their distracting effects. A careful use of PEDs can enrich opportunities for interaction with peers and instructors, as well as with course materials, increasing student engagement and learning. It is clear that this issue is invites further investigation.

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#### IMPROVING ONLINE COURSE DELIVERY

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#### **ABSTRACT**

Many departments and faculty are using various online delivery mechanisms to teach their classes. The types of mechanisms range greatly in appearance, content delivery, efficiency and effectiveness. What lessons can we learn from those who have gone before us regarding online delivery? What lessons have we learned in our endeavors?

This presentation is initially focused on a completely online course offered at The University of North Carolina Greensboro for the Bryan School of Business and Economics. The author will expand the coverage to additional online courses from different universities in an attempt to learn more about effective and efficient online course delivery and improved student learning in these types of courses.

Given the growth in online courses that is predicted, one would expect to see much more written and published about the topic. This presentation attempts to expand our knowledge on both effectiveness and efficiency.

#### **BODY**

#### Initial Concerns with Course Effectiveness

As universities offer more and more courses online, it is vitally important that we analyze the effectiveness of those offerings, from a student engagement viewpoint to a student-"friendliness" one to a student learning effectiveness standpoint. Efficiencies, from both professor and student perspectives, must also be part of the analysis.

The Bryan School of Business and Economics has offered both face-to-face and online sections of the same required undergraduate core courses for about four years. The author is presently in the fifth iteration of offering the required Operations Management course via online delivery, and has made many improvements over the past four years. Our assessment of student learning was primarily through various learning outcome assessments and end-of-semester student evaluations of both the course and the professor. While Bryan faculty and department heads had also evaluated appearance and content delivery issues, there was still a need for an outside perspective.

Several organizations were selected as possible outside "auditors". A series of criteria were established; these were based on overall process used, client feedback, amount of expected interaction between the organization and teaching faculty, and cost. The Bryan School of Business and Economics utilized an organization named Quality Matters [x] to receive outside feedback regarding the effectiveness for two of our undergraduate core courses. This presentation reports on the modifications that were made based on the recommendations from Quality Matters.

#### Course Background

Operations Management (SCM302) is a required core course, taught with class sizes around 80 and online sections around 70. Roughly 90% of the SCM302 students will not take another Operations or Supply Chain course, and few possess any prior knowledge of Operations Management. Bryan students sometimes have little appreciation for this course, before, during or after they take it! We have many engaged learners who succeed because of their hard work and their willingness to learn new topics and integrate this knowledge into their general business competencies. The larger challenge for SCM302 (and Bryan in general) is to engage all students in this conversation within all of the common courses and help them succeed.

#### Description of the Online Learning Improvements within SCM302

Many student learning enhancements are promoted through the online delivery of SCM302, and then many of these are then integrated back to the face to face sections. Lessons learned from online delivery also need to be applied to f2f classes in order to further enhance student learning.

Student course evaluations for the Summer 2011 online offering of this course were excellent. This was somewhat surprising, since many of our students have little or no prior experience with online courses. Furthermore, SCM302 might not be the best course to start one's online experience with, and the compressed summer time frame worsens the stress! There are many different components of the course, and combined with the focus on applying mathematical skills, some students can easily have a less-thansmooth experience with the online version.

The online course design focused on two basic aims: to provide both structure AND to provide flexibility. The structure was important to keep students on schedule with readings and assignments, to enable them to find the resources they needed in a timely fashion, and to give them many opportunities to interact with me. The flexibility was important because students learn in so many different ways, they learn at different times, and they appreciate having some leeway in how and when they deliver assignments. The Bryan School's COOL (Committee On Online Learning) survey [1] indicated that flexibility is very important to undergraduate students also.

Structure was provided by an assortment of devices:

- a. Creation of 40 lesson plans that were divided up into 4 equal parts with 4 exams.
- b. Two emails sent prior to Day One to notify students of important online resources
- c. Additional email sent the first class day directing students to START HERE! link
- d. Getting Started Document with all links on one page
- e. Weekly reading and homework assignments to accomplish all lesson plans and various student learning objectives
- f. Online chapter quizzes and graded homework assignments tied to lesson plans
- g. Topic and Exam Schedules, with all assignments and due dates posted
- h. Methods to contact me, and expected response time based on day of week

Many students have commented positively on these components, as they can always determine what the expectations are of them at any point in time and what they need to do next. I try to do this in f2f (face-toface) classes also, but sometimes that does not work when you hold class once a week or a student misses a class. This information is always available online, provided they can find it – and the START HERE! and Getting Started resources help with that problem too. I think that the majority of the online students were very successful staying on track.

Flexibility was delivered in three main areas: student preparation, personal faculty support, and course support for different learning styles. All three are important, although certainly a diverse set of learning opportunities/presentations is the most important piece.

The very first online presentation within the course addressed the faculty member's expectations and the necessary level of student preparation to do well in class. Students had to view this video/audio presentation prior to accessing the syllabus. This was an attempt to raise their awareness of the differences created by online courses, how students would need to change their preparations and timing, and how they could find online help and find resources (including the professor) offline. The video and the discussion was successful in setting course expectations, both for the students and for the instructor.

One of the key components to student preparation and performance was the need to utilize excel for different assignments and exams throughout the course. This expectation was well received by the majority of the students, and used by them to produce solid student learning and course grades. Unfortunately, there was a wide range of acceptance, and some online students did not receive this message well, leading to poor performance re course grades. This message continued to be emphasized, in both online and face-to-face (f2f) sections. In the f2f sections, the message fell on even more deaf ears. This was surprising, considering they were in a f2f class. Again, this continues to be an emphasis for SCM302 in future classes, either f2f or online.

Personal support started with the professor's announcement of his willingness to meet with students in a variety of avenues, from a f2f meeting to a very quick email response time to online "live" discussions using Elluminate. Students were very surprised and appreciative of the fairly constant and personal contact they received during the entire Spring and Summer sessions. Of course, this availability is also very time-consuming and inefficient.

The Elluminate sessions received lots of positive feedback, as sessions were targeted to solve each specific mathematical problem types that would be on the upcoming tests. These were recorded and hence available both live and at later times, providing more flexibility for the students. These sessions were also offered to f2f students, and several of them took advantage of this learning opportunity.

Students in SCM302 students have always exhibited different learning styles and abilities concerning the mathematical and critical thinking components of the course. Some students want to see "thousands" of solved problems, while others are fine with two, and some are visual learners. This is always a balancing act for the professor, and rarely results in a solution that is satisfactory for everyone. Online offers many ways to provide flexibility, and SCM302 uses the following options:

- 1. Annotated powerpoint slides that are part of the lesson plans, explaining each type of homework problem step by step
- 2. CONNECT software for required chapter quizzes and homework problems
- 3. CONNECT software for optional homework problems with solutions provided
- 4. Course menu tab for Additional Homework Problems, with solutions
- 5. Course menu tab for Exam Quality Problems, with solutions
- 6. Screencam tutorials for using Excel to solve each type of homework problem
- 7. Elluminate sessions where I use Excel to solve different problems
- 8. Saved Elluminate sessions for future reference, and saved in .iOS and ipad formats
- 9. Met with small groups of students f2f for test reviews throughout course

Online students have written in their course feedback about the importance of these options and the effectiveness of the variety. This assumes that they are willing and able to take advantage of the different sources. The majority of the Summer 2011 online students did that!

#### SCM302, Version 2.0 - Fall 2012 version

Quality Matters [2] is a consulting firm that provides extensive feedback to online instructors about the effectiveness of their online course design. Three instructors chosen by the Bryan School to undergo an audit! QM feedback included many different areas of course delivery improvement as they gave SCM302 an initial score of 32 out of 100. Many improvements in the course were made for the Spring and Summer 2012 editions, and the overall score was raised to a passing score to about 85.

These instructors also offered a Bryan Master Teaching Seminar on Improving Online Course Delivery. The SEINFORMS presentation will include a powerpoint presentation on Improving Online Course Delivery [3] that provides some details about our improvements and the areas that were addressed. Their Standards consisted of:

- 1. The overall design of the course is made clear to the students at the beginning of the course.
- 2. Learning objectives are clearly stated and explained.
- 3. Assessment strategies use established ways to measure effective learning, evaluate student progress by reference to stated learning objectives, and are designed to be integral to the learning process.
- 4. Instructional materials are sufficiently comprehensive to achieve stated course objectives and learning outcomes.
- 5. Meaningful interaction between the instructor and students, among students, between students and course materials is employed to motivate students and foster intellectual commitment and personal development.
- 6. Course navigation and the technology employed in the course foster student engagement and ensure access to the instructional materials and resources.
- 7. The course facilities student access to institutional services essential to student success.
- 8. The face-to-face and online course components are accessible to all students.

The online course has drastically improved the organization through new editions of the Getting Started Document and the Start Here link. A series of links that provide "one-stop shopping" for students that need various UNCG and Bryan resources, including a link named Keys to Success for Bryan Students.

Thanks for reading and participating in the presentation; I would enjoy receiving any feedback that you may have!

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## TAKING A BITE OUT OF STRATEGIC UNDERSTANDING: THE APPLE ANALYSIS IN A STRATEGIC MANAGEMENT CLASSROOM

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#### ABSTRACT

This paper proposes a new process, the APPLE Analysis, for developing pre-analysis comprehension about company conditions, resources, and challenges, as a part of the undergraduate strategic management curriculum. The results of its first application indicate strong student support for its ability to deliver on content outcomes, with 74.9% noting its value.

#### INTRODUCTION

Strategic Management (previously referred to as Business Policy) is often found as a capstone course in colleges of business. While these courses continuously evolve in response to the evolution of the field, most involve a focus on a "strategic assessment" that seeks to incorporate the cross-disciplinary learning up to that point in time in the student's curriculum as well as key strategic assessment tools. Often these assignments include evaluating a written case about a focal company or developing a strategic assessment of a firm without the benefit of a published case. Smircich and Stubbart (1985) note that strategic management is organization building that results in a shared interpretation of reality. As such, good strategic analysis must begin by "setting the stage" for the reader.

In many strategic management classrooms, traditional external and internal analysis is conducted resulting in a SWOT analysis that is used to justify directions for future actions. However, this approach makes an implicit assumption that the creator of the analysis already understands the company and its context relatively well. Given that a misunderstanding of the range and scope of the firm will precipitate an inaccurate evaluation of the external and internal environments, it becomes clear that defining a process for ascertaining and validating the range and scope of the firm is critical since it stands to reason that if the analyst cannot demonstrate that a full and accurate understanding of the range and scope of the firm, then any analyses and interpretations for further action will be suspect. For example, imagine that an analyst's report recognizes only that XYZ firm has been involved in the plumbing supplies business since the firm's founding and that the firm's performance has been suffering for the last several years. If the team leaves out recognition that XYZ firm has spread itself also across 7 different industries in big acquisitions and diversification moves over the last 4 years, then the reader is left to assume that the team does not understand that the firm has changed substantially over the past several years, the scope of XYZ has changed dramatically, and perhaps these elements have some bearing on why performance might be suffering.

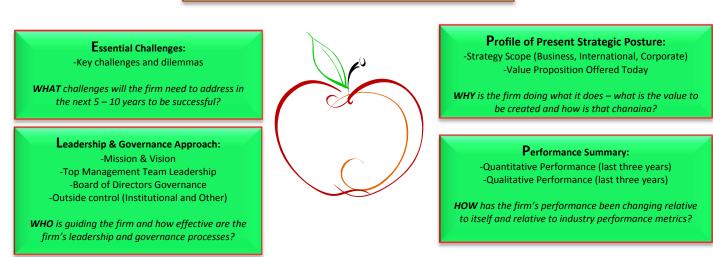
In strategic management instructional contexts, this process is complicated by the traditional layout of the textbooks that begin with an overview to strategic management without any analytical processes attached, and then turn rapidly either to external analysis and/or internal analysis components for which analytical processes and/or components are addressed. In practice, strategic management instructors noted that this distinction was very important to developing a clear understanding of the breadth and depth of the firm that framed a clear foundation for future realistic directions.

#### The Development of the APPLE Analysis Assignment

On the basis of reviewing and trying several different approaches, the authors at a AACSB-accredited College of Business located in the Southeastern University arrived at the acronym APPLE (Figure 1) (Areas of Operation, Profile of Present Strategic Posture, Performance Summary, Leadership and Governance Approach, and Essential Challenges) to develop in student analysts an appreciation of the development and range of the firm to present. The assignment called for students to craft a consultancy report that covered the following issues as a preliminary step to the completion of a comprehensive consulting report for a publicly traded firm. The APPLE Analysis was to include no more than 10 pages of textual analysis, with supporting appendices, tables, graphs, and charts to be included and interpreted and appended beyond the 10 pages.

Figure 1. APPLE Analysis Summary Segments

# Areas of Operation: -Segment Assessments (Operating and Geographic) -Key Value Chain Activities/Vertical Integration -Evolutionary Learning/Adjustments & Vehicles Used WHERE is the firm operating and how has that been changing?



The following paragraphs describe the key focus of these segments as individually and collectively they attempt to demonstrate a strong understanding by the student of the historical evolution and present position of the firm before the student analyst attempts to apply external or internal analyses attempting to justify a particular course of action.

#### THE PIECES OF THE APPLE ANALYSIS

The APPLE Analysis examines the firm's present

- Areas of Operation
- Profile of Present Strategic Posture
- **P**erformance Summary
- Leadership & Governance Approach, and
- Essential Challenges.

These five perspectives provide insight into the where, why, how and who questions that can guide what can be done for the future. As noted by Maranville (2011), the process of strategic management is about understanding the frameworks and analyses such that one can manage both the art and science elements of strategic prescriptions effectively and not just follow the crowd.

#### 1. Areas of Operation

To communicate clearly that the student analyst understands the firm, they must communicate a clear understanding of the scope of the firm's activities at present. In other words, the student analyst must communicate that he or she understands WHERE the firm is operating. To do so, focus on three different perspectives and a summary of those insights to define the potential for opportunities for improvement and resources to do so in the future:

- (a) The key activities and product/service categories in which the firm is involved, which includes the major product/service categories; performance of and reliance on major operating segments (including both geographic and product). The student analyst's explanation of the spread of these activities will demonstrate comprehension of the complexity of the firm and the extent to which it is tied to multiple types of value creating activities or focused on a more limited and defined set of these activities:
- (b) An overview of the key value chain activities the firm is involved in and how vertically integrated the firm is at present. While the first insight provides perspective on the scope of the activities of the firm, this second perspective sheds light on the breadth and depth of focus in different value chain activities. Vertical integration is the ownership (or other control) of various stages of the value chain activities of the firm. Vertical integration may provide some benefits to firms, as it can help to lend greater control over the procurement of needed input for the firm (backward integration) and/or greater control through the distribution process of the firm's outputs. However, vertical integration can also provide challenges to firms since the activities are provided for internal consumption and therefore may lack the market-based incentive to excel. Moreover, firms competing in multiple value chain activities are challenged to be effective competitors relative to all firms in each of the respective value generating activity areas. In other words, an auto manufacturer, such as GM, that owns a battery production firm to fulfill a dedicated supplier base for its car batteries, must be competitive with up-to-the-minute technologies and processes for not only auto manufacturing, but also for battery development and manufacturing; and
- (c) An explanation for the critical evolutionary adjustments that have brought the firm to BOTH the current range and scope of activities as well as the key learning and skills areas it has available in its arsenal for future competitive engagement. Analyzing the evolution of the firm requires a reading of the timeline of the firm and then making an assessment of what the major milestones are in the company's history and what these milestones mean the company has learned/has experienced. To frame an analysis of this perspective, use the timeline (and a review of past and more recent news releases of the firm and even stock trading history) to develop and support your assessment of the key developmental phases through which the firm has evolved and to denote the key learning and skills in the firm's arsenal.

#### 2. Profile of the Firm's Present Strategic Posture

After denoting the areas in which the firm operates (WHERE?), it is critical to explore WHY the firm is performing the activities in which it is currently engaged. The current strategic posture of the firm should provide a clear framework for why these activities of the firm are occurring. As shown in Figure 2 below, the firm's leadership develops strategies at different levels within the organization. Traditionally these strategies are organized into a pyramid. The challenge within most strategic management textbooks is that while there is a basic definition of corporate strategy in the first chapter, there is no way to understand

how to apply it in the firm's analysis. As such, student analysts are left until Chapters 7 or 9 in the textbook to learn about how to apply this level of analysis, while they usually begin cases or other applied analysis much earlier in the course of the semester. Our approach differs in that the complexity is developed from the beginning such that students understand the interdependence of their thinking at the business level with potential resource demands or provisions at the corporate level of more complex firms (and their lack of such resources in a very simple firm).



Figure 2: Layers of Strategy Within An Organization

The assessment should include preliminary evaluations of strategic commitments from four perspectives: (1) Corporate; (2) Business; (3) Functional; and (4) International. Our approach relies on the idea that since overall corporate leadership directs resources around the firm, the analysis should begin with the corporate strategy of the firm. This level asks the critical questions about the industries in which the firm is operating and how resources are allocated among the various lines of business in which the firm operates. This perspective helps to shed light on how focused the activities and attention of management are on a single line of business. Differing diversification strategies can be used to spread the firm's attention across multiple industries and lines of business to garner benefits such as economies of scope or scale, resource sharing, internal financial synergies, among others. Identifying which strategy the firm appears to be seeking sheds light on its support and future resource contributions and commitments to the industries in which the firm is involved.

Next, student analysts are asked to review the business strategy of the firm. In his 1980 book, entitled *Competitive Strategy*, Michael Porter identified three basic generic competitive strategies which focus on the firm's commitment to value delivery. In other words, this generic business strategy model seeks to answer the question, "How will the firm compete in the XYZ industry?" Firms can focus on differentiating based on key tangible (best technology, reliability, fastest service fulfillment, engaged customer service) or intangible (brand name, image, customization) features which tend to drive up costs of operating (differentiation). Examples of firms pursuing such strategies include Nike, Apple, and Mercedes Benz. Alternatively, firms can also work to drive down costs across the value chain (e.g., shortening the value chain, removing activities, outsourcing, reducing product breadth, limiting customization choices, shoring up supply chains). Examples of firms pursuing such an approach include Dollar Tree and Wal-Mart, as well as Ryanair. Firms also have the choice of whether to pursue a broad market position or to seek a narrower (focused/niche) level of operations. Later researchers identified successful efforts of some firms to pursue hybrid strategies given the opportunities in the global

marketplace to recognize both cost cutting and differentiating features simultaneously. Thus, some firms have been able to walk the tightrope of pursuing a combined strategy (best cost provider) that integrates some benefits from both low cost and differentiation. Therefore, the following five strategies are available for firms to pursue at the generic business level: Focused Low Cost, Broad-based Low Cost, Focused Differentiation, Broad-based Differentiation, and Best Cost. More recently, Kim and Mauborgne (2009) have noted the importance of also considering a blue ocean strategy which adopts a comprehensive set of new practices and processes for competing in a given industry to win customers. Firms such as Ryanair in the European Union have done so by revolutionizing air travel. In addition to identifying the firm's basic generic competitive business-level strategy, it is important to consider how aggressive and fast the firm is in supporting new initiatives and activities. Is the firm a first-mover, a second-mover, a follower, or a late adopter?

Another perspective to be gained regarding strategy at the business-level is the profile of the firm when delivering on its strategy. Miles and Snow (1978), in their critically acclaimed book, "Organizational Strategy, Structure, and Process," offered a typology which defined four generic categories that define a firm's approach to the marketplace. This typology included the following:

- 1. Defenders these organizations have very narrow product-market exposure, and they focus on limited adjustments to continue delivering value in these chosen markets.
- 2. Prospectors these organizations are consistently seeking new market opportunities and often experiment and adopt new processes, technologies, and/or structures to deliver on these opportunities.
- 3. Analyzers these organizations operate in multiple product markets, with some markets being very stable (in which the firm maintains clear focus on existing processes) and some markets still developing (in which the firm observes and adapts very quickly).
- 4. Reactors these organizations either fail to perceive market changes or else they are unable to adapt to those changes that they do perceive.

As the student analyst works to develop a clear statement of the types of business-level strategic postures that the firm is pursuing, he or she will also develop a more complete understanding of the types of benefits the firm's leadership appears to be seeking. With this business level profile information in hand, the student analyst will be able to consider the types of Functional Level Strategies the firm employs. The next phase looks at each of the functional level strategies to identify what explicit approaches are being adopted, and how they support the business and corporate-level strategies. For example, consideration of the types of marketing efforts being targeted help to reinforce or show a need to reinforce clearly stated business objectives.

The next perspective needed is to articulate the current international scope of strategy. Ghoshal and Nohria (1993) defined four different international strategies that firms can adopt to compete internationally, including home replication, multidomestic, global, and transnational. Of course, some firms have very limited involvement internationally and so the first question to consider is whether the firm has significant activities abroad and to what extent those efforts have been strategically programmed versus opportunistically acted upon. Certainly the adoption of a particular strategy does not mean that it will be successful, as shown by Wal-Mart's decision to apply the home replication strategy to its market entry and management styles in Germany failed dramatically, while others such as HP have found that changing the expectations for subsidiaries to adopt and fulfill global mandates has been very successful.

## 3. Performance Summary

Developing a perspective of how well the intended (WHY) activities of the firm have delivered value requires the student analyst to review the performance of the firm. Performance assessments from multiple perspectives yield valuable insights that complement (and sometimes contradict!) one another.

The need for multiple perspectives was realized in the 1990s with the development of the Balanced Scorecard. The Balanced Scorecard is a tool used by more than 70% of Fortune 500 companies to assess and manage strategic performance by actively seeking to recognize that firm leadership cannot serve only one of its stakeholder groups at the expense of the others and maintain the commitment of all groups to the organization's future. So to engender a clear commitment to seeing performance as more than just top and bottom line income statement performance, the student analyst will also need to address explicitly performance from the perspective of 4 critical stakeholder groups as shown in Figure 3.



Figure 3. Critical Stakeholder Groups & Performance Measures Using the Balanced Scorecard

To review and understand performance in these areas comprehensively, it is important to examine both performance across the range of these perspectives relative to the firm's own past performance as well as relative to industry averages for the key industry segments. Performance can be assessed from both qualitative and quantitative perspectives. Quantitative assessments utilize objective measures that are widely available to show how the firm has delivered on key performance areas relative to its own historical performance and relative to industry averages. Such insights are derived by obtaining market share measures through market reporter and other publicly available sources, stock price and volume graphs over longer time periods compared to industry competitors and major indices, and financial statements of the firm, available through S&P NetAdvantage, Mergent, or the firm's own financial statement or investor information reporting pages. These analyses provide the following insights:

- a) a summary of the firm's market share position relative to competitors (based on industry and brand market share measures) as well as an evaluation of how this position has been changing and the impact of these changes on the firm;
- b) stock price relative to the firm's key rivals in the industry and relative to a/the major stock index/indices and what these observations tell about the relative performance of this firm and the direction it is going;

- c) raw financial statements (balance sheet, income statement, cash flows) and key insights derived from observing those statements reported in terms of:
  - a. horizontal (trends) analysis of the balance sheet and income statement as well as vertical (common sized) analysis of the balance sheet and income statement
  - b. cash flow analysis and evaluation of cash flow and cash flow to inventory (if appropriate) measures; and
- d) key ratio analyses over the past three years for the firm that capture assessments of profitability, management effectiveness, efficiency, financial strength, growth and valuation, debt management, inventory management, turnover, economic value added, and market value added, as well as what these measures tell about the financial health of the firm over the time frame included AND with focus on how these ratios compare to critical industry averages.

Qualitative assessments focus on more subjective criteria that are developed from multiple sources. Such indicators include rankings, ratings, reviews (e.g., Top 100 Places to Work, Industry Leadership Roles, Best or Worst Board ratings). These evaluations and assessments provide insights into key performance measures and indicate how the firm is regarded relative to others in the industry as well as other firms in all industries. They provide insights especially into the internal stakeholders, marketplace, and sustainability perspectives of the Balanced Scorecard introduced above. For example, Apple and Google are viewed as leaders in technology and innovation not just in their core industries but across all industry settings. As such, leaders and executives from these companies are seen as fertile ground for recruitment to other sectors and industries to provide leadership on innovation and process changes to convert firms in those industries as well. SAS has been noted as among the best places to work for many years because its focus on employee development and well-being. This focus has translated well into innovative products and limited turnover which both help to serve effectively clients of the firm. After calculating and discussing the insights from each of these analysis areas, the student analyst should be able to summarize how effectively the firm has been able to deliver on the strategies to date. This summary is critical to defining areas of needed action for the future and/or areas of concern.

### 4. Leadership and Governance

While inputs into strategic decisions and their implementation are provided throughout the firm, these activities are coordinated by the leadership of the firm. When performance from both a qualitative and quantitative perspective is positive, it is generally thought that strategic leadership is effective, but when there are demonstrated slides and slips in performance, strategic leadership and/or overall board governance is questioned. Attributing strong performance increases alone, however, has been shown to be inadequate for evaluating the effectiveness of governance, since examples such as WorldCom, Enron, and Tyco show that it is important to dig deeper into noting whether the process of planning for and delivering on effective governance of the firm is likely setting the stage for long-term success or short-term grandstanding. A more holistic approach to effective governance views the process as the sum of the effectiveness of the firm's management of the often conflicting set of demands placed on the firm by its various stakeholder groups. According to Turnbull (1997) as summarized in Figure 4 below, the sum of these parts includes the following public and private sector influences. It is therefore important to evaluate the ways in which the critical leadership groups within the firm consider the resources, control and collaboration needed to manage these various stakeholder groups.

Figure 4. Influences Affecting the Operations of Publicly Traded Firms

Private sector influences	Public sector laws/regulators
Customers	Trade practices
Competitors	Anti-monopoly
Shareholders	Securities
Employees	Labour & Equal Opportunity
Unions	Arbitration courts, etc.
Suppliers	Fair trading
Bankers & financiers	Credit & bankruptcy
Auditors	Corporate
Stock Exchange rules	Federal/State/Local tax
Market for shares	Health & safety
Media	Environmental
Professional associations	Quality
Trade associations	Building
Directors & Advisers	Community

Source: Turnbull (1997)

Given the importance of the interaction of top management team, boards of directors, and outside controlling ownership positions in influencing how strategy is derived and implemented, it is critical to focus on effective practices and processes with each of these groups. As a result of this process, it will be possible to denote areas of concern and/or identify best practices that may create a differential advantage over other companies. This analysis should focus on the most critical influencers of strategic direction in the firm: (a) the Board of Directors, (b) the Top Management Team; (c) large external stockholders (whether individual or institutional); and (d) the course agreed upon by these leaders via the firm's vision and mission.

## Contributions and Assessment of the Board of Directors

When analyzing a company, it is important to review the tools, expertise, resources and connections that are brought together by its leadership and to determine to what extent effective governance mechanisms have been established (The Business Roundtable, 2002). The board of directors' principal responsibility is to hire the chief executive and monitor the actions and decisions of top management to assure that the firm is operated in an effective and ethical manner. As such, the board performs three roles for the firm simultaneously which are described in Figure 5 below.

The board of directors is the group that provides an important linking mechanism and balance between a small team of key managers in the firm and a vast group of shareholders in publicly traded firms and a voice of balance between stakeholders and managers in not-for-profit organizations. In the United States, the law requires that the board have a strict and fiduciary duty to ensure that the company is run in a manner that is consistent with the long term-interests of the owners (shareholders). Good boards require at least some freedom from influence of the firm's CEO to be effective in delivering on their roles. Board requirements differ by country, with some countries, such as Germany, having two-layer boards (supervisory and operating boards). So it is clear that the board plays an important role in affecting management and leadership within an organization. Boards consist of executives that come from other firms, representatives from key stakeholder groups, retired executives with noted experience in desired areas of exposure, and former public officials or non-profit leaders.

Strategy **Service** Institutional theory Stakeholder theory notes organizations supports the role of the develop inner logic of board to provide how to act that seeks information, make to avoid control - as linkages to other such boards need to resources, and be looking out for longenhance the firm's term rewards and legitimacy commitment of the organization Control Agency theory supports the idea that managers will seek to benefit themselves, so the board's job is to also assure that managers are acting in ethical and effective behaviors to support the optimization of the use of the resources of the firm

Figure 5: Roles of Boards of Directors

Source: The Business Roundtable (2002)

Although observation and familiarity with the firm's board is the best way to develop insight as to its effectiveness, several other issues warrant reflection and evaluation, such as the structure, composition, and processes in place. According to The Business Roundtable (2002), the principle responsibilities of the board of directors typically include:

- "Planning for management succession
- Hiring and evaluating the chief executive officer (CEO)
- Understanding, reviewing and monitoring the implementation of the firm's strategic plans
- Understanding and reviewing annual budgets and operating plans
- Focusing on the integrity & clarity of the firm's financial statements and financial reporting

- Engaging outside auditors and considering independence issues
- Advising management on significant issues facing the corporation
- Reviewing and approving significant corporate actions
- Reviewing management's plans for business resiliency
- Nominating directors and overseeing corporate governance."

Therefore, the following issues should be evaluated with respect to any board:

- **Board Composition and Performance** *How many insiders (executives) versus outsiders* (non-executives) are on the board?
- 2. **Leadership/Chairmanship** Is the chairman's position on the board independent of the executives or is it held by the CEO?
- Term Limits and Time Together as a Board Are there term limits for membership on the board, and how long has the present board been together?
- Frequency of Meetings/Contact with Top Executives How often do board members have access to top management?
- **Committee Structure** *How many and what kind of committees guide board action? How* independent are these committees? At a minimum, public companies should have Nominating, Audit, Governance and Compensation Committees with independence.
- **Linkage to Long-term Performance** To what extent are board members affected by the decisions taken as a board? (How much stock does each board member hold?)
- Diversity of Backgrounds and Resources Brought to the Firm through Board Membership - what range of behaviors and resources are brought to the board to assist in the strategy, service and control components of the board's responsibilities? Consider here not only demographic diversity, but also how the backgrounds and experience of the individual board members provide insight for control, service and strategy roles.
- Oversight Guidance what types of roles, rules, procedures and processes has the board adopted to provide focus and commitment to a common set of values and actions on behalf of the board, executive leadership and other parts of the organization? (E.g., codes of conduct, ethical statements, sustainability initiatives, etc.)

To complete this evaluation as comprehensively as possible, student analysts can be encouraged to work through Mergent, the company's investor relations posting, or S&P Netadvantage to develop a summary appendix that includes the backgrounds of each of the members of the board of directors, indicating clearly the background (professional and educational profiles, age and gender), stock holding in the firm, and indication of whether the person is an insider or outsider. Then, after reviewing this basic background, as well as the Governance page of the firm's Investor Relations or homepage, they can develop and support responses to items 1-8 above. Ultimately student analysts should summarize whether you believe that the firm's board of directors is able to provide effective fulfillment of the roles noted above.

## Contribution and Assessment of Top Management Team

While the Chief Executive Officer (CEO) is the key architect of organizational strategy, the collaboration of the entire top management team is critical to successful strategy development and execution. Aside from the CEO, other top management team members may include the CFO (Chief Financial Officer), the CIO (Chief Information Officer), Controller, Counsel and Senior/Executive Vice Presidents of key business areas within the organization. To some extent, who these key leaders are depends upon the firm's industry and its own internal organizational structure. Close familiarity with the individual executives who lead a company is most helpful to understanding their motives and commitments to the

organization over self. According to The Business Roundtable (2002), senior/top management (TMT) responsibilities include:

- "Operating the corporation
- Strategic planning
- Preparing annual budgets and operating plans
- Selecting qualified management and establishing an effective organizational structure
- Identifying and managing risks
- Ensuring integrity in financial reporting
- Demonstrating strong and decisive leadership of values
- Exerting effective internal controls."

Therefore, the following issues should be evaluated with respect to the TMT:

- 1. Diversity and Background of the Top Management Team what resources are brought to the team by its membership?
- 2. Stability of the Top Management Team how long has the top management team been together?
- 3. Linkage of the Top Management Team to Decisions Undertaken how much might the TMT be affected by its strategic decisions? (How much stock does each member of the top management team own in the firm?)

To complete this evaluation, student analysts can consult Mergent, the company's investor relations posting, or S&P Netadvantage, popular press items, and analyst insights to develop a summary appendix that includes the backgrounds of each of the top management team members, indicating clearly the background (professional and educational profiles, age and gender), stock holding in the firm. Then, reviewing this basic background, as well as the investor relations pages and annual reports, they can develop and support responses to items 1-3 above. Ultimately a conclusion should be reached about whether the student analysts believe that the firm's top management team is adequately composed to provide effective strategic leadership and implementation for the firm's strategies. For example, in December 2011, Avon's Andrea Jung stepped down as CEO and maintained only her position as Chairman of the Board for the firm, noting that the performance slowdowns in several sectors required these roles to be different to enable the CEO to focus entirely on rebuilding positions lost.

## Assessment and Control by Outside Investors

Over 60% of the stock of publicly traded firms in the United States is held by institutional investors such as pension funds, mutual funds among others. In addition, powerful families (e.g. Tyson, Heinz, etc.) often hold a significant share of stock in what used to be private, family-owned companies that have now transitioned into publicly traded firms. Finally, individual investors, such as Carl Icahn in Clorox, hold large ownership positions within individual firms. As such, these individuals or institutions may use their voting power to push for specific types of strategic decisions in a firm. The more concentrated the ownership -- in individual hands or in the hands of institutional investors -- the more likely that undue pressure can be exerted from these sources on decision making and processes within the firm either by these individuals voting with their shares to change board members who share their beliefs about desired strategic directions of the firm or through initiating takeover bids that take management attention away from managing the firm while the Top Management Team deals with the challenges posed by the takeover bid. Therefore, it is important to consider the following:

**Concentration of ownership** – how concentrated is the ownership of the firm and what, if any, influence are these groups imposing or capable of imposing on strategic decision making? What percent of the firm is owned by outside investors (individual or institutional)?

To evaluate this potential for control and influence, student analysts should look to the institutional and individual holdings in the firm to determine if any entity holds more than 5% of the stock of the firm. This information can be identified through public filings and through access via databases such as Mergent or S&P Net Advantage, but be sure to check the recency of the information! If specific institutional or individual investors hold large chunks of the stock of the firm, then one should recognize the ability of these institutions or individuals to put pressure on the leadership of the firm to pursue specific decisions. Such pressure may, or may not, be in the best future interest of the firm as a whole.

### Assessment of the Mission and Vision

The firm's vision and mission provide those inside and outside the firm with a clear idea of the direction and focus of the firm's activities – and therefore these statements serve as guides to the kinds of decisions and actions that should be supported by the firm's leadership. Clearly the vision and mission should be reflective of the actual strategic profiles being enacted by the firm. Otherwise, the vision and mission should be revised OR the strategic profiles should be adapted. This evaluation should include an assessment of the adequacy and appropriateness of each of these statements in clearly articulating and supporting the firm's stated direction. It is important to evaluate the following issues for each firm's vision and mission.

The vision directs the future of the firm. It should be a clear statement that guides future decision making on issues such as product/market/customer/technology and ethics issues, but it should also enable enough flexibility to allow the firm to be responsive to market conditions. A well-communicated vision functions as a valuable managerial tool to give the organization a sense of direction and shape organizational identity. It serves to inform all stakeholders where the company is headed, and it enables these important groups to view all actions of the firm as being supportive of this direction thereby creating further legitimacy for the firm. Perhaps most importantly, the vision provides reference points for management and employees to act in manners fitting with the future focus to which the firm has committed. evaluate the vision, Gamble and Thompson (2009) propose that the following aspects be considered:

- Clarity paints a picture of the kind of company management is trying to create and the market positions the company is striving to stake out;
- 2. Directionality is forward-looking; describes the strategic course that management has charted and the kinds of customer/product/market/technology changes that will help the company prepare for the future;
- Focus specific enough to provide managers with guidance in making decisions and allocating resources:
- Feasibility within the realm of what the company can expect to achieve in due time;
- Desirability why the chosen path makes good business sense and is in the long-term interest of stakeholders (especially shareholders, employees and customers); and
- Understandability explainable in 5-10 minutes, and ideally can be reduced to a simple, memorable slogan.

The firm's mission should articulate what the firm is at present. To evaluate the mission statement, the following issues should be considered:

- 1. Is the statement clear but short?
- 2. Does it identify the customers to be served?
- 3. Does it give insight to the breadth of the firm's product focus?
- 4. Does it explicate the firm's commitments to stakeholders and describe how they will be fulfilled?

At the conclusion of evaluating each of these indicators of leadership and governance, student analysts should provide a summary statement indicating how the assessments and analyses create an overall picture of the effectiveness of the current leadership and governance practices as they apply to the range of stakeholders the firm faces at present and how they adequately prepare the firm for the long-term.

## 5. Essential Challenges

The APPLE Analysis ends with a consideration of WHAT to do about the current situation. On the basis of an accurate and complete assessment of the current scope of the firm and its evolution up to the present (Areas of Operation - WHERE), a clear consideration of the committed approaches that have led to those positions thus far (Profile of Competitive Strategies - WHY), recognition of the performance outcomes that have resulted to date (Performance Assessment - HOW), and explicit consideration of how the current leadership processes, practices and people have provided guidance to this process (Leadership and Governance – WHO), the student analyst is now ready to make some preliminary assessments about the key challenges that face the firm at present. These issues should be stated as problems/issues the firm must address, not as suggestions for what it should do. Focus should be given to the most critical challenges. Since the first four areas of the APPLE Analysis have just provided an overview of the firm, the findings from these sectors should point to where some of these challenges lie.

### RESULTS AND DISCUSSION

At the conclusion of the APPLE Analysis, the student analyst is now ready to move into looking at what is happening to change the environment in which the firm operates. The addition of the APPLE Analysis allows student analysts a pre-exposure to the company as a whole. As such, there is a higher likelihood that they will be able to better incorporate the insights derived from the various components of the external and internal analyses more traditionally completed as a part of the strategic assessment processes used for case studies and company projects.

Results from the first semester's application of this process indicate that of the 216 students who worked through this APPLE Analysis assignment found it to be very valuable to their understanding of course concepts, with 74.8% reporting that it was very valuable or extremely valuable (a 4 or 5 on a 5-point Likert style scale). Furthermore, student projects and overall analysis increased over previous semesters in both quality and depth of analysis, a further indicator that the APPLE Analysis was helpful to achieving course outcomes. As such, further refinement of the process is being planned. It is clear that the addition of the APPLE Analysis was helpful to improving student learning outcomes, concept familiarity, and depth of analytical reasoning in the strategic management course.

Such efforts are critical to defining appropriate ways to engage students with strategic management concepts. Assignments such as the APPLE Analysis help to provide one way to help students develop a quick oversight to the critical aspects that will ground the company's ability and willingness to act in certain ways in the future. Other approaches that help to advance this effort should be explored and further research is needed on the most crucial components of this analysis.

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## DOES SEMESTER LENGTH FOR ACCOUNTING I MAKE A DIFFERENCE IN STUDENT PERFORMANCE IN ACCOUNTING II?

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### **ABSTRACT**

More and more colleges and universities are offering courses in a compressed form in order to accommodate the hectic schedules of their students and faculty. Numerous studies, across disciplines, have looked at the effectiveness of these shortened classes and found mixed results. This study looks at whether the format of an Accounting I class affects student achievement in the Accounting II class. Utilizing data across seven academic years and controlling for numerous variables, including instructor and textbook, results suggest that students in the compressed form of Accounting I performed as well in the Accounting II class as students taking Accounting I in a traditional length class.

### INTRODUCTION

As more individuals attempt to fit college into their busy lifestyles, intensive 3 or 4 week class terms have become more common. Typically, most colleges and universities have offered some variation of an intensive semester for many years by way of summer school. Others include 3 or 4 week intersessions, generally offered either in May or January, as part of their regular academic calendar. Many students often prefer these shortened semesters since they typically involve only one course, not four or five as in a traditional-length semester, allowing students to focus on one topic. Instructors often like them because the longer class period allows for more in-depth coverage of the material, resulting, hopefully, in a longer-lasting understanding of the material. However, both students and faculty complain of fatigue, stress and burnout from the intensive nature of these courses. What should be important to everyone is whether intensive courses are an effective approach for student learning. For the most part, studies on the effect of course length on student achievement have shown mixed results. This study investigates whether the length of a class term for an Introduction to Accounting I class makes a difference in student achievement in the Introduction to Accounting II class.

#### LITERATURE REVIEW

Numerous studies have investigated the impact the length of class terms has on student achievement. Most have focused on the differences in identical courses taught in sessions of differing lengths. Van Scyoc and Gleason [3] concentrated on students enrolled in a principles of microeconomics course that was taught in both a 3-week and a 14-week format. They controlled variables such as contact hours, course content, instructor, time-of-day, and cost. The only significant difference between the two subject groups was the length of the term. At the beginning of each class, the Revised Test of Understanding College Economics was administered as a pre-test measure of the students' knowledge of economic concepts. The same test was given to the students at the end of the course. They found that students in the 3-week course scored significantly better on the post-test than students taking the 14-week course. In addition, to measure differences in long-term retention of the microeconomic concepts between the two groups, they administered the same test to students on the first day of a subsequent intermediate microeconomics course. On average, four semesters had elapsed since the principles course had been taken by the students. They found no significant differences between the two groups.

Anastasi [1] also investigated the effectiveness of class length and found that overall academic performance, measured by course grade, was similar in full-semester courses and intensive courses. They examined student performance in three different psychology courses taught over both a 16-week semester and a shortened summer session. After controlling for instructor, teaching style, contact hours, examinations and other assignments, they found no significant difference in the final course grades between the two groups.

Most research has focused on short-term performance by students. However, Seamon [2] measured both short-term and long-term performance differences. Students in an educational psychology class taught in both an intensive and traditional-length format were given a pre- and post-test at the beginning and the end of the course. The test consisted of 25 multiple-choice questions designed to measure understanding of specific learning objectives for the course. In addition, approximately half of the questions measured declarative knowledge while the other half included higher order learning-type questions. They found that students in the intensive courses performed better on the post-test, especially on the higher order questions, than did students in the semester-length class. In addition, they conducted a follow-up study three years later, administering the same post-test to 29% (9) of the original thirty-one participants. They found no significant differences between the two groups, suggesting that, in the long run, semester length is not significant to learning.

## RESEARCH QUESTION AND METHODOLOGY

This study investigates whether the length of term for the first introductory accounting class makes a difference in student performance in the second introductory accounting class. The subjects for this study were students at a small, liberal arts college in the mid-Atlantic region whose academic year consists of fall, January, and spring terms. Fall and spring are traditional—length courses lasting 13 weeks each while the January term is a 4-week mini-session where students typically meet five days a week for two hours each day. Most students take only one course but are permitted to enroll in two. Traditionally, Introduction to Accounting I—the first accounting course required of majors—is offered in both fall and January while Introduction to Accounting II is offered only in the spring. Accounting I is a pre-requisite for Accounting II and consists entirely of financial accounting concepts. Approximately 75% of Accounting II covers financial accounting while the remaining 25% covers managerial topics. The same instructor teaches all of the Accounting I courses during the fall and January terms, in addition to one section of Accounting II in the spring. Approximately, 75 students take Accounting I each year with the number dropping slightly for Accounting II.

The study utilizes data from seven academic years, 2005 - 2006 to 2011 - 2012, and includes students that took Accounting I in either fall or January and then took Accounting II in the immediately following spring term. All of the courses included in the study were taught by the same professor, minimizing any potential noise in the analysis. In addition, the same book, albeit different editions, was used throughout all of the courses. This resulted in a total of 173 subjects, 122 (70.5%) that took Accounting I in the fall and 51(29.5%) in January. In addition, 98 (56.6%) of the subjects were male while 75 (43.4%) were female. Table 1 provides a breakdown of the group.

T-tests were utilized to determine if a significant difference in final course grades in Accounting II exists between those students that took Accounting I in a traditional-length semester versus those that took it during the intensive 4-week January session. In addition, final course grades for male versus female students were analyzed to determine if gender had an impact on course performance.

TABLE 1: TEST SUBJECT BREAKDOWN

		Academic Year								
		2005 –	2006 –	2007 –	2008 –	2009 –	2010 –	2011 –		
Accounting I term	Total	2006	2007	2008	2009	2010	2011	2012		
Fall	122	18	19	20	16	19	14	16		
January	51	2	5	8	8	8	11	9		
Total	173	20	24	28	24	27	25	25		
Gender										
Male	98	8	17	14	10	20	14	15		
Female	75	12	7	14	14	7	11	10		
	173	20	24	28	24	27	25	25		

#### RESULTS

To determine if the length of the class term for Accounting I makes a difference in course performance for Accounting II, t-statistics were run comparing final course grades in Accounting II for the traditional-length students to those in the intensive course group. As Table 2 shows, no significant difference exists between the two groups. T-statistics assuming unequal variances were calculated also and showed no significant differences (t = .45) between the two groups. In addition, no significant differences between final course grades for males versus females were found.

### **DISCUSSION**

As the statistics show, the students taking Accounting I in the intensive 4-week format performed just as well in Accounting II as those taking the initial course in the traditional 13-week semester. Controlling for instructor and course materials, class length does not appear to be a significant factor in how well a student retains and utilizes material from a pre-requisite course.

TABLE 2: T-TEST: TWO-SAMPLE ASSUMING EQUAL VARIANCES

**Semester Length** 

	Traditional	
	Term	Intensive Term
Mean	0.812031183	0.806000666
Variance	0.009578838	0.005113517
Observations	122	51
Pooled Variance	0.008273188	
Hypothesized Mean Difference	0	
df	171	
t Stat	0.397612564	
P(T<=t) one-tail	0.345705849	
t Critical one-tail	1.653813324	
P(T<=t) two-tail	0.691411699	
t Critical two-tail	1.973933915	

Interestingly, even though no significant differences existed between the final course grade in both groups, the variances in the grades within the groups did differ significantly. Students from the

traditional-length group had much more dispersion in their Accounting II grades than did the students in the intensive-format group. As Table 3 shows, an F-test on the variances shows significance at the p > .01 level. Self-selection bias may be one explanation for this finding. Knowing the intense nature of a 4week course, better students may self-select into it while weaker students may choose the traditionallength class. In addition, the time between the two classes may have had an impact on student performance. Students in the 4-week intensive course started Accounting II one week following the completion of Accounting I. The traditional-length group did not begin Accounting II until approximately two months after finishing Accounting I.

Future research should be conducted to provide further evidence as to the importance of class length on student learning. Using the same initial data from this research, it might be interesting to identify which students continued on into Intermediate Accounting and analyze whether the length of the Accounting I class makes a difference in their performance in Intermediate.

TABLE 3: F-TEST TWO-SAMPLE FOR VARIANCES

Average Course Grade for Accounting II

	T 1::: 1	T
	Traditional	Intensive
Mean	0.812031183	0.806000666
Variance	0.009578838	0.005113517
Observations	122	51
df	121	50
F	1.873238521	
P(F<=f) one-tail	0.006674707	
F Critical one-tail	1.510909603	

## **CONCLUSION**

Previous research on whether the length of a course term affects student performance primarily focused on single courses and showed mixed results. No definitive conclusions were reached. In addition, a few studies attempted to measure long-term effects of class length on retention of course material, again, with mixed results. Like the previous studies, the current research found no significant differences in student performance either. For institutions utilizing the intensive format approach, this is good news. Instructors and students can be reasonably assured that the material learned in the first course of a pair of sequential courses will be retained just as well no matter what term length a college or university utilizes.

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# CROSS DISCIPLINARY PEER OBSERVATIONS FOR CLASSROOM BASED **LEARNING ACTIVITIES**

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#### **ABSTRACT:**

The teaching styles vary across disciplines. Some styles may be effective in certain disciplines and not in others. In this project, instructors observe the teaching styles of their peers in their disciplines and outside their disciplines. The idea is to determine the effective teaching techniques, as seen from an observer's or a student's point of view, that are used in various disciplines. The goal is to determine whether these techniques can then be applied to other disciplines. The disciplines involved in this research include arts, music, languages, law, and various fields of engineering including mechanical, systems, aerospace, and electrical. This on-going research will determine whether the teaching techniques used in a given discipline, can then be applied to other disciplines with the same level of effectiveness. The techniques include but are not limited to hands on activities and group discussions.

To conduct the study, the instructors in each discipline observe their peers in other disciplines. The idea is not to critique each other's teaching styles, but instead to observe and analyze whether a particular style is applicable in another discipline. Some of the techniques observed in peer observations include:

- Ice breakers or Warm-up activities
- Emphasis on real world examples, providing context
- Emphasis on key highlights, giving overviews
- Student-centered activities, e.g., presentations, group work
- Relaxation Response, e.g., breathing exercises, meditation
- Reinforcement
- Historic and cultural significance of theory?
- Re-entry work
- Lessons in punctuality, e.g., quizzes over homework during 1st 5 min. of class
- In-class experiments
- Humor

These and several other techniques used by professors across disciplines are discussed.

## AN AEROSPACE ENGINEER'S OBSERVATIONS IN A LAW CLASS

In a law class, the following activities were observed by an aerospace systems engineering professor.

Ice Breaker:

Ice breakers are important to get student buy-in. The professor walked in and casually started a conversation about the presence of computers outside the classroom. A simple comment helps emotionally connect students to the campus. By the time she walked over to her desk, almost all the students in the class were paying attention.

### Sign-in Sheet

A sign-in sheet was passed around. The use of sign-in sheet can convey the message that the professor cares about the student's presence in the class and wants to reward the students who are making an effort to learn the material.

### Professor Solicits Student Responses

Instead of giving all the information to the students, the professor asked for student's opinions. Students were asked to read the material ahead of time and the professor went over the high points. While discussing the high points, the professor solicited students thoughts, ideas, understandings or misunderstandings. Because of this activity, students were constantly involved in the class.

## Professor Knows the Material Well

The professor did not use a sheet to copy the notes to the board. But instead she remembered all the material she wanted to cover in the class. One of the ways to accomplish this is to remember the highlights or the headings, and then fill in the blanks during the class. Student responses were used to put the final material together on the board.

## Safe Environment for the Students

The professor created a safe environment for the students. She encouraged questions and appreciated all of them. This created a safe environment for the students where they felt comfortable in asking more questions. The discussion ensued. A two-way or a multi-directional controlled discussion seemed like a valuable pedagogical technique.

### Emphasis on Important Points

Instead of overwhelming students with lots of material, the professor emphasized on the few important points that the students needed to remember. These points were definitions, rules or principles. Once understood, these could be applied to relevant situations to solve the corresponding problems. The professor made sure that the 'high-points' were repeated multiple times. She repeated them using different verbiage to ensure that students understood their importance.

## Real World Examples

The professor gave real world examples to convey how the principles and definitions discussed applied to real world. She discussed several valuable examples of real law cases from her experiences. Students also brought up cases that they had experienced that related to the topic of discussion. They asked questions about the topic relating to the cases. Analogies like these help reinforce the material. Students are likely to remember the material if they have experienced something that relates or hear about a real world example from someone else's experience.

## Super Bowl

This Monday class was held right after the Super Bowl weekend and the professor's favorite team had won. The professor was excited about that. She announced a super bowl for the class. The class was divided into two groups. Students were asked questions that were related to the topic of discussion. If a group got the answer right, they got one point and if they missed it, the other team got the point. Students started slow but quickly caught on and were actively participating towards the end. This was a fun way to teach the course material while bringing the current affairs in context and involving students in a game.

### AN AEROSPACE ENGINEER'S OBSERVATIONS OF A MUSIC CLASS

#### Class Attendance:

Attendance was taken at the beginning of the class. Apparently the professor remembers everyone by name.

### Music in the Class:

Shortly after the class started, the door was shut and loud music started playing. It felt like being in a concert but no one was dancing. Instead all the students were taking notes. Students listened intently. They were asked to identify the instruments, notes, repetition patterns, and unusual rhythms. There is no better way to learn any material than immersing students in the real world application. It invokes their visual, auditory, tactile and other senses. So learning happens not just by one way listening to the instructor, but by the simultaneous use of multiple senses. While the music was being played, the professor pointed out the things to listen to. These corresponded to the theory they were learning in the class. It was an immersive environment. It was equivalent of an aerospace professor taking his class to an airshow or an aerospace museum and discussing aircraft design. Or it corresponded to the concept of an integrated laboratory and lecture based learning in STEM disciplines. Several case studies have shown that students learn and retain better in immersive learning environments [x].

#### Student Presentations:

It turned out that the music being played was brought in by a student in the class. They had chosen a track from medieval period – which was the topic of discussion. Students brought music on media and played it in the beginning of the class for a few minutes. The student then presented the technical aspects of the music including its history, genre, culture etc. They were then asked a few questions by the professor. So student did not only have to bring the material to the class, but also present it and then answer a few questions. This helped transfer some of the responsibility for learning and teaching from the instructor to the students.

## Cups for Participation:

All students were encouraged to participate actively in the class. The professor brought plastic cups of three different colors. During the course of the class, the professor asked several yes/no type questions and students were asked to raise their cup in response. The green cup corresponded to 'yes' (or liked), red for 'no' (or did not like) and yellow for no opinion. This little exercise ensured that everyone in the class participated without being pressured. This technique works well to keep the students focused specially in a large class, where students sitting in the back may have the tendency of getting distracted or distracting others or both.

### Professor Excitement:

It is said that 'Excitement is Contagious' – the statement is certainly true in a classroom setting. The professor seemed very excited about the subject matter. She even seemed excited about the fact that the test was over and that the students did not have to worry about it. She asked all of them to give high-fives to their neighbors to the left and to the right. This small break broke the monotony and created a sense of belongingness to everyone present in the class. It also acted as a 'mind break' so students could now refocus on the topic of discussion in the class.

## Students Create the Power Points:

The professor did not show any Power Point slides during the class. Instead she asked students to write all the notes in class. Students were asked to prepare Power Point slides later. She gave a lesson on effective notes taking strategies. She wrote material on the board and asked students to convert it into Power Point slides and submit them to her. The idea was not because she wanted the Power Points for her, but because

she wanted the students to get in the habit of taking notes in class and then reviewing them after the class. By asking them to put the notes in an electronic format, the professor ensured that everyone took all the class notes, the notes were safe for students for later review. By student submission of the notes, she could gauge if there were any students not participating in the class. This exercise also provided for students a good repository of all the important notes in the class.

## Breathing Exercises:

Any time the professor noticed that there was a need for a little break during the lecture, she paused and changed the subject for a few moments. She emphasized how breathing exercises are important for musicians. All the students were asked to take a few deep breaths and then the class ensued. Similar exercises can be done in all disciplines and in most classes.

## Candy Questions:

Students were constantly encouraged to actively participate in the class. A few times during the class, they were asked 'Candy Questions.' These were either questions from previous classes or questions that were discussed in the class a few lectures ago. Apparently, the word candy excited most of the students. They wanted to participate and get the candy – even if they had to guess the answers. This was an effective method to motivate students to participate actively.

## *Inductive Style of Teaching:*

The professor often asked a question, and instead of answering it, led the students to the answer by gradually asking other related questions. The inquiry based learning [x] method was used, which is an effective method for obtaining general, observation based information. It helps to guide students through critical thinking, awareness, evaluation of what they observe, and the drawing of logical conclusions and explanations. This class reminded the author of a drama class, where the professor enacted a single person drama during the class period to teach students about the science and arts of drama.

### Relations to Culture and History:

The professor gave a detailed relationship of the medieval music to culture, religion, and history. Adding the cultural and historical aspect helps students relate the subject matter to their own prior experiences. It therefore helps in long term learning and retention. It also helps students understand the need, the origin, and the reason of existence of an entity.

### *Use of Multi-Media:*

Professor used internet to show pictures and more importantly music related video. These pictures and videos included the musical notes. It helped convey the importance of the material covered in class. Professor also brought a pictorial book that she passed around. The book contained pictures of instruments, their history, and their cultural significance.

## Preparedness:

Throughout the class, it appeared that the professor was well prepared. She has planned the entire class period and had thought about all the details of how it would be conducted. In general, a professor spends a significant amount of time in preparing for the class is likely to conduct an effective class. The professor did not look at any of her notes while writing on the board. She wrote over five slides worth of material. All of it was well prepared and presented.

### Controlling the Class:

Every once in a while, there is a student who would distract other or disrupt the continuity of the class. The professor had a strong sense of presence. She knew how to deal with difficult students. She politely and assertively asked one student to be disciplined, and it had a positive effect on the entire class. Dealing

with difficult students without affecting the class environment could be challenging. The professor handled it well and quickly moved on with the rest of the class.

## Significant Material in One Session:

One of the complaints often heard from STEM professors is that they have too much material to cover in a semester and not enough time to do it. From observing the Music class, the author felt that a significant amount of material was covered in one session, and a number of active learning techniques were used to facilitate learning from multiple facets. The trick is to cover the material in a way that will help the students to retain and use it long after the semester is over.

#### AN AEROSPACE ENGINEER'S OBSERVATIONS IN A MATHEMATICS CLASS

#### Give students a chance to re-do:

It is not uncommon for students to receive their graded assignments back, look at their earned grade and put the papers away. In the mathematics (Calculus 1) class, the quizzes and exams were graded and returned to the students. Students had the option of correcting their mistakes and resubmitting their work for an additional 2.5 points. This technique gave them a motivation to review the mistakes they made and correct them. Students get a chance to learn the material and correct their mistakes that they would otherwise overlook. Their motivation to do this extra work was a few additional points, that almost all of them were willing to work for.

### Checklists (Notes):

In aviation, all pilots are required to use checklists. The Federal Aviation Administration (FAA) has learnt from experience that it is not worth taking a risk to have pilots memorize procedures and then forget an important step. All pilots are required to use their notes. The mathematics professor used her notes to write problems on the board. Although, a mistake may not be as critical as in aviation, this practice ensures that all students get the error free content while they are learning.

## Students solve problems in groups:

The professor gave students problems to solve in class based on the material that was taught in the previous class. Students were encouraged to work in groups of 2-3 people. They shared their work and solved numerical problems together. Several students took the role of teachers. They explained material to each other. Researchers have argued that students learn better when they teach each other. If they did not understand the material, they asked students in other groups for help. The professor encouraged groups to interact with each other and help solve the problems. If students did not understand the problem, the professor was there to help them out. She walked around the class to check and make sure that every group was actively engaged in problem solving. She moved around the room to see if students had questions and checked their work to ensure that they were making progress. Students also shared their work with others to get feedback. If a student or a group got stuck, the professor asked another group to help. She also gave hints, without giving away the answer. This created an environment of camaraderie in the classroom. Students learned together and from each other and the instructor. Most students seemed excited about helping their peers. There were however some students who minded their own business even though they were turned towards each other to work in groups.

## Students solved problems on the board:

In order to utilize the available time most efficiently, the professor asked one or two students to write a problem on the board that they had successfully solved. This gave the other students, who could not finish solving the problem, a chance to understand the process. The professor reviewed the student's work and corrected it as they wrote on the board. Mathematics (Calculus) requires working the problem by hand.

Students need to see the process of evolution of mathematical equations or derivation of steps to understand the material. This technique also gave students, who volunteered, a boost of confidence. Students who volunteered got words of encouragements from the instructor. The instructor went over the solved problem and explained to the rest of the class how the problem was solved. Everyone was given a chance to take notes and determine their own mistakes. Students were encouraged to solve several problems. In mathematics, the proverb 'Practice makes one perfect' is certainly true.

### Solicit Questions:

Students are often shy and would not ask questions, unless given a chance. The professor paused several times during her lecture / presentation and asked if there were any questions. While reviewing student's work, if a student made a mistake or had a question, she addressed it to the entire class to ensure that everyone understood the material and could avoid the potential error.

## *Instructor Solved problems on the Board:*

Instructor challenged the students to solve a difficulty problem on the board. If she did not get any volunteers, she solved a few sample problems on the board. To understand mathematics, students need to see the process. Computer, projector, internet, or slides were not used during the lecture. Problems were solved step by step on the board. These were in addition to the problems that volunteer students had solved. After showing the process, the instructor put more problems on the board and challenged students to solve them.

## A Lesson in Punctuality:

The best way to preach something is to practice it. The professor started and ended the class right on time. The presence of a clock in the room would help the professor stick to the time. She collected all the homework at the beginning of the class. Students learnt that if they did not do the work on time, they would lose credit.

## After Class Help:

The professor announced that the class was officially over at the end of the class time. But the she remained available to answer any questions that student had after the class and stayed until all the questions were answered. She stuck around to answer further questions or help students out in case they needed more help.

## Witty Jokes:

Throughout the lecture, the professor made several little witty jokes, which helped retain student's attention. Little sentences like 'make friends with the product rule,' and 'Calculus is fun for grownups,' were commonly used during the class. When a student working on the board made a sign error, the professor jokingly remarked 'plus one million or minus one million – not a big difference.' After the class period ended and students continued to solve problems, the professor remarked 'you are having a really good time – you do not want to stop!' When announcing a quiz, she said, 'you are all probably wondering: when can I show her how good I am at this...' Little jokes cracked a few students up and kept the class atmosphere friendly.

#### AN AEROSPACE ENGINEER'S OBSERVATIONS OF AN ELECTRONICS CLASS

## PowerPoint Presentations:

The professor used Power Point presentations throughout the class to supplement his lectures. The presentations were used in conjunction with problem solving and explanation of material on the white board. This adds value for students to attend the classes. It also gives students all the class notes in a well-

documented format if they miss something during the class session. Although the initial development of all the Power Point slides can be tedious for the instructor, but once developed, they can easily be maintained and updated for future use. Power Point, however, have certain limitations. In engineering and mathematics problem solving, a concept is often better conveyed when students see the process of evolution of an equation or a numerical problem. The ideal way to do that is to actively solve a problem in class so students can understand how a similar problem can be solved step by step. Just showing a solved problem on a Power Point slide may not convey the process of solving often complex problems that engineering students face.

## Real World Applications:

Engineering is an applied subject. The professor used several real world examples e.g. the use of telephones, internet etc. while talking about the bandwidth and how it can be expanded. The instructor emphasized the importance of the topic of discussion and detailed its practical significance. Students often learn and retain material better because of the real world examples that they can relate to. This may even motivate students to pursue further inquiry into a certain area, which might not happen if only the theory part is taught during a class.

## Asking Questions:

Several times during the class the professor gave students opportunities to ask questions. If he noticed that there were no questions, he started the interaction by asking questions. This created a friendly environment in the classroom where students felt at ease in their conversations with the professor. A healthy, friendly, and open environment is likely to facilitate better learning than an environment where only one way interaction takes place.

### AN AEROSPACE ENGINEER'S OBSERVATIONS OF PHYSICS CLASS

## Logistics:

Majority of the students who take the physics class are either freshmen or sophomores. Almost all of them aspire to become engineers. So students in all engineering disciplines start out by taking physics classes, which makes the size of the physics classes much larger than the other classes observed in this study. Large classes pose special challenges, which a small class instructor may not have to deal with. The physics class observed had over 75 students enrolled. Almost all of them were present on the day of the observation, which was a healthy sign. The class was held in a large lecture hall. The professor would typically need a microphone to communicate in a hall that large. But it was observed that students were well behaved and disciplined – which may be an indication of the strong sense of presence of the instructor. The instructor did not need to use the microphone and was yet clearly heard all the way in the back of the class

#### Answer Solicitation:

The instructor put a problem from the previous lecture on the board and solicited answers. Without judging, she put all the answers on the board. She got three different types of replies. Instead of giving the right answer at that point, she asked for votes for each reply. She then gave students some time to discuss the problem amongst their neighbors and explain what they thought. Research has shown [ref] that students occasionally learn better when they hear from each other as opposed to constantly hearing from the (same) instructor. After giving them a couple of minutes, the instructor asked for votes again for the three options. In this pole, almost everyone agreed on the right answer. In the author's opinion, this was an effective technique of getting everyone to understand the problem, reason and discuss with each other and rationalize the correct answer. It also got everyone engaged in the class from the very beginning. By the time the instructor was done discussing the problem, everyone in the class was focused and attentive.

The instructor kept all the students engaged by constantly asking questions.

## *No Notes for the Instructor:*

The instructor did not use her notes to write on the white-board during the lecture. It appeared that the instructor was well prepared on the topic of her discussion. Even the subject matter experts teach better when they review the material before the classes. Having a good grasp of material helps but being current on it also reflects the instructor's will to perform well. Students can sense when an instructor is well prepared. A well prepared instructor is likely to be more engaging than the one who scrambles through their notes during the class.

## Emphasis on Historical Significance:

The instructor emphasized the historical significance of the subject matter. That helps generate interest in students. When the instructor talked about the centripetal force, she clarified that the word is composed on two Greek words meaning 'center seeking'. A little history lesson will help remind students the direction of the force and when it is applicable.

### *Use of Props:*

The professor brought several props to demonstrate live experiments during the class. She used a bucket filled with water and a stick attached with a string to demonstrate centripetal force in action. She claimed that if the bucket is rotated at a fast enough speed in a vertical circle, the water will not fall even when the bucket is facing down at the top of the circle. She explained this with a force diagram. Experiments like this may only take a few extra minutes from the class time but they help students understand and retain the concepts. They also help break the monotony in the class. Students get better engaged during and after the experiments. The professor also solicited help from students to conduct the experiments.

## Real world examples:

In addition to the use of props, the professor gave several examples of real world cases when centripetal force affects us. She discussed the example of washer-dryer, which work because of centripetal force. A detailed problem was solved to show that a car in a turn on a ramp does not slide due to the angle of the ramp, even though a centripetal force is acting on it. She also explained that the car would slide if it went around the curve at a faster speed. She went on to explain why there are reduced speed limits around the curves. She solved the complete example problem on the board to determine the speed limit beyond which a car would skid. Friction force was also calculated in class. After listening to this example application, a student may drive around a curve and be able to explain to their peers why a reduced speed is needed, when centripetal and frictional forces are taken into account. It would also help them understand, why from a physics standpoint, it is important to slow down around the curve. The professor used different colors of markers to highlight or emphasize the important points. She highlighted the key concepts. In another example, she explained why small cars driving on a highway next to the large and heavy 18-wheeler truck get sucked towards the truck. Several other real world examples were used throughout the lecture. The author could clearly observe the level of curiosity increase amongst the students when such examples were discussed.

## A problem with mistakes:

The instructor put a problem on the board and asked students to help solve it. There was an error in the solution. In her experience, students made that same error in the previous semesters. She even mentioned that it was a problem from the previous year's exam. She then asked the students to try to find out the error. She later explained why students typically fell in the trap and committed the same error. This was again an effective way to get the point across. Just telling students that they will make a mistake may not

be sufficient. Having them make that mistake and then giving them the right answer is potentially going to help students experience, learn, and remember. Also it helps clarify to a lot of students exactly what error they are prone to making.

#### Recitation:

In addition to the regular class session, the instructor conducts recitations in the after-hours. These are supposedly informal sessions where the instructor provides help to students by solving even more problems and discussing the course contents in a smaller group setting. Problem solving is a key to physics (and engineering) education. Giving students the extra help indicates to the students that the professor is interested in seeing her students learn and succeed.

### AN AEROSPACE ENGINEER'S OBSERVATIONS OF A LANGUAGE CLASS

## Current Affairs:

The professor in the Spanish class started the discussion with the current affairs pertaining to the Latin countries. Students were encouraged to review the online Spanish newspapers and come prepared to discuss the current affairs. Additionally, she discussed the related activities on campus. A Fulbright Foreign Language Teaching Assistant was visiting campus from Argentina. She encouraged all the students in the class to attend his presentation. He was also going to showcase an international film from Argentina (in Spanish), which the professor had organized. Such synergistic activities on campus, coordinated by the professor, help stimulate students' interest in the subject matter.

## Sense of Presence:

The professor was aware of all the classroom activities. She acknowledged the presence of the guest (observer) for the purpose of the project. That made the observer and the students comfortable and it created a relaxed and amiable environment in the classroom.

### Circular Seating Arrangement:

In all the observations, this was the first class where the seats were not arranged in rows or bolted to the ground. The professor encouraged everyone to sit in a semi-circle – thus facing each other and creating an environment to encourage student participation. This also helped the professor become part of the group. It changed the role of the professor from being a lecturer to a facilitator.

## Student input incorporated:

In regards to the assignment submission deadlines, the instructor solicited student feedback. In general, having a firm deadline helps students complete their work. But if students are overwhelmed with the number of assignments, and have other jobs or family responsibilities, they often choose not to complete the homework and therefore suffer in the course. By asking them for their input in terms of the submission deadlines, students understand that the professor wants them to learn the material and cares about them. Establishing a student-professor relationship of mutual respect and understanding may help motivate them to put in the extra work required to learn the material.

### Student Interaction:

The class had lots of student interactions. Students were constantly engaged because of their continuous interaction with the professor and fellow students. Almost all the material involved some kind of student involvement. If the professor discussed the use of past tense in a sentence, every student was asked to say a sentence that had a past tense involved. The professor made the class lively by adding little witty jokes during discussions. In the entire class session, students were observed talking, collaborating, and

contributing. For a few activities, they were paired with each other to discuss certain topics and then report their findings. All the students in the class were engaged. The professor went in circle to ask questions from everyone in the class. Having a small class certainly helped with that activity.

## Supplemental Material:

In addition to the class notes and the text book, students were referred to several supplemental materials including related online books, articles, Youtube videos, facebook etc. The professor showed a few Youtube clips of the related topic. She had a class facebook account. All students were required to friend with the professor on the class facebook account. Important announcements, links, and references were posted on the account. This ensured that students were getting all the latest course related information, even when they were involved in unrelated social activities.

## Individual Attention:

Language classes are mostly electives. Students enroll because they are interested in learning the language. The professor spoke Spanish during most of the class session. This approach attracted and retained their attention and forced the students to try to understand what was going on during the class. Students were asked to respond to questions in Spanish. It also created a certain level of peer pressure. The class period seemed like a constant dialog between the professor and the students. The professor had a constant eye contact with all the students and gave every single student individual attention. The professor later confessed that she did not believe in any board work (writing on the blackboard). Students learnt by an immersive environment of speaking and practicing.

## Tests and Assignments:

The professor claimed that the chances of academic misconduct are minimized in her class because students were not evaluated by traditional testing methods. She tests students with one-on-one oral interviews. In addition, their comprehension is tested by having the students listen to speech and respond to written questions based on the speech. They will understand the material if they prepare all the extensive self-graded online activities. For the assignment, the professor asked students to write a paragraph about job interview. She gave them questions to address and answer in the paragraph. This was a good way to prepare them for a possible real world scenario where a student might be seeking a job in a Spanish speaking business environment. This approach has been referred to as 'learning by assessment'.

## AN AEROSPACE ENGINEER'S OBSERVATIONS OF AN ARTS APPRECIATION CLASS

### Second Chance:

In the book 'What the best college teachers do,' Ken Bain notes that in his research, he found that the most effective college professors give students multiple chances to excel. Even towards the end of the semester, if a student has not been doing well, a good professor would give them a chance by telling them that they could still make an A in the class if they did XYZ. It was observed in the arts appreciation, which is an optional class, that the students who wanted to improve their grade were given another chance to work on the test. Those who could not take the test at the designated time were allowed to submit it at a later time. Some people may argue that it would be unfair to the students who are diligent and want to finish their work in time. But the counter argument is that students who have other commitments may end up not doing the classwork at all and thus failing the class if they are not given another chance to succeed. Strong students are going to do well in either case. If a professor can bring the not so strong students up, and get them to complete the work, then the professor has probably done a good service for the entire class.

## Group Work:

Students were asked to form small groups and discuss for a few minutes the Picasso's work that they had

selected. As part of their homework, they were asked to answer the following questions regarding their selected work of art

• "Are we to paint what's on the face, what's inside the face, or what's behind it?"

During the group discussion session, the professor actively walked around the room to see whether students were working. She listened to a few conversations and gave her point of view. During the group discussion session, although students were working in small teams, the professor had the ownership of the entire classroom space. After the discussion session, a few students were asked to share their thoughts with everyone else in the class. When there were no volunteers, the professor picked on the students.

#### Museum Art:

The art at the local museums was discussed. As part of the assignment, students were asked to visit the local art museums, and then share their experiences. Professor pulled up pictures of the art pieces on the screen. Students were also asked questions about the art pieces at the museum. After visiting the museum, students were asked to put together reports summarizing their findings. To ensure that everyone visited the museum, the professor required that they took their picture at the museum. She asked students to read a paper before the following week related to art at the High Museum in Atlanta. As part of their report, they were also required to relate the art with the principles of design. This exercise gives students the sense of importance and significance of the subject matter. It is an applied method to help them internalize the principles discussed in the class. This active learning approach also helps students retain the material for long term.

### *History and Culture:*

The professor emphasized the historical importance of the art. She talked about how and why art came to the U.S. from Europe. She showed a map of where the ancient art came from. She discussed how art was sometimes discovered accidently in the caves while people were digging for other purposes. Other cultural connections were drawn. Such cultural and historical connections help students realize the importance of arts. Pictures of the art being discussed were shown. She showed the picture of the Venus of Willendorf and discussed how it was discovered in the glaciers of Alps mountains. She showed pictures of the art from ancient Egypt and emphasized how art had existed since the beginning on civilization. It helps students appreciate art and its significance in the social and cultural context.

#### Engagement:

To actively engage them, students were asked to draw on a piece of paper, their mental images of a deer, bull, and a bird. They were not shown pictures of these animals while they were drawing. To be able to draw these figures, they needed to think about what the animals looked like. They had to draw the sketches from memory without any visual reference. Some of the sketches drawn were funnier than others. The exams, homework and other papers were returned to students while they were engaged in drawing the images. This helped save some valuable instruction time for more productive activities. The professor then showed the ancient cave drawings of similar animals. She discussed how the cave men drew these based on their mental pictures of the animals. Some of the animals were large and could not have been brought into the caves. This exercise helped the students appreciate those paintings and acknowledge why it was important to preserve them. The class session was interactive. The professor spent most of her time asking and answering questions throughout the class instead of giving all the information. In this manner, critical thinking was encouraged. Students were acknowledged for their backgrounds or for what they knew e.g. mathematics, biologists, engineers, architects etc.

## *Importance of the Subject:*

The professor discussed the importance of preserving art. She related arts to the Rosetta stone and why it was important to preserve it. A student is likely to get interested in a subject matter if the professor is

interested in the subject and emphasizes its importance. She also drew connections between art work and astronomy and its various theories. She emphasized how it was important to preserve all the theories and work done by ancient artists because that would impact where art could go in the future. To lighten the mood, she would introduce little jokes related to astronomy suggesting that if the students were sky gazing in Atlanta, they should be careful because what they see might be a Delta airlines aircraft as opposed to their favorite star in the sky.

### AN AEROSPACE ENGINEER'S OBSERVATIONS OF AN ENGINEERING MATERIALS CLASS

## *Use of Multimedia*

Engineering education is enhanced significantly by the use of multi-media. In addition to writing mathematical equations, derivations, and problems on the white board, the professor used the Power Point slides, pictures, and oral presentation to deliver the lecture. Since different students respond to different stimuli, using a variety of instruments helps gain attention of most of the students. It also helps the professor the repeat the important points from different points of views, which as a result further help in student understanding of the material.

### Announcements available on Slides

The important announcements and dates were made available on the slides, which are available to students on the class website. Although, the dates are available to students at other locations e.g. the syllabus, homework or project sheets etc. making them available on the slides gives them another location to see them and provides an additional possibility that students will see them and not miss a deadline. This however may cause additional work for the professor. A change in date may require updates at several locations, which may lead to the possibility of confusion.

## Laboratory as part of the class

Most engineering courses are applied in nature. But not all of them emphasize enough on the application aspects of the theory. When a course is taught in conjunction with the corresponding laboratory it gives the students a real sense of importance of the material inculcated. It helps them appreciate the value of the theory discussed in class. It helps them relate the mathematics with its application. The same professor who taught the engineering materials course was responsible for teaching the laboratory course. Students got one extra credit for the added work load.

## Things should know or immediately find out

To highlight the important points, the professor projected a slide entitled 'things you should learn from this module.' This list gives students a good reference point. They can refer back to it to ensure that they have met the learning objective of a given module or a chapter. It also helps review the material quickly. The slide had items that students were expected to know for the exam. Before the exams, students can review the list to check whether they have learnt the material expected to be learnt in a given module. This approach is also beneficial for long term retention of material.

### *Puzzle of the day*

The professor showed one slide that was unrelated to the material covered in the class. The slide had a riddle. Students were given a few minutes to determine the answer. When no one could solve it, the professor asked students to think about it and give the answer the next time they met. This was a way to pique the curiosity of the most of the students. Most students got excited and felt challenged.

#### Casual Discussions

The professor maintained a casual atmosphere throughout the class session. Students felt at ease to ask questions. The significant portion of the lecture was spent in discussion with students. The professor gave examples and solicited student examples from their experiences.

### Real World Examples

A large number of students appreciate the material when real world examples are used or demonstrated in conjunction with the course material. When discussing the 'dislocation of materials', the professor gave examples of metals, ceramics, polymers etc. and showed pictures of how they dislocated differently. He also related the material with other courses that the students might have taken e.g. when discussing 'work hardening', he emphasized how it related to material science.

Several Witty Jokes

Several witty jokes were used throughout the class to keep the students engaged.

As the professor saw students drifting or getting restless, he would say 'close your eyes as I go to the next slide – because you are going to see something totally wonderful.'

When discussing 'cold working' (a mechanical process to shape materials e.g. forming, forging etc.), he related to working in the cold weather and how hard it was

When discussing the structure of the materials, he pointed out FCC and then gave several possible definitions of what that might stand for e.g. Federal Communication Commission and waited for students to correct him (He was referring to Face Centered Cubic)

When talking about 'slip plane,' he joked the plane that you can slip on (he was referring to the plane along which material internal structure can slip when deformed)

Towards the end of the class, when he saw students closing their note books, he politely mentioned – we still have 60 (gave a pause) seconds. This cracked a few students up

## AN AEROSPACE ENGINEER'S OBSERVATIONS OF AN ENGINEERING MATERIALS CLASS (2)

Due to the high demand of the Engineering Materials class, two separate sections of the course are taught by two different professors. The following observations are from the second professor's class. Since the material and the syllabus were similar, a lot of techniques used by the first professor were also employed by the second professor and vice versa.

## Several opportunities to demonstrate learning

Students were given several opportunities to demonstrate that they had learnt the material. On the day of the observation, there was a 20 minute quiz at the beginning of the class. This was one of the five quizzes given throughout the semester. Additionally, students got homework, three midterm exams, one final exam and the laboratory assignments. This method gave students plenty of opportunity to catch up if they missed one assessment or did not perform up to their expectation level.

### Small class size

Small class sizes have their advantages. The professor was able to monitor all the students at all times. Students listened quietly but observed the lecture with interest and asked questions.

## Real work experience

Professor solicited work experience from students and also gave examples from his experience. He used a combination of Power Point presentations and black board to teach the class. He also mixed in the cultural and historical significance of the material at hand. When explaining Polymers, he broke the word down to

Poly(many) and mers(repeat units) and then showed pictures of example repeat units that make up the structure of various materials. He also detailed the applications of different types of polymers. He demonstrated his knowledge and command over the material. An effective professor is the one who knows the material inside out and is good at delivering it.

## Teaching by Examples

The professor introduced the concept of Co-Polymers which is formed by combining the good properties of two separate polymers. He explained the idea by giving the example of sticky spaghetti. Important points to remember were also emphasized. He also related the concept with the material covered in previous classes e.g. he defined viscosity, which is taught in more detail in fluid dynamics classes, when discussing thermoplastics. He gave example of a TV show and its relevance with viscosity.

#### A LANGUAGE PROF'S OBSERVATION OF AN AEROSPACE ENGINEER'S CLASS

The procedure used is to check what is observed in the class at intervals of every five minutes. The behaviors observed are the following:

### Warm up

The first activity in every class exists to pave the way into the class. In can be something as simple as a conversation with the professor, music, the introduction of a manipulative, etc.

### Instructor talk vs. Student talk

If the purpose of teaching is to provide students with the incentive to "own" the material, i.e., to internalize it, then there should be less instructor talk than student talk. If the class is one in which material is introduced, then there may be more instructor talk, with opportunity for students to participate, depending on whether the presentation is inductive (students arrive at a generalization alter using new material) or deductive (instructors give rules or laws, and then provide examples).

### *Instructor active vs. instructor passive*

If the class is a presentation, and the instructor simply talks with no additional systems of delivery, i.e. visual, audio, story-telling, or kinetic activities, then the instructor is passive, a talking head. If, however, the instructor provides all sorts of vehicles for the delivery of the material, it will appeal to the students' varying learning styles, and the instructor is deemed to be active in this effort to reach more learners.

Students attentive or attending vs. Students distracted

This refers to student engagement. What are students doing at each 5 minute interval? Are they asking questions, taking notes, actively listening? Or, on the other hand, are they checking email, talking about things other than what is going on in the class, not focused?

Overview, Prime, Drill, Check.

Following Constance Knop's system of executing a successful class activity

- a. Overview did the instructor explain what will be taking place?
- b. Prime (as in priming a pump) Did the instructor lay the foundation for the activity by connecting it to previously presented and learned material?
- c. Drill did the instructor execute the activity successfully? Were the instructions clear?

d. Check--Was there a check for learning with re-entry of the material in another format? (Or did the instructor say "Do you understand?" – Without checking to see if the learners actually do understand.

Mechanical-Meaningful-Communicative

maktas maksas

This is a continuum that moves from mechanical to meaningful to communicative (for want of a better word)

- a. Mechanical did the professor simply ask the students to learn verbatim, to parrot the material back?
- b. Meaningful—Did the instructor leave room for the student to show s/he knows the material beyond the simple repetition of it, to apply the material to a context suggested by the instructor?
- c. Communicative—Is the student able to apply the material to new contexts not presented by the instructor?

Nuhfer-Halten	Rubric for Observing Teaching									
	:05	:10	:15	:20	:25	:30	:35	:40	:45	:50
Warm-Up										
Instructor Talk										
Student Talk										
Instructor Active										
Instructor Passive										
Student Attentive										
Student Distracted										
Overview										
Prime										
Drill										
Check										
Mechanical										
Meaningful										
Communicative										
Reinforcement										
Errors Correction										
Supportive Material										

Comments Reinforcement

What does the instructor do when a student answers his/her question correctly? What sort of reinforcement is used? Is there a hierarchy for degrees of correctness?

Errors correction

Which errors should be corrected? How should they be corrected?

Are errors bad, or should they be analyzed to determine if the student should change his/her learning strategy? Hint: errors analysis is very useful for improving learning.

What does an instructor do when a student answers a question incorrectly? What strategy does the instructor use to insure that the student experiences success? That is, does the instructor go to another student for a correct answer, then return to the first student and give him another opportunity to respond to a re-worded question, in order to instill success in the first student?

## Supportive materials

What sort of supportive materials and strategies are used to reinforce learning? Visuals, manipulatives, audio materials, kinetic activities, etc.

#### AN ELECTRICAL ENGINEER'S OBSERVATIONS OF A MUSIC APPRECIATION CLASS

Warm-up Activity (Student presentation of a piece of music)

- A student played an audio clip of a piece of music that he selected.
- The student provided a narrative of different musical features that he observed while the piece was playing.
- Student engagement appeared to be approximately 100% during this exercise.

## Professor-led discussion

- This warm-up activity was followed by a question and answered-based discussion that appeared to review a topic taught previously.
- Rather than going over the topic on her own, the question and answer format encouraged student participation in the review and also provided an informal assessment of student understanding of
- If students appeared to have difficulty answering a specific question, hints were provided (instructional scaffolding technique).
- Student participation was about 70%
  - o Some students were actively engaged throughout, i.e. answering questions.
  - o Some students were attentive, i.e. focusing on the professor, but never answered any questions.
  - o Some students could be seen performing other activities during this period of the class.

## Professor-led Presentation of a New Topic

- A new topic was presented after the review session.
- The professor wrote various facts pertaining to the topic on the blackboard, while students took
- Questions were asked at various points during this presentation and answers from students were solicited.
- Student participation was about 100% (all students appeared to be taking notes)

#### Multimedia Presentation

- Immediately following the presentation, a demonstration on the piano and the playing of an audio clip with a visual component was performed.
- This would assist student learning for students with different learning styles.

## General Observations

• The enthusiasm of professor for the topic was palpable and I believe this assisted with student engagement.

#### AN ELECTRICAL ENGINEER'S OBSERVATIONS OF A CALCULUS CLASS

### Warm-up Activity

- Warm-up activity required students to complete a problem based on the topic covered in the previous class (find the extrema of the function f(x) = 1 - 9x - 6x2 - x3).
- The solution of the problem was divided into steps.
- The students were given approximately 5 minutes to complete each step.
- After 5 minutes the professor solicited the students for the solution to the step, which she wrote on the board.
- If any of student's response was incorrect, then the professor would gently guide the class to the correct response.
- The professor also walked around the class during this activity to assist individual students with their queries/misconceptions.
- The final step required the students to graph the function in the regions surrounding the extrema (good for visual learners).
- The overall time for the warm-up exercise was 20 minutes.
- Student participation was 100%.
- Essentially this activity employed instructional scaffolding.

## Professor-led Presentation of a New Topic

- A new topic was presented orally after the warm-up activity.
- The professor wrote salient points pertaining to the topic on the blackboard, while students took
- The professor would at times make statements based on incorrect assumptions to see if the students would correct her (a method to evaluate student understanding of the topic).
- Student participation was about 100% (all students appeared to be taking notes)

## General Observations

• The method of delivery of the professor was enthusiastic and she utilized humor (this seemed to encourage student engagement).

## A MECHANICAL ENGINEER'S OBSERVATIONS OF AN ARTS APPRECIATION CLASS

In an Art Appreciation class, the following was observed by a Mechanical Engineering Technology professor.

## Continuity

The instructor reviewed the sequence of topic coverage and listed the topics that would be on the following exam. This particular lecture was on early 20th century American art and included a review of previously covered work on that topic plus some review of previous material on European art for contrast.

#### Presentation

Instructor asked a lot of questions of the students and was successful in evoking participation. She

frequently mentioned where specific works are currently on display, especially the works that can be seen locally (at the High Museum in Atlanta).

## Directing/assessing/monitoring

Instructor gave students many opportunities to think independently about the subject. Instructor was extremely encouraging regarding participation, entertaining even questions which did not seem to make much sense.

### Managing

Although there was a significant degree of participation, no disruptions were observed. Students were asked to discuss a question in small groups. Apparently, this discussion was often about homework which had been returned. (This observer thinks that is a very good way to get students to explain things to each other and, since they have the graded work in front of them with the instructor's comments, they are not likely to teach each other something that is too far off the mark.) In this particular session, the groups were to discuss a quote by Picasso instead of a homework assignment.

### A MECHANICAL ENGINEER'S OBSERVATIONS OF A MUSIC CLASS

In a Music Appreciation class, the following was observed by a Mechanical Engineering Technology professor.

This class session began with students getting a chance to see their results on a graded exam. The instructor called several students forward at a time. She seemed to know the students by name, and sometimes major, although this was a fairly large class. She kept control of the exams although it looked chaotic up there. Very good rapport between the instructor and students was observed. A feature of her grading system is that the lowest test grade is discarded and the highest one counted twice.

Two pieces of music that students had brought in were played. In the first case, the student explained why he liked the particular piece of music. As the music played, the instructor pointed out how it started calmly and built excitement as it went. She pointed out what particular instruments drove the excitement and how they did that. The student who brought in the second piece of music was a musician and quite knowledgeable. In this case, the instructor carried on a dialogue with the student and asked the other students to listen for what key it was in (how many sharps, rather than the note designation, as this is "not a music theory class"). I thought this was a very good example of adjusting to the level of the student. During all of this, there was much student participation and joy and focus. Once again, this observer thought that chaos was about to erupt, but in reality there was a very high level of beneficial participation.

Next, the subject of the current lecture, the Baroque Period, was introduced. The lecture, which was mostly run as a lively discussion, included a little biographical information about J.S. Bach. Then the period was contrasted with the Renaissance, which had been discussed in the preceding lectures. Snippets of music recorded with various period and modern instruments were supplemented by the instructor playing piano as she explained aspects of the music, and contrasted the piano with the harpsichord. Humor was interspersed throughout. You-tube videos were incorporated. The instructor was aware of what instruments some members of the class played and used this to strengthen the connections between all the students and the material being taught.

While most of the class is carried out as a lively discussion, there were short intervals of pure lecture. The instructor would throw candy to students who correctly answered questions. When the discussion would get too lively, or it was time for a pure lecture portion, the instructor quickly settled the class down, somehow

This observer has never attended a more enjoyable class. The pace seemed fast and the students seemed energized by the pace and by the lively personality of the instructor.

### A MECHANICAL ENGINEER'S OBSERVATIONS OF A CALCULUS CLASS

In a Calculus I class, the following was observed by a Mechanical Engineering Technology professor.

On this day a test was returned. The professor discussed grade distribution and let students in a certain grade range know how much work would be required in the remaining weeks of the semester. Students can turn in corrections to test for some additional credit. They are encouraged to work together on the exam corrections.

### Continuity

The professor told the students what topics would be covered in the next few weeks and reviewed what they already knew. After revealing something that followed logically from the previous discussion, she asked if anyone was "shocked to the core." Many light hearted comments such as this contributed to obvious good rapport with the students. As she discussed derivatives, she referred back to particle motion. I thought that it was unusual that the application had preceded the math, which is good for the type of learners we have at SPSU.

### Presentation

The professor used the white board rather than the computer screen for the most part. Theorems were written out on the white board and graphical solutions were done in "real time," which I think provides much better pacing than other methods. Some discussion was interspersed throughout.

## Directing/assessing/monitoring

The professor stopped and had the students do some short computations individually on paper. On some of these occasions, she would have the students pair up and compare notes after they had worked individually. I observed one student sitting near me who only became engaged with the material when he had to discuss it with another student. One problem the student had to work on required factoring, of which she said, "We did factoring before--almost like I knew it would come up again." She also gave a hint on a negative exponent which she said she knew would give the students trouble. As students worked on these problems, she walked around and looked for problems they were having, although the room was crowded so she couldn't get to everybody.

## Managing

Throughout, good rapport with the students was evident. No disruptions were observed. After class, students were invited to stay and work on the exam corrections.

## A MECHANICAL ENGINEER'S OBSERVATIONS OF A SYSTEMS ENGINEERING CLASS

In an Aircraft Design and Performance class offered by Systems Engineering, the following was observed by a Mechanical Engineering Technology professor.

The class had been on a Lockheed Tour, so the professor answered some questions from that. The professor had graded an exam. He gave average score, high, low, and standard deviation, but waited until end of class to return the exams (a good strategy). He used this opportunity to explain the concept of standard deviation without numbers or formulas. I think this is an important concept and students often

get confused by the math. Using something that is important to students personally, their grades, and purposely avoiding the formulas are good strategies for teaching this concept. There was quite a bit of interaction with students in this explanation.

The professor pointed out that one student had solved a particular test problem in a way that indicated he had memorized a formula rather than applying concepts he should have known. I can so relate.

There were ten students present and all seemed to be engaged and most participating. The current lecture was on drag reduction through minimizing wetted area and vortex control. He did a good explanation, using whiteboard, of keeping cross-sectional area constant. This is accomplished on Boeing 747 by the fuselage bump—a good example that uses something with which every student is familiar.

## Continuity

The professor pointed out how the material from this lecture and related YouTube sites could be used in their projects. The project is apparently an aircraft design.

#### Presentation

The professor used the whiteboard rather than the computer screen for the most part, but showed a YouTube video. He mentioned that there are many YouTube videos on aircraft design. Very interactive presentation, with student being asked to speculate on various aspects of aircraft design. Lecture was very conversational in style.

#### A MUSIC PROFESSOR'S OBSERVATION OF AN AEROSPACE ENGINEERING CLASS

#### *Ice-Breaker*

Class was well-prepared and well-paced. Within the first ten minute section, the professor discussed assignments; handed back tests; took a consensus with students and agreed the next test would be given the following week (respect for student input; students greatly appreciated this). Being a very personable professor, a light discussion about an upcoming field-trip ensued. Finally, the professor asked, "Any questions before we start?"

## Student-Led Teaching and Learning

The next ten minute section began with the professor clarifying objectives which related to prior lesson knowledge. A designated student went to the front of the room and reviewed what was leaned in class the previous week. The professor took this opportunity to ask this student questions about her knowledge and understanding with the subject matter. When this student could not answer correctly about a formula, the teacher asked another student who was able to relay the correct information. This technique took the pressure off the 'designated' student and she was able to write down the correct formula at this time.

## Professor-Led Teaching and Expectations

A model of a plane was displayed on the overhead projector and a discussion ensued about its design and color. The professor also drew an example of a plane on the whiteboard to point out specific features to which the students and professor carried on a dialogue. This created a segue-way into the lecture where the professor informed the students that they must begin their (end-of-semester-project) airplane sketches; what was required of such sketches; and during this time, the professor wrote a list of expectations on the board for this assignment.

New Concept

A candy question followed but the students could not answer it. The professor gave the students the answer and also wrote it on the board for students to write down the information. The greatest amount of time (twenty minutes) was dedicated to learning about this new concept.

## Learning Atmosphere

Although this class was a professor led dialogue with student input, the students were provided a safe and comfortable atmosphere to learn and share their knowledge. The professor used well-timed and smooth transitions within topics. Students were encouraged to participate from professor's questions.

## Professor Knowledge

The professor is very knowledgeable with the subject material and did not need to refer to notes or a textbook, allowing him to freely walk around the front of the room and interact with the students.

### A MUSIC PROFESSOR'S OBSERVATION OF A DATA COMMUNICATIONS CLASS

The professor began class by stating the objectives for what was being taught that particular day. The first half of class time was a professor led dialogue teaching a new concept and the second half of class was used for group assignments.

## New Concept

Power points from the book's publisher were used. While these were displayed on the overhead projector, the professor explained and wrote information on the opposite whiteboard. During the explanation process, the professor would ask the students questions and try to have them answer. One of the publisher's power points had an error to which the professor took the opportunity to have his students find the mistake. He and the class re-worked the answer on the whiteboard together.

### Learning Atmosphere

This was a small and quiet class; probably typical of an engineering class with a professor-led discussion. The second half of the class was livelier when the students were encouraged to work together in groups. Although provided a safe and comfortable atmosphere, the students were more concerned with writing notes than answering questions and actively participating.

## Professor Knowledge

The professor is very knowledgeable with the subject material and did not need to refer to notes or a textbook, allowing him to freely walk around the front of the room and interact with the students.

## A MUSIC PROFESSOR'S OBSERVATION OF A FOREIGN LANGUAGE CLASS

This was a very interactive and student focused class where students used name cards. Students sat in a crescent-shape where they were able to see one another and the professor. This seating arrangement aided and encouraged class discussion.

### Ice Breaker

The professor and class discussed assignments and homework (or lack thereof) together. Due to the students being behind with their work, the professor announced that class would be cancelled for students to use this time and "catch up." A two-way discussion ensued again, with the professor asking students if they were in need of more structure with due dates and deadlines. There was humor and a mutual respect demonstrated.

### New Cultural Concepts

Class officially began with the use of technology: incorporating facebook and a music video. When the video concluded, the professor asked students questions in Spanish and aided students responses (in Spanish) when needed. Another short video was played, teaching students a cultural lesson on how to make Cuban coffee. (It would have been wonderful to have been able to make some in class.) This use of technology made the class very enjoyable and this could be seen on the students' smiling faces.

### Student Centered Learning

The next section in class focused on current events which the students were assigned to share with the class. Discussed in Spanish, the class interacted either speaking or listening. The professor, acting as a facilitator, aided student vocabulary with correct pronunciation and correct use of verbs which the students were encouraged to verbally repeat.

As an activity, students were paired together to speak with one another in Spanish; encouraging proper usage of the language and vocabulary.

The final part of the class focused on an upcoming exam. Students were provided information on what the test entailed and how many points were associated with the different sections of the test.

## Learning Atmosphere

This was an enjoyable and enthusiastic class which was professor-led with questions and humor, ensuing that students were constantly communicating in Spanish. Students were happy to be in class and participating.

### A MUSIC PROFESSOR'S OBSERVATION OF A CONSTRUCTION LAW CLASS

This was an informative class that began with a lecture; explaining legal terms; and court procedures. As the professor wrote the terms on the whiteboard and gave explanation, students were encouraged to ask questions while taking notes.

## Professor Knowledge

The professor did not refer to notes or a textbook which allowed her to move freely at the front of the She used "fill in the blank" questions to solicit student participation. room.

## Professor-Led Teaching & Student Centered Learning

Forty minutes of instruction ensued and then the students were divided into two groups where they had to arrive at reasons to either go to trial or mediate a situation about a concrete driveway that was fairly new but broken. It was interesting to hear the questions asked by opposing groups and directed at one another. During this time, the professor role-played as the disgruntled owner of the broken driveway. This activity had the students apply the new body of knowledge that was presented earlier and allowed the professor to assess student understanding.

Class objectives were well planned and a smooth transition between lecture and activity occurred. The material was logically sequenced and the professor affirmed and praised students' correct answers and participation.

#### A MUSIC PROFESSOR'S OBSERVATION OF A MATH CLASS

## Learning Atmosphere

The professor was very excited and animated; she was constantly moving around the front of the room; smiling; and obviously passionate about her subject. She also mentioned her office hours for students that needed extra help allowing students to know that this professor cared about them.

### Professor-Led Teaching

Class began with the reason for why calculus was important and how 'it' was able to provide answers. Handouts were given to the students and then the professor wrote out the objective on the chalkboard and discussed it.

As the professor wrote a math equation on the board, students worked on the problem in their notes. During this time, the professor constantly engaged the class by asking many questions and complimented the students when an answer was suggested.

The professor's enthusiasm for calculus and solicitation for student participation also indicated a confidence in her students.

#### CONCLUSIONS

The objective of this project is to give an opportunity to the faculty members in different disciplines on a Polytechnic university to observe their peers in various disciplines for innovative classroom based learning activities. The observations were done throughout the semester. The idea was to give a chance to faculty members to explore if there are techniques used by other professors in or outside of their own disciplines, analyze those techniques, reflect on their effectiveness, and possibly adapt them for their own use in their respective disciplines. A number of these techniques discussed in this paper can be used by professors across disciplines. In this on-going project, the idea is to expand this exercise and give professors from other disciplines a chance to observe and adapt the effective teaching methodologies for improved teaching and learning in higher education.

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# UNDERGRADUATE STUDENT SALARY AND JOB EXPECTATIONS: WHAT THEY THINK IS GOING TO HAPPEN AND WHAT IS **REALLY GOING TO HAPPEN!**

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#### **ABSTRACT**

This study examines the salary and career expectations of upper-level business students as compared to the actual offerings of today's business environment. In addition to salary expectations, this research also examined the level of student debt as well as students' use of career services and job search activities. Differences were found between race and gender in the areas of expected salary and use of debt to finance an undergraduate degree, suggesting a disconnect between the cost/return function of a general business degree. Relationships were also found between GPA and salary expectation, GPA and involvement in an internship, as well as salary expectations and the willingness to relocate.

#### INTRODUCTION

Recently, undergraduate business students are finding that their expectations for job opportunities, as well as compensation packages are falling well above those that are actually offered by the current business environment. Students are finding it harder to obtain meaningful employment, especially in their field of study (Greenburg, 2011). Even those that are finding employment are realizing that the resulting salary and benefit package are much lower than expected (Lavelle, 2008). This problem is exaserbated by the reports from some areas of business employment, especially with graduate degrees, that salaries are climbing. In addition to the realization that the expected return from an undergraduate business degree is decreasing, the cost of obtaining a college degree is skyrocketing, increasing much more that inflationary trends (Kristof, 2009). This paper examines this gap between student expectations and current market conditions and suggests practices which may help students make more reasonable decisions when choosing academic programs and the cost of obtaining them. We examine the expected return, or compensation packages that students expect to receive in their first jobs as well as the extensive use of debt that students use to finance their academic pursuits. This study also examines activities such as the use of internships, academic career services, and internships that may help students acquire meaningful employment.

Business schools have recently come under fire for presenting the business curriculum within "silos". Silos are described as separate activities and functions, such as accounting or marketing, that address the specifics of that course material, with little or no integration with other disciplines (Rosen, 2010). In addition, these silos offer little guidance to the interaction of all curriculum material as well as the realities and behaviors expected by the job market.

# JOB AND SALARY EXPECTATIONS

While undergraduate students remain fairly optimistic about their job possibilities and good salaries, the resulting environment does not support such beliefs. However, there is research that suggests these benefits are dependent on subject and institution (Walker and Zhu, 2010). This overestimation of future earnings amplified the situation of graduates unable to find employment returns that justify their investment (Brunello, Lucifora, and Winter-Ebmer, 2004). The unemployment rate for 20 to 24 year olds in 2012 was a staggering 14% (Greenburg, 2011). That figure might be explained by the fact that 37% of senior students surveyed had not even started looking for a job (The Class of 2011 Student Survey Report, 2011).

In earlier recessions, companies often laid off their older workers who were making the highest salaries, but recently younger workers are having a tough time because companies are keeping their most talented and trained individuals, leaving little room for hiring newly minted undergraduate business students (Scott, 2009). Even those individuals that are lucky enough to find employment during this recession will find little comfort in the fact that placement during a recession can lead to a negative \$100,000 impact on lifetime earnings (Greenburg, 2011). Despite tough job realities, college graduates continue to have high expectations about their ability to obtain a good job (College Graduates Optimistic: Have High Expectations, 2001)

It has been suggested that a downturn in the economy is a good time for students to enter graduate programs and try to ride out the troubled times, but others suggest that the added cost of graduate school does not justify that decision (Greenburg, 2011). There has even been criticisim about schools and financial institutions exaggerating the value of a college degree, even going so far as to label it fraud (Kristof, 2009). In addition to skyrocketing cost of a college degree, an underlying and often ignored variable in this equation is the hidden costs of financing a degree. It has been suggested that most students will struggle for at least a decade to pay off their college bill (Kristof, 2009).

To add to this malaise of debt and lost income potential are the low numbers of students that actually succeed in obtaining a degree. On average, three-quarter of those earning a high-school degree try to continue in college. Of that number, only half will graduate, while the other half will be left with no degree but a large amount of debt. To compound this problem, six in ten of African Americans that enter college will leave without a college degree, even though they are responsible for the debt incurred.

It certainly appears that the cost/return equation for higher education is entering a new and difficult period. This is not to suggest that all undergraduate degrees do not promote a return on their investment. However, not all students share in an even cost/return scenario. It has been reported not only do men expect to earn more than women (The class of 2011 Student Survey Report), but in fact, female undergraduates start at \$4000 less than their male counterparts (College graduates optimistic: Have high expectations). Students graduating in more technical degrees such as computer-related degrees are seeing an increase in starting salaries (Yousuf, 2010). Undergraduate business degrees are seeing increases in Accounting and Finance, but other business degrees are experiencing a downturn (The Business Review, 2011).

### STUDENT DEBT

The average cost of an undergraduate business degree in the US is currently topping \$40,000 (National Center for Education Statistics). To pay for this staggering sum, students are relying on government and private lending sources, with the students averaging \$25,000 in debt. To compound this increase in debt, employment rates for new college graduates have fallen drastically in the last two years (Hill, 2011). It seems that easy money from both government lending as well as private sources has exacerbated the increase in student lending (Kristof, 2009). With college debt added into the equation, most college graduates do not see real earnings above high-school graduates until the age of 33. Making this problem even worse, the US Government is seriously considering doubling the interest rates on student loans (Steinhauer and Lowrey, 2012).

## **METHODOLOGY**

One hundred undergraduate business students from a small southeast university were administered a sixteen item measure which gathered information on their salary expectations, outstanding debt on student loans, as well as willingness to relocate for employment. Of the 100 subjects, 52 were males and 46 were females. Of the respondents, 79% were Caucasian and 17% were African-American. Sixty-seven percent of the subjects were Seniors. Field of study for this group was reported Management (55%), Accounting (35%), Marketing (8%) and Finance (2%). Other questions on the measure recorded student use of

university career services, activity in use of internship program, intention of attending graduate school, and their satisfaction with their field-of-study choice. Several questions concerned the student's satisfaction with choice of business degree and career choice. Finally, the students were asked how long they had been looking for a job and how long they thought it would take them to find a job.

#### RESULTS

An analysis was conducted examining all variables in the consideration of business school students' expectations in the areas of future career outcomes. This initial set of analyses was performed using SAS Proc GLM and all GLM results can be found in Table 1. Respondents to the question concerning salary expectations found that 52% believed they would make between \$35, 000 and \$50,000, with 27% believing that they would make between \$40,000 and \$50,000. The remaining 14% of students reported that they would make more than \$50,000 a year. The average salary for business administration majors was \$44,000 in 2011. As stated earlier, exaggeration in expected earning is not uncommon for undergraduate students. Overall, there was a relationship between the GPA and salary expectations (F = 3.10, p<.01, R2 = .12). As students do better in school, they also seem to increase the size of their compensation package after graduating. There was also a relationship between salary expectations and a willingness to relocate (F = 2.51, p<.06, R2 = .07). Students that do well also appear to be willing to relocate to use their good GPA to land a good job. Not surprisingly, GPA and intentions to attend graduate school were also related (F = 4.38, p< .03, R2 = 4.09) as were GPA and experiencing an internship (F = 5.68, p<.01, R2 = .06). The belief that students would find a good job was associated with the amount of debt incurred for school (F = 1.95, p<.09, R2 = .09). This relationship might be explained by the realization that the debt must be paid and so the outlook for a good job may be exaggerated.

**Table 1**Proc GLM Simple Regression Analysis on Specific Variables

Variables	Equation F	R <sup>2</sup>	
GPA/Salary Exp.	3.10**	.12	
Salary Exp/Relocate	2.51+	.07	
GPA/Grad. School	4.36*	.04	
GPA/Internship	5.98**	.05	
Good Job/Total Debt	1.95+	.09	

<sup>\*\*</sup>p<.01, \*p<.05, +p<.10

Other interesting findings centered around the differences between gender and race concerning earning potential, importance of finding a job in-field, use of university career-services, intentions to attend graduate school, and the belief that a business degree relates to getting a good job. The results of a two tailed T Test are as follows. It seems that White Males had higher salary expectations than did White Females (t (72) = -1.89, p<.06) (see Table 2). The negative t value is the result of the inverse coding of the data.

**Table 2**Significant Tests of Differences Between Gender and Salary Expectations

Gender	Salary Expectations Means	t
White Male	2.65	-1.89*
White Female	3.31	

The amount of student loans used by African-Americans and Whites was also significantly different (t (87) = 2.0, p<.04) (Table 3), with African-Americans relying more on loan debt to finance their undergraduate degree. Again, socio-economic differences between these two groups could explain this difference.

**Table 3**Significant Test of Difference between Race and Student Loans

Race	Student Loans Means	t
African-American	4.26	2.0*
White	5.01	

<sup>\*</sup>p<.05

There was also a difference found between African-Americans and Whites in their use of university career services (t (78) = 3.03, p<.00) (Table 4) and the intention of attending graduate school (t (87) = 2.52, p<.01) (Table 5). It is possible that African-Americans are using available resources for job placement more readily than whites because of the historic difficulties African-Americans have experienced with job placement. African-Americans may also see graduate programs as a way to increase their job and earning potential and again are trying to use every resource available. And lastly, African-Americans believe that receiving a business degree is more influential in landing a good job than do White students (t (86) = -1.75, p<.08).

**Table 4**Significant Tests of Differences Between Race and Use of Career Services

Race	Use of Career Services	t
African-Americans	1.75	3.03**
White	1.37	

<sup>\*\*</sup>p<.01

**Table 5**Significant Tests of Differences Between Race and Intention to attend Graduate School

Intentions to Attend Graduate School	t
1.64	-1.75+
1.31	
	Graduate School  1.64

#### DISCUSSION

This research examined the career expectations of junior and senior business students in areas such as salary, job placement, as well as difficulty in finding employment. In addition, we examined the amount of student loan debt as well as the student's willingness to relocate or take a job out of field. Our findings indicate that students in general have an inflated view of salary and career opportunities, such as length of time it will take to find a job. In addition, we found that there were differences in these expectations depending on gender and race.

Expectedly, we found a relationship between expected salary and GPA. Students that maintained a high academic average believed that they would make a higher salary, which is to be expected. However, in today's tight job market, students are finding both jobs and high salaries a difficult quest. A high GPA was also associated with willingness to relocate as well as intentions to attend graduate school. These relationships are not surprising. Not surprisingly, students with high levels of college debt also had exaggerated beliefs in the availability of a good job.

It also appears that African-American students have lower salary expectations than do White students. This can be partially explained by the historically low wages earned by African-Americans during most of this country's existence. Although not significant, it was also interesting to see that white males had higher salary expectations than white females. As women have historically made less at the same job than men, it seems females realize that salary inequalities exist. It was also found that, African-American Females have higher salary expectations than African-American Males.

Results also indicate that African-American students are more reliant on student loans to pay for college than are White students. The continued increase in college tuition and the depressed earnings of the African-American community could combine to make borrowing a primary way for African-Americans to fund college tuition. It was also found that African-American students used the university career services office more frequently than did White students. African-American students seem to be using available resources more often in order to better promote themselves in the job search. And lastly, African-Americans students showed a greater interest in attending graduate school than did their white counterparts, which may suggest that African-American students see graduate school as yet another resource to better one's chances of success.

This research examined the disconnect between student evaluation of career and salary opportunities, suggesting that students are generating unrealistically optimistic views of reality. The recession that started in 2008 has begun a rebound, although slower than most would have predicted. Perhaps students have been insulated from current economic realities and are using old models of hiring and placement. We also found some remarkable differences in the way different genders and races viewed their economic prospect.

While there is little that Business Schools can do to change the current environment, we certainly can have realistic discussions with our students concerning their future possibilities. It is vital that young adults are well informed of the costs and benefits of a higher education degree (Jerrim, 2011). Perhaps seminars could be developed that asked students to research for themselves, the current state of available hiring and salary ranges. However, this interaction cannot take place during their last semester. To be effective, this process would have to start early enough to allow students to engage in career promoting activities, such as use of career services, internships, and other career enhancing programs.

As always, there were limitations to this study. The overall population was small (100) with an even smaller population of African-Americans. We also only have data from one university in a southeastern

state. Further research is necessary to help the academic community understand the disconnect between student expectations and the actual environment. It is essential that schools of business administration do everything they can to present a realistic preview of the investment required and the return to be delivered. It is also imperative that universities prepare students for the quality of life that they and their families expect.

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### ACADEMIC DISHONESTY: A VIGNETTE BASED STUDY

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#### INTRODUCTION

Plagiarism and academic dishonesty are topics of interest to academics in their roles as both teacher and Student cheating takes many forms ranging from copying on tests, to unauthorized collaboration on assignments, to copying published material without citation, to the outright purchase of a completed paper or project. Despite the attention to this topic and the volume of research exploring it, academic dishonesty continues to be a pervasive problem in colleges and universities [16].

This research builds on the authors' previous research studies (citations provided upon acceptance) that investigated whether students had different perceptions about what constitutes academically dishonest behavior for different types of assignments and about whether or not education about academically dishonest behaviors change students' perceptions about what constitutes cheating. We were specifically interested in perceptions as they related to programming assignments. To investigate the previous research goals, a survey instrument using a Likert scale was used to determine what student perceptions were as related to academically dishonest behaviors. To gain a richer understanding of students beliefs, in this study we propose using a vignette-based approach. The focus will still be on technology based assignments and to compare whether or not students in various disciplines have varying perceptions. We will look at students in IT-related degree programs, business majors and various additional majors. We will also investigate whether students get more ethical as they progress through their degree programs (compare freshman to seniors etc.). The richer vignette based approach will allow us to further explore students' perceptions and motivations regarding cheating especially with respect to digital assignments.

### **BACKGROUND/LITERATURE REVIEW**

Academic research into cheating has a long tradition going back well over one hundred years [4] [7] [11]. While we cannot include a comprehensive review of this literature in our proposal, we present an overview of research on cheating with special attention to the work most relevant to the proposed study. A considerable portion of the work that has been done on cheating has attempted to establish the rate of occurrence. Self-reported incidence rates of cheating behavior vary widely from a low of 3% [13] to a high of 95% [17]. Researchers have also investigated personal and environmental factors associated with Many different personal factors including gender, age/class, marital status, religious orientation, and traits such as locus of control and moral obligation have been examined with inconsistent results [9]. The personal factor most consistently associated with a propensity to cheat is academic performance: students with lower grades and/or lower test scores are more likely to cheat [9] [10] [18]. Researchers have also tried to evaluate the impact of environmental factors on cheating, with the risk of being caught and peer behaviors identified as the most consistent predictors of cheating [9].

Technology and the Internet have had a profound impact on the delivery of education. Unfortunately, it has also opened numerous avenues for academic dishonesty. The wide availability of source material has made it easier for students to copy anything from a small portion of unattributed content, to entire papers

or assignments [6] [12]. However, technology has also provided new tools for detecting plagiarism. There are several tools that attempt to determine the degree of similarity between student work and documents found on the Internet or compiled in a database of source material. *Turnitin* is one of the most popular such tools. With the advent of such tools researchers have begun to use them in studies of academic dishonesty. Comparable to the results of self-report studies, cheating rates identified in studies using plagiarism detection software have varied widely: reported rates range from 10.8% [24] to 61% [15]. Even with automated systems, there is some subjectivity in the determination of plagiarism rates. Plagiarism detection software such as *Turnitin* is essentially a text matching tool; it is left to the instructor to review reports generated by the system and make a determination as to how much of the copied material is harmless (such as might be expected in a bibliography or in properly cited quotations from source material) and how much is actually cheating. Furthermore, researchers reporting plagiarism statistics have used different threshold values for the proportion of matching text in a document that is considered to be cheating. These values range from a low of 3% [15] to a high of 50% [14].

Some researchers have tried to evaluate how students react to knowledge that their work will be screened by plagiarism detection software. While students generally report favorable perceptions of the software [2] [14], warning students that such software will be used to evaluate their work does not appear to be a strong deterrent to cheating. One study compared plagiarism rates between students who were warned about the use of Turnitin and those who were not. In this study all of the plagiarized papers were submitted by students who knew their work would be screened while the control group, whose work was screened without their knowledge, submitted no plagiarized papers [26]. In another study, evaluating plagiarism rates between two subsequent assignments did show a small reduction when students were notified that their work would be screened [5]. Personalized feedback to students appears to be a more effective deterrent; written notification of plagiarism in one assignment reduced, but did not eliminate, plagiarism by the same students on a subsequent assignment [23]. Encouraging students to use Turnitin to evaluate their own work resulted in some attempts by students to reduce unintentional plagiarism (primarily in the form of poor paraphrasing) but failed to improve appropriate use of citations [22]. Dee and Jacob [10] report the use of web-based tutorial educating students about plagiarism and how to avoid it had a positive impact. Submitted work was evaluated using Turnitin. Students who completed the tutorial were less likely to submit papers containing copied text.

Findings from these recent studies suggest that some portion of plagiarism is due to a lack of knowledge as to what constitutes acceptable behavior on graded work. This conjecture is supported by a recent study investigating cheating behavior and attitudes among computer science and engineering students and faculty [8]. One aim of this study was to identify what behaviors are considered to be plagiarism; 100% of the faculty and 94% of the students identified submitting copied work as plagiarism and indicated that the individual turning in the copied work was responsible for the dishonesty. However, only 52% of the faculty and 30% of the students identified the person providing the material to be copied as responsible for the plagiarism. Furthermore, 63% of students indicated that they had given their work to another student. Other studies have also found that those who share their work with others are perceived has having committed a less serious offense than those who use the work of others [25].

#### **METHODOLOGY**

This study adopts a vignette experiment methodology. "Vignettes are short descriptions of a person or a social situation which contain precise references to what are thought to be the most important factors in the decision-making or judgment-making processes of respondents" [1, p. 94]. Vignette-based studies can be used to assess beliefs, attitudes, or judgments [3], and "combine ideas from classical experiments and survey methodology to counterbalance each approach's weakness" [3, p. 128].

For example, vignettes have an advantage over short-item survey instruments, as vignettes provide researchers with an opportunity to present respondents with a richer set of stimulus material, (i.e., a

greater level of external validity) within a more controlled environment (e.g., each subject may be presented with a series of vignettes that differ across one or more experimental factors).

Vignette studies have seen limited use in the academic dishonesty literature. One study used vignettes to determine students' attitudes towards various motivations for helping a peer to cheat [25]. Other vignettebased studies have examined the impact of various personality and situational variables on students' likelihood to cheat [19] [20] [21]. Findings of these studies have included: students who are motivated by extrinsic factors (grades, comparison against peers) are more likely to cheat than those motivated by intrinsic factors (desire to learn); students with low competence are more likely to cheat than those with high competence [20]; neutralizing attitudes or rationalizations that may be used to justify unethical behavior are associated with a greater likelihood of cheating as is the presence of a cheating culture in which students observe others committing dishonesty acts [21]; and, a focus on academic integrity is associated with a lower frequency of cheating than a focus on punishment [19].

In the proposed study, we wish to evaluate factors related to digital assignments, such as spreadsheets or computer programs. The authors of this proposal have previously evaluated student attitudes toward digital assignments and found that copying of programming assignments is perceived as more acceptable than copying on an essay assignment. We intend to further explore these attitudes by developing vignettes which illustrate different possible justifications for such attitudes. We hope that this study will allow us to replicate findings from our survey-based research and further extend our understanding of academic dishonesty in digital work. The vignettes will be authored to reflect ethical dilemmas students might encounter, and students will be asked to respond to the vignette in order to gauge attitudes. For example, you have completed an assignment and your roommate is struggling with it... Would you let your roommate look at the assignment for help? Give the assignment to them to copy? Give them the assignment with the understanding that they will only use part of it? Does the type of assignment make a difference?

The next steps in the proposed study are as follows:

- Develop vignettes
- Pilot test vignettes
- Refine vignettes
- Administer vignettes to students in courses which contain digital assignments. These include programming and business applications courses, etc.

Data analysis will involve determining whether students who respond to different vignette scenarios report a different likelihood that the vignette protagonist would cheat. We hope that this approach will give us greater insight into students' perceptions of acceptable behavior with regard to digital assignments. Knowledge gained from this study will help us to educate students and to structure digital assignments in such a way as to reduce the propensity to cheat.

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#### A SURVEY OF STUDENT TEXTBOOK BUYING BEHAVIOR

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#### **ABSTRACT**

This paper presents the results of a survey that assessed the textbook buying behavior of college business students. The results, for the spring semester of 2012, show that the majority of students prefer to purchase traditional print textbooks from bookstores even though these are the highest priced option. About 18% of the students rented textbooks and about 32% purchased textbooks through the Internet. Printed textbooks are highly preferred to e-books.

#### **INTRODUCTION**

The market for products and services to meet the needs of educational institutions has clearly evolved from the time of the first printing press to the present day mix of print and on-line resources. How these resources are created, selected, and used is influenced by an interesting mix of stakeholders that includes: publishers, educational institutions, book suppliers, instructional technology designers, instructors, and students. As a result, a variety of different forms of educational materials is available with an increased number of ways to purchase these materials.

This research focuses on the textbook purchase decision of students enrolled in a four-year liberal arts university and majoring in business. Our inquiry of students' buying behavior started based on hearing and experiencing student comments such as: "I did not purchase a text, it was too expensive", or "I did not believe that I needed a text", or "I am sharing a text". We suspect that some students do not budget for textbooks in their financial planning for college. Also, the price of textbooks has been increasing at an extraordinary rate relative to the general rate of inflation in the economy. The Consumer Price Index (CPI) [1] for "Educational books and supplies" for 2011 was 529.545 using 1997 as the base. This means that the average 2011 price for these products was 5.29 times the average price in 1997. Further, the change from 2010 to 2011 was a +4.7%. (For additional information and comparison, the 2011 CPI for "Tuition, other school fees, and childcare" was 597.208).

So, the current challenge for instructors and students is to get the required course materials in a market that provides a variety of options, prices, and sources for course materials. We are interested to know how students use the current textbook market to acquire course materials.

Our inquiry of student course materials purchase behavior recognizes two characteristics of the market: 1) course materials can be expensive; and 2) there are many purchase options that vary in the relative cost of the materials. As an example, we surveyed the market for the 7<sup>th</sup> edition of Basic Statistics for Business and Economics by Lind, Marchal, and Wathen [2]. Table 1 shows the variety of sources and prices available to students.

TABLE 1. LIND ET AL. BASIC STATISTICS FOR BUSINESS AND ECONOMICS, 7TH ED.

Source	Condition	Price
Privately owned off campus	New	\$191.65
Privately operated university	Used	\$144.00
bookstore		
Privately owned off campus	Used	\$143.75
Amazon.com	New	\$115.01
Amazon.com	Used	\$81.22
Amazon.com	Ebook/Kindle	\$124.02
Amazon.com	New Looseleaf	\$11.86
Amazon.com	Used Looseleaf	\$11.87
Chegg.com	Rental	\$42.49
Chegg.com	eTextbook rental (180 days)	\$82.42
Usenet.com (others)	Ebook	Free?
Barnes & Noble.com	New	\$153.73
Barnes & Noble.com	Used	\$80.99
Barnes & Noble.com	Rent	\$40.25

Table 1 demonstrates that there are a wide variety of purchase options and corresponding prices. The table suggests several questions regarding student buying behavior such as: Are students aware of the options? What barriers exist regarding purchasing behavior, such as: lack of market knowledge, financial and student loan issues, inertia versus convenience, and the availability of supporting technology such as laptops, ipads, etc.?

#### SURVEY AND METHODOLOGY

The purpose of this study is to investigate the status of student textbook buying behavior in a particular college of business. The survey, included in the Appendix, was issued to undergraduate students majoring in business administration during the spring 2012 semester. 455 surveys were collected from a variety of courses offered in a College of Business classified as: business core course, major course, minor course, elective course, or other. Table 2 shows the frequencies of the responses by type of course:

TABLE 2.
DISTRIBUTION OF STUDENTS BY COURSE TYPE

Course type	Frequency	Relative Frequency
Business core	289	67.05
Major	99	22.97
Minor	25	5.80
Elective	3	0.70
Other	15	3.48
Missing	(24)	-

Overall, the demographics of the surveyed students in terms of gender, business major, in-state versus out-of-state, transfer students, and grade point average are very close to the demographics of all students in the college of business. We would surmise that our sample is a good representation of the population of students in the college.

Of the 455 responses, 328 students indicated that the course required a textbook. And of these 328 students, 294(90%) indicated they purchased a textbook and 34 (10%) indicated that they did not purchase a textbook.

Focusing on the 294 students who were required to buy a text, Table 3 shows how students acquired the textbook. The survey results show that, of the students who were required to buy a text, nearly 40% preferred purchasing a textbook through the campus bookstore. Students also used the Internet to acquire a text. Nearly 21% used the Internet to purchase a textbook and nearly 12% rented a text through the Internet.

TABLE 3.
DISTRIBUTION OF HOW STUDENTS ACQUIRED TEXTBOOKS

How was textbook acquired?	Frequency	Relative Frequency (%)
Buy on campus	115	39.66
Buy off campus	55	18.97
Buy on the internet	60	20.69
Buy from friend	4	1.38
Rent on campus	11	3.79
Rent off campus	1	0.34
Rent through the internet	34	11.72
Borrowed	8	2.76
Shared	2	0.69
Missing data	(4)	-

Student textbook buying behavior is summarized in Tables 4 and 5 in terms of buying versus renting a textbook. In our survey, Table 3 shows nearly 81% of the students bought a textbook and nearly 19% rented a textbook. Table 4 shows nearly 65% of students bought the textbook in a store and nearly 32% of student bought the text via the Internet.

TABLE 4.
TEXTBOOKS BOUGHT VERSUS RENTED

Bought vs. Rented	Frequency	Relative Frequency(%)
Bought	234	80.70
Rented or borrowed	54	18.61
Shared	2	0.69

TABLE 5.
TEXTBOOKS BOUGHT VIA THE INTERNET VERSUS STORE

Store vs. Internet	Frequency	Relative Frequency(%)
Store	190	64.62
Internet	94	31.97
Borrowed or Shared	10	3.4

Another purchase decision is whether a student buys an e-book version of the textbook. Table 6 summarized the results for the 294 students who indicated that they were required to purchase a textbook.

Nearly 93% of the students purchased a printed book. Table 7 shows the relationship between how a textbook was purchased and whether the purchase was an e-book or a printed text. While it is possible to purchase an e-book through a bookstore, 18 of the 21 e-books were purchased through the internet.

TABLE 6. E-BOOK PURCHASES

E-book purchased?	Frequency	Relative Frequency(%)
Printed book	267	92.71
E-book	21	7.29

TABLE 7.
TEXTBOOKS BOUGHT IN PRINT VERSUS E-BOOK VERSUS HOW THE TEXTBOOK WAS PURCHASED.

How was textbook acquired?	Print	E-book
Buy on campus	109	2
Buy off campus	54	1
Buy on the internet	44	15
Buy from friend	4	0
Rent on campus	11	0
Rent off campus	1	0
Rent through the internet	30	3
Borrowed	8	0
Shared	2	0
Missing data	(10)	-

Our survey also included questions regarding the availability of web based textbook supplements and whether the students decided to purchase the supplement. In this analysis, 232 responded to these questions. The results are shown in Table 8. Students do what is required.

TABLE 8.
WAS A WEB-BASED SUPPLEMENT REQUIRED AND/OR PURCHASED?

		Did you buy the web-based supplemen	
		Yes	No
Is a web-based supplement	Yes	152	11
required?	No	9	60

Tables 9, 10, and 11 show purchase behavior in terms of employment status. Table 9 shows the overall results. Tables 10 and 11 summarize the comparisons between buying versus renting, and purchasing in a store versus buying through the Internet. When the choice of buying versus renting is compared, employment status does not appear to be related to this choice (p=.4916). However, when comparing the choice of purchasing in a store versus the Internet, differences are apparent (p=0.0027). While all three employment groups prefer to purchase in a store, part-time employed students have the highest preference for purchasing through the Internet following by full-time employed students. We believe that students who are employed part-time tend to be older and self-sufficient and will shop the variety of sources for the best price. Students who are not employed are the least likely to use the Internet to purchase a textbook.

TABLE 9. HOW A TEXTBOOK WAS ACQUIRED BY EMPLOYMENT STATUS.

How was textbook acquired?	Full Time (n=56)	Part Time (n=106)	Not Employed (116)
Buy on campus	45%	33%	46%
Buy off campus	14%	18%	23%
Buy on the internet	16%	32%	12%
Buy from friend	2%	1%	0%
Rent on campus	2%	3%	6%
Rent off campus	2%	0%	0%
Rent through the internet	20%	11%	9%
Borrowed	0	2%	2%
Shared	0%	0%	2%
Missing data	(16)	-	-

TABLE 10. STUDENT PREFERENCE FOR BUYING VERSUS RENTING BY EMPLOYMENT STATUS

Bought vs. Rented	Full Time	Part Time	Not Employed
Bought	77%	84%	82%
Rented or borrowed	23%	16%	18%

TABLE 11. STUDENT PREFERENCE FOR BUYING IN A STORE VERSUS INTERNET BY **EMPLOYMENT STATUS** 

Internet vs. Store	Full Time	Part Time	Not Employed			
Store	63%	54%	78%			
Internet	36%	43%	22%			

### **DISCUSSION**

The purpose of this research is to survey the textbook buying behavior for a sample of undergraduate business majors. As Table 1 shows for a sampled textbook, the textbook market can be very diverse in the source for the purchase, the type of textbook, and the price. One of our questions is to what degree students may use these purchasing options, especially to manage rising textbook costs. This discussion includes a comparison of our results to the results of the 2010 Florida Student Textbook Survey [3]. The Florida Survey gathered 14,220 responses from students enrolled in twenty-eight colleges and eleven universities across the state of Florida between September 21, 2010 and March 21, 2011.

The most expected result is that students in both surveys prefer to buy textbooks in print. Note that in our survey about 7% of the purchased textbooks were e-books. The following table from the Florida Survey [3] shows a very similar result to ours. Note that a student could respond to more than one of the options so the categories are not mutually exclusive. In addition, the Florida survey included open-ended questions providing respondents an option to cite reasons that they were NOT interested in digital or ebooks. The top four reasons were: 1) they want to a printed textbook to highlight and annotate, 2) reading electronic text was inconvenient, 3) difficulty moving within a digital text, and 4) lack of access to technology for using electronic textbooks.

2010 Florida Student Textbook Survey: How Students Access Textbooks					
Q. 14. For Fall 2010, how do you access your textbooks? N=12252					
<b>How Students Access Textbooks</b>	N	Percent			
Print - used	9398	76.7			
Print - new	6997	57.1			
Print - rented	3037	24.8			
Print - borrowed (no cost)	1794	14.6			
eBook - limited ownership license	1124	9.2			
Checked out from the library or interlibrary loan	652	5.3			
Open Textbook - online, download, self-print	557	4.5			
eBook - permanent access	443	3.6			
Open Textbook - commercial print	270	2.2			
Total number of selections	24272	·			

While buying printed textbooks may be preferred, it is interesting that a relative minority of students choose to rent a printed textbook at a lower price. In our survey, about 19% of the students rented texts. In the Florida Survey, for almost 40% of the classes, students rented textbooks. In our sample, the rental option is in its second year and students may not be aware of the option or the option is not available for all classes. The response in the Florida Survey may be higher since it includes students attending colleges. Clearly the rental option provides students with a print textbook and a lower cost. In our university, we would do more research on the availability of the option and the student decision to rent.

In our survey, we included a question regarding purchase decisions of printed textbooks through the Internet. Our survey shows that about 32% of students did shop the internet options and purchased through the Internet. Based on the information in Table 1, we would conclude that these students are aware of their purchasing options and are seeking the best price for their textbooks.

The Florida Survey supports our inference that students use the Internet purchase option to manage costs. The Florida Survey shows that the top response to manage costs is to shop sources other than the campus

2010 Florida Student Textbook Survey: Measures Used to Reduce Textbook Cost					
Q. 11 What measures have you taken to reduce your textbook costs? Check all that apply.					
Answer Options	Responses	Percent			
Buy used or new books online from source other than the campus bookstore	8932	72.2%			
Buy used copies from campus bookstore	7940	64.2%			
Sell used books	7170	58.0%			
Share books with classmates	4808	38.9%			
Do not purchase the required textbook	4585	37.1%			
Rent textbooks through an on-campus rental program	3003	24.3%			
Buy an electronic version of a textbook	2101	17.0%			
Use a reserve copy in the campus library	1576	12.7%			
Buy only the e-textbook chapters needed for the course	861	7.0%			
Do not attempt to reduce textbook costs	316	2.6%			
Other	1123	9.1%			

book store. It is also interesting to note that renting a text and buying an electronic version of the textbook were not highly rated options. Also, students indicated that not purchasing a textbook is a very real option.

The last analysis reported in our survey is the relationship between employment status (full-time, part-time, and not employed) and buying behavior. The interesting result is the relationship between the source of the purchase or rental and employment status. The results show that part-time employed students are most likely to purchase or rent through the Internet followed by full-time employed students, and the least likely are students who are not employed. Our presumption is that employment status may be an indication of a student's financial status. In our case, students who are employed, either full- or part-time are more sensitive to prices and use the internet to find lower priced textbooks. This particular question would need further research to validate our presumption.

#### **CONCLUSION**

The results of this research indicate that students prefer traditional printed textbooks. The research also suggests that most students do not price shop the various sources of textbooks deferring to make their textbook purchases at campus and off-campus book stores.

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# **Securing Textbooks for your Courses**

We would like to learn more about your textbook buying behaviors. From this information, we hope to better serve your instructional needs in the future. Rest assured, your responses will remain confidential. We'll combine all data so each response remains anonymous. We thank you in advance for sharing the requested information with us.

Q1	Is there a textbook available for this course?	Q6	What form of the book did your acquire?
	Yes		A printed copy
	No		An e-book
			Not applicable. I did not acquire the textbook
Q2	Is a textbook required by your instructor?		
	Yes	Q7	Is there a Web-based supplement (i.e., CONNECT, WileyPLUS, MyLabs) for this course?
Q3	If there is a textbook for this course, do you have one (whether it was required or recommended)?		Yes
	Yes	Q8	Is the Web-based supplement (i.e., CONNECT, WileyPLUS, MyLabs) required by your instructor?
Q4	Assuming you do have the textbook for the course, are you using the most current edition?		Yes
	Ves	Q9	Assuming there is a Web-based supplement (i.e., CONNECT, WileyPLUS, MyLabs), did you buy it?  Yes
Q5	Assuming you have a textbook for this course, how did you acquire it? (Check one)		
		Q10	Gender
	I BOUGHT it at the ON-CAMPUS bookstore		Male
	I BOUGHT it at an OFF-CAMPUS bookstore		Female
	I BOUGHT it from a FRIEND or other source	Q11	What is your major?
	I RENTED it from the ON-CAMPUS bookstore		Accounting
	I RENTED it from an OFF-CAMPUS bookstore		Economics
	I RENTED it from an INTERNET site		Finance
	I BORROWED the textbook		Management
	I SHARE(D) the textbook with a friend		Marketing
	I DID NOT ACQUIRE the textbook for this course		Resort Tourism
			Other

Q12	Are you an in-state student?	Q17	Which of the following devices do you own? ( Please check all that apply.)
	Yes		Laptop/Desktop
	No		Tablet
013	Are you a transfer student to Coastal Carolina		eReader (Nook, Kindle, etc)
QIJ	University?		iPad
	Yes		
	No	Q18	Do you receive some form of financial aid?
			Yes
Q14	What is your approximate Grade Point Average (GPA)?		No
	Below 2.00	Q19	Assuming you do receive financial aid, which
	2.00 - 2.50		specific aid type applies? (Please check all that
	2.51 - 3.00		apply).
	3.01 - 3.50		Scholarships/Grants
	3.51 - 4.00		Loans
			Work Study
Q15	Which statement best reflects where this course fits into your degree program? (Check		Not applicable. I do not receive financial aid
	one)  Business Core	Q20	Which statement best reflects your current employment status? (Check one)
	Major field of study		I work full-time for CCU
	Minor field of study (or cognate)		I work part-time for CCU
	Free Elective		I work full-time off-campus
	Other		I work part-time off-campus
			I am not currently employed
Q16	What is your year in school?		
	Freshman	Q21	Student Status
	Sophomore		I am a FULL-TIME student
	Junior		I am a PART-TIME student

Thank you for participating in this study!

#### EXPERIENCING PRODUCTION LAYOUT: A NOT-SO-EASY TASK

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#### Introduction

Incorporating experiential learning in the classroom has become common, and in some cases, a necessity to ensure learning outcomes. To be effective, any experiential learning module must combine the experience with reflection to support the learning process (Kantula & Threnhauser, 1999). Successful exercises offer complexity which affords the opportunity to explore many dimensions of the intended subject, but also have a defined purpose which centers the discussions on key learning outcomes.

This paper describes an exercise utilized in a principles of management course to emphasize the production management topic of facilities layout. This course serves as a pre-requisite to all other business courses, surveys many sub-fields, and is primarily populated by sophomores. Prior experience suggests students have limited experience in managing operations, and in the aggregate, do not have sufficient background to comprehend the general concepts associated with making things. Conducted as an in-class seminar, this exercise seeks to address these shortcomings.

#### **Seminar: Facilities Layout**

This exercise challenges teams of students to design and implement an envelope-stuffing process.

Teams are provided with specifications of the finished product, inventoried stock, and general facilities conditions. Their task is to work in teams to design a system to effectively and efficiently produce a finished product. Specifically, they must determine the processes that will allow them to collate 8 sheets of paper (different colors), clip them together, insert them into inter-office envelopes, seal the envelopes, and address the envelopes as directed. On the surface, this seems an easy task, and also a simple design, however, given the constraints of space and time to design, the exercise becomes complex and ripe for critique.

# **Goals and Learning Objectives**

At the core of any experiential exercise should be a statement of one or more outcomes, however such outcomes should take the form of "do" statements. That is, what will the student be able to "do" once the learning activity is completed? Once identified, the role of the instructor is to provide an appropriate environment to build the skills necessary to "do", but also to provide the knowledge (principles) to support the skills. In the case of this exercise, the "do" items include (but are not limited to):

- Design an effective and efficient system to satisfy the specifications
- Work with others to satisfy project outcomes
- Effectively present the design and participate in constructive critiques
- Incorporate critiques into re-design efforts

In the case of this particular exercise, the instructor's role is to assign appropriate readings on facilities layout, provide a detailed project specifications, and prepare the needed materials. In application, it is appropriate for the instructor to avoid answering questions about the exercise, leaving the decision-making to the dynamics of each production team.

# The Exercise and Teaching Notes

An example of the Exercise currently in use, as well as a set of teaching notes, is appended.

Each team is provided large-scale paper (roughly 3 X 4 feet) for the preparation of their design, markers, and masking tape. Once posted the designs serve as the focal point for each team's presentations and critique. Several variations on a theme can be utilized to spearhead the critiques. For example, one involves representatives from each team "grading" all other team's displays, using the specifications as a grading guide. Each grading team then explains why they awarded the grade given. Another approach assigns two team members from each team to a design (not their own), and they are then responsible for explaining the design using the specifications as a guide.

Generally, the shortcomings of the designs are readily apparent, and teams are instructed to "do it again", which of course, they detest. Teams are given another piece of large-scale paper on which to create their revised design; these are posted and critiqued in similar fashion to the first round.

Experience has shown that student-generated critiques generate broader discussion and improved redesigns.

At this point, teams are allowed to volunteer to "test" their design in real-time. After a team has been selected and they have committed to how many completed envelopes they can complete in 5 minutes (this time can vary at the discretion of the instructor), the "room" is made ready. Using an open space in the classroom, masking tape is placed on the floor to delineate the walls and a table is moved into the "room". Once set, the instructor says, "Go" and starts the clock.

For quality control, one team (or representatives from several other teams) either volunteer or assigned as "observers" who look for violations or variations from the displayed design. They also serve as QC inspectors of the finished product(s) once the time has run out.

### **Key Debrief Items**

As with any exercise, working with students to understand effective critiques is vital. Emphasis on ways to improve, as wall as highlights of elements that work well, is key to effective critiques. Vague, ill-defined responses are not appropriate. Neither are brutal attacks. The instructor's role is to model appropriate critiquing skills by encouraging students to ask questions that begin with "why" or "how". Instructor experience reveals some common pitfalls.

- No design allowance for collecting materials from inventory (this is the #1 mistake, and worthy
  of discussion)
- Failure to comprehend the space limitations of the room, table, and task
- Ill-designed task roles
- Limited or no quality control standards, measures, or methods

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# **Production Layout Seminar**

# Time:

Design 15 minutes
Presentation preparation: 10 minutes
Presentation of design: 5 minutes

#### **Deliverable:**

Design an effective and efficient system using a production team and a control team to maximize the quantity and quality of finished products in the time allotted.

# Materials available from inventory:

- 8 separate stacks of standard sized paper (8 different colors—50 sheets of each)
- 50 large (10" X 13") "interdepartmental" envelopes with fold-over flaps and tie-down strings.
- 2 ball-point pens
- 50 paper clips

#### **Other Resources:**

- 1 table, 36x48"
- Room size is 6'-0" X 8'-0" with one access point at 3'-0" wide.

#### **Product Specifications:**

Each set must be collated; paper clipped in the upper left-hand corner of the page, and inserted into the envelope, facing page toward the back of the envelope. (The back is the side with the flap and tie-down.) Each envelope must be "sealed" by securing the tie-down tab and the mailing labels on the envelopes must be "marked" by writing "Jackets" in the spaced called "Name" located in the 1st column, 3<sup>rd</sup> from the bottom on the back side of the envelope. Remember: Quality Matters.

The collating order for the pages is as follows:

# Page Color

- 1. Green
- 2. Purple
- 3. Pink
- 4. Orange
- 5. Blue
- 6. Grey
- 7. Peach
- 8. Yellow

Document your design ideas in preparation for presentation to the class. Paper and markers are available for your presentation.

## **Design presentation should include:**

- Graphic Process Layout (picture of your design)
- Role Descriptions (what each worker does)
- Quality Control Procedures (type and metrics/measures)

Be sure the names of all your participants are on the Process Layout.

# **Production Layout Seminar**

# Teaching Note:

This simple seminar project has two parts. The first requires the design of a production system in a small group setting. Students can be assigned to groups of 5 or 6 using a variety of methods, but random assignment works well in this setting. If desired, a sub-set set can take responsibility for design and another for implementation. During the design phase, students are expected to document their design ideas for presentation to the class. Briefing, design, documentation, and presentation should take 30-45-minutes, but the timing can be adjusted to fit particular class needs. Groups must post their designs in the room. Be sure to bring along large sheets of newsprint and markers.

The second part of this seminar allows the groups to implement their designs. To do so, the instructor must have pre-arranged the collection of materials listed in above in "inventory". It works best if the students do not know they will actually implement their designs. One approach can provide pre-packaged materials needed for each group for ease of distribution. Another requires the production teams to "pull" from inventory, a vital, and often missing part, of the original design.

By any number of selection methods, allow one or more groups the opportunity to test their production layout and produce as many completed envelopes as they can. Use a stopwatch to ensure equal time for each group. Evaluate output on the basis of quality and quantity.

Each group must follow their original design. Allow time at the end of the exercise to de-brief about process improvements. One variation allows one or two competing team members to serve as "inspectors" who note variances in implementation and design, as well as quality control of the finished product.

Note 1: In this exercise, colored pages, paper clips, and re-sealable envelopes are used to allow for re-use in future classes.

Note 2: While teams determine which will go first, instructors must delineate the room size (e.g. place masking tape on the floor to simulate the walls) and install the work table.

#### **Evaluation Rubric**

10% 20%	Active design phase—involvement of group  Thoroughness of design—consideration of design criteria, tie to POM readings
20%	Completeness of Presentation—does it tell a full story?  Adherence to original design
10%	Output (quality and quantity)
20%	Individual Participation

# A STUDY OF THE IMPACT OF UNETHICAL BEHAVIOR AMONG BUSINESS STUDENTS IN AN EDUCATIONAL ENVIRONMENT

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#### **ABSTRACT**

Ethics is a relevant and interesting topic, which also is an area of concern in college and employment settings because students ultimately seek jobs, often in the business community. This paper examines some of the ethical issues which students are currently encountering. Additionally, it identifies the significance of these issues from the perception of students in various business classes at a small, public, southeastern university. The study further examines the likelihood of students continuing to engage in unethical conduct within an educational setting if they believe it will cause harm to others. Surveys were administered in six business classes. The classes consisted of two sections of managerial accounting, two sections of operations management, and two sections of Analytical Analysis II. The diversity of these classes would give the authors a good sample of both upper level and lower level business students. The purpose of the surveys is to gather data on the ethical behavior of business students. The survey consists of thirty questions covering a wide range of ethical issues. The data will be analyzed for significant differences, and inferences will be made regarding the behavior of business students.

#### INTRODUCTION

Atkins & Radtke (2004) indicate that several studies (Johnson & Beard, 1992; Stevens, et al, 1993) have been done on the concept of students' perceptions of ethics in business (1). Likewise, Shurden, Santandreau, & Shurden (2010) conducted a study in which students were surveyed in 16 ethical areas within the business realm ranging from personal use of company e-mail to accepting gifts from clients. The overall result in the Shurden study indicated an increase in awareness concerning ethical issues over a period of three years whereby the students were deemed to have been taught ethics (8). This study is in contrast to an observation made by McCabe in 2005 whereby he indicates that after working in the corporate world for over 20 years, his return to the classroom revealed an "erosion in the ethical values of recent college graduates" (5, 2005).

According to Richter & Buttery (2002), "ethics refers to a set of rules that define right and wrong conduct that help individuals distinguish between fact and belief, decide how issues are defined, and decide what moral principles apply to the situation..." (7, p. 142). Within the area of unethical behavior among college students is the topic of academic dishonesty which includes the subject of plagiarism. This topic is only one of the questions in the following study on the unethical behavior among business students. Other questions addressed are whistle blowing on classmates, protecting classmates by covering for them either by signing the roll when they are absent or allowing them to copy homework, doing homework for them or sharing group work. Likewise, using the excuse of illness to miss an exam due to under preparedness is discussed in this study. Students surveyed are then asked how to minimize this unethical behavior from their perspective. The results will hopefully help faculty in addressing the issue of student unethical behavior among business students in an educational environment.

#### METHODOLOGY

A study was conducted of business students enrolled in select classes at a small, southeastern, public university. Approximately 118 students were surveyed with 111 of the surveys being useable. Students were advised of the nature of the study and told that it was voluntary on their part. There were 30 questions in the survey regarding ethical situations within the educational environment. Of these 30 questions, the following nine questions were selected as representative of ethical situations which can occur within an educational environment.

### **DATA ANALYSIS**

According to Table I, only 23% of the students in the study indicated that cheating on exams was "likely" to exist at this university and 4% indicated "very likely". This means that the majority of the students at this university do not deem cheating to be a problem. If cheating were a problem, they believe it would cause "significant" harm to the school, their classmates, and themselves.

Table 1 Cheating on Exams

Questions	Very Unlikely	Unlikely	Likely	Very Likely
How likely is conduct in this area?	25%	48%	23%	4%
How much harm would this conduct cause	Little	Moderate		Significant
You	19%	17%		64%
Your classmates	21%	27%		52%
Your school	13%	2	26%	61%

However, academic dishonesty is a major area of ethical concern with faculty at other universities and with the authors (5, McCabe, 2005), (2, Johnson & Martin, 2005) with about 75% of students admitting to cheating in 2005 and only 5% of those students getting caught (2, Johnson & Martin, 2005). In fact, Johnson & Martin (2005) indicated that during their interview of students on the subject, "one student likened cheating to driving over the speed limit—everybody knows it is against the rules, but everybody does it". It is the authors' opinions that cheating on tests is more prevalent at this university than perceived by the students, and perhaps the opinion by students in the Johnson and Martin study (2, 2005) could represent the reason for the minimal perception by the students in our study.

Table 2
Allowing another student to copy your work

Questions	Very	Unlikely	Likely	Very Likely
	Unlikely			
How likely is conduct in this	11%	32%	42%	15%
area?				
How much harm would this	Little	Moderate		Significant
conduct cause				
You	33%	33%		34%
Your classmates	25%	40%		35%
Your school	31%	3	6%	33%

The concept of academic dishonesty can include allowing a student to copy your work. The authors generally attribute this unethical behavior to homework situations; however, it could include cheating. In this survey, the authors intended the question to be anything other than cheating on tests, which was the aforementioned question. Table 2 shows that students consider this type of unethical behavior as "likely" to occur with a 42% rate and "very likely" at 15%. They also perceive the harm caused to them as almost

equally ranging from "little" at 33%, "moderate" at 33% and "significant" at 34%. These students also deem this behavior as having a "significant effect" on classmates with a response rate of 35% and a "significant effect" on the school at 33%. The almost equal response rate in regard to the "significant effect" is approximately 20% to 30% lower than in the question regarding cheating, indicating to the authors that students do not believe this "copying work" behavior as having an effect as serious as the cheating situation on themselves, others, or the school.

Allowing someone else do your assignment

THOW IN SOMEONE CASE OF THE STATE OF THE STA					
Questions	Very	Unlikely	Likely	Very Likely	
	Unlikely				
How likely is conduct in this	28%	34%	32%	6%	
area?					
How much harm would this	Little	Moderate		Significant	
conduct cause					
you	29%	32%		39%	
Your classmates	34%	34%		32%	
Your school	36%	33%		31%	

Allowing others to completely do an assignment is along the same line of unethical conduct as cheating. However, it has a slight difference to "allowing someone to copy" as in Table 2 in that it absolves the perpetrator of doing any work whatsoever with another individual completing the entire assignment. This type of unethical behavior could also include the next question regarding plagiarism because if a paper is written by one individual and turned in by another, plagiarism has occurred by the perpetrator taking credit for another's work. According to the results in Table 3, 32% of the students believe this behavior is "likely" to occur at this university with only 6% believing it is "very likely" to occur. If it does occur, 39% of the students believe there will be "significant" harm to themselves, 32% believe "significant" harm will occur to classmates, and 31% believe "significant" harm will occur to the school. The authors believe this is a serious infraction, especially if it involves a research project.

Table 4
Plagiarism (copying work directly from a source and turning it in as your own)

r lagiarism (copying work uncerty from a source and turning it in as your own)						
Questions	Very	Unlikely	Very Likely			
	Unlikely					
How likely is conduct in this	32%	39%	39% 24%			
area?						
How much harm would this	Little	Moderate		Significant		
conduct cause						
you	24%	18%		18%		58%
Your classmates	29%	21%		50%		
Your school	19%	22%		59%		

Plagiarism is an area that goes "hand in hand" with cheating. Based on Table 4, students in the study do not view this ethical issue as a problem at this university. A total of 29% (combined) view plagiarism as likely or very likely. As with the cheating on exam question, the majority of the students at this university do not perceive plagiarism as a problem at this university; however, if it were a problem, over half indicate that it would cause "significant" harm to their school, classmates, or themselves.

In an overall analysis of the above three questions, they would all be grouped under "academic dishonesty". While some academic dishonesty such as plagiarism may be attributed to ignorance (2, Johnson & Martin, 2005), the perception of Bill Puka (6, 2005), a philosophy professor at Rensselaer

Polytechnic Institute indicates that professors themselves are to blame for academic dishonesty. His article "Student Cheating" (2005) indicates that many professors pride themselves on making courses difficult for students. "They [the professors] depict themselves as 'hard-nosed graders' who give 'killer exams,' which many fail and almost all do poorly on" (6, p. 33). Likewise, if the truth be known, college business professors take few if any courses on teaching prior to entering the classroom. Generally, they are often more interested in research than their performance in the classroom (6, Puka, 2005, p. 34.)

Table 5
Whistle blowing (ratting) on a classmate

whistic blowing (ratting) on a classifiate							
Questions	Very	Unlikely	Likely	Very Likely			
	Unlikely						
How likely is conduct in this	33%	51%	15%	1%			
area?							
How much harm would this	Little	Moderate		Significant			
conduct cause							
you	53%	22%		25%			
Your classmates	28%	33%		39%			
Your school	39%	3	28%				

The authors define whistle blowing as revealing unethical conduct. The results in Table 5 show that 33% of the students believe it is "very unlikely" that whistle blowing will occur at this university, and that 51% believe it is "unlikely". If whistle blowing on the part of peers occurred, 53% believe it would have little effect. However, the effect of whistle blowing on other classmates is deemed to be "significant" as indicated by 39% of the students, and only 28% of the students believe the effect on the school is "significant". The authors believe that the 53% who indicate that whistle blowing would have little effect on them could imply this is the percentage of students in the study who would be less likely to be involved in academic dishonesty, either by cheating or plagiarizing.

Table 6
Signing the class roll for an absent student

Signing the class for for an absent student							
Questions	Very	Unlikely	Unlikely Likely				
	Unlikely						
How likely is conduct in this area?	14%	28%	36%	22%			
How much harm would this conduct cause	Little	Mo	Significant				
you	48%	2	28%				
Your classmates	40%	24%		36%			
Your school	46%	31%		23%			

The authors have observed that students tend to "cover" for one another, especially if there is a friendship relationship. Therefore, the results to the "forging class roll" question are not surprising. Based on Table 6, the majority of the students indicate that this conduct is "likely" (36%) to occur or "very likely" (22%) to occur. If it did occur, 46% the students perceive the harm it would cause to the school is "little", with 40% and 48% respectively believing the harm to classmates and to themselves is "little". Likewise, the authors do not deem this infraction as to be as severe as academic dishonesty; therefore, the consequences to the student would not be that significant.

Along a similar vein of a student missing class and allowing someone to sign the roll for them is the concept of using illness as an excuse to miss class. Table 7 indicates that students at this particular university deem missing class due to illness as "very unlikely" to occur with a 31% response rate, followed by 39% viewing it as "unlikely" to occur. A combined total of 30% believe it is "likely" or "very likely" to occur among these university students. Perhaps these responses indicate that approximately 70% of the students surveyed would themselves be unlikely to use illness as an excuse, or naiveté on the part of the students as to the magnitude of this problem could be prevalent. The authors believe students are more "likely" to use this excuse, especially if unprepared for a class where a test may be given that day. Likewise, these students believe that "little" harm is done in using illness as an excuse with 43% of the students indicating "little" harm to themselves; 64% of the students indicating "little" harm to classmates; and 52% of the students indicating "little" harm to the school will occur.

Table 7
Telling the professor that you are ill on a day of an exam because you are not prepared

tening the professor that you are in on a day of an exam because you are not prepared						
Questions	Very	Unlikely Likely		Very Likely		
	Unlikely					
How likely is conduct in this	31%	39% 25%		5%		
area?						
How much harm would this	Little	Moderate		Significant		
conduct cause						
you	43%	23%		34%		
Your classmates	64%	23%		13%		
Your school	52%	29%		29%		19%

The results of the next two questions pertain to group work, both taking credit for group work and allowing for group credit, are presented in Tables 8 and 9 respectively. In both questions, 41% (Table 8) and 46% (Table 9) of the students, respectively, believe this conduct is "likely" to occur with 13% (Table 8), and 16% (Table 9) believe it is "very likely" to occur. That indicates a total of over 50% of the students believe this behavior occurs. If this behavior in Table 8 and 9 does occur, 27% and 28% respectively believe it will cause "significant" harm to them, with 39% and 38% believing it will cause "significant" harm to classmates, and 31% and 28% respectively believing it will cause "significant" harm to the school.

Table 8
Allowing a student to get credit for group work although they did not contribute

Questions	Very Unlikely	Unlikely	Likely	Very Likely		
How likely is conduct in this area?	22%	24%	41%	13%		
How much harm would this conduct cause	Little	Moderate		Significant		
You	36%	37%		27%		
Your classmates	19%	42%		39%		
Your school	37%	32%		32%		31%

Table 9
Putting your name on a group assignment although you made no contribution to the work

Questions	Very	Unlikely	Likely	Very Likely		
	Unlikely					
How likely is conduct in this area?	14%	24%	46%	16%		
How much harm would this conduct cause	Little	Moderate		Significant		
You?	34%	40%		28%		
Your classmates?	28%	34%		38%		
Your school?	31%	31%		31%		28%

Table 10 shows the students' response regarding methods that may discourage unethical behavior. "Public disclosure" and "threat of severe punishment" received support of 84% and 81% respectively by the students. A "written policy" received only 59% support of the students.

Table 10 Discouraging Unethical Behavior

Questions	Yes	No
Would a written policy on ethical conduct affect your behavior?	59%	41%
Would the threat of severe punishment discourage unethical behavior?	81%	19%
Would public disclosure discourage unethical behavior?	84%	16%

These results may indicate that more action needs to be taken rather than just putting something in writing. Students may need more of a punishment based approach to discouraging unethical behavior than a passive approach.

The students in this survey indicated how effective they thought certain initiatives by faculty would be in minimizing the risk of unethical behavior in an educational setting. The results are presented in Table 11.

Table 11

How effective do you think the following initiatives would be in minimizing the risk of unethical behavior?

Possible Initiatives	NE	SE	FE	VE
Close teacher monitoring	4%	38%	48%	10%
A student code of ethics	14%	40%	34%	12%
Ethical discussions in all classes	11%	40%	35%	14%
A confidential system to report conduct without being identified	8%	27%	40%	25%
A university zero tolerance policy regarding unethical behavior	6%	24%	39%	31%

NE = Never Effective SE = Somewhat Effective FE = Fairly Effective VE = Very Effective

"Close teacher monitoring" was deemed by 48% of the students as being fairly effective on the 4-point Likert scale which ranges from "not effective", "somewhat effective", "fairly effective", and "very effective". Only 10% consider monitoring as "very effective". The majority of the students overall in the survey indicated teacher monitoring was "effective" to some extent (combined total of SE, FE, VE). While, only 4% of the students believed teacher monitoring was "not effective". The authors believe that teachers who monitor the classroom, especially during tests, will curtail the majority of the unethical

behavior which occurs, yet some will cheat anyway. Increased technology use by students, such as cell phone and programmable calculators, seem to make it virtually impossible to curtail all cheating.

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Having a student code of ethics was believed to be "somewhat effective" and "fairly effective" with responses of 40% and 34% respectively. The university in which this survey was conducted actually passes out the Business code of ethical conduct in pamphlet form to students (together with an incentive to stop by and get one of also handing out chips or candy) during the early weeks of the semester. Additionally, most universities have a published code of ethics in their student handbook indicating the consequences for unethical conduct. Generally, the consequences may involve a tiered system whereby the instructor is given the option of assigning a failing grade on the test, which may later be followed with failing the student from the class with ultimate penalty of suspension for repeat offenses. The code of ethical conduct also generally allows for a review board consisting of faculty and students to determine the "fate" of the perpetrator. One of the authors of this paper has used this method. The paperwork and meetings prior to the consequences being handed down makes this "peer review board" method less likely to be used, in our opinion. However, the positive aspect of this method is that it takes the responsibility away from the professor who may be bombarded with pleas for mercy on the part of the student.

Ethical discussions in the classroom were deemed by students to be effective with 40% indicating answer "somewhat effective", 35% indicating "fairly effective", and 14% indicating "very effective". Again, the university at which this survey was conducted requires some discussion of ethics in each classroom because it is a goal established as part of their accreditation process. One of the authors spends approximately a week of classroom time for the teaching of ethics. However, the question has been posed as to whether ethics can be taught (3, Kullberg, 1988). Shurden, Santandreu & Shurden (8, 2010) indicated in their research that ethical awareness of student's progress increased with years spent at this particular university; therefore, it is our opinion that this method of having ethical discussions is effective.

Whistle blowing, which was previously defined by the authors as reporting unethical conduct, has taken a "hit" in the previous years. In business alone, the whistleblowers of the Enron and WorldCom scandals were ostracized and shunned by their fellow employees (4, Lacayo, R. & Ripley, A, 2002). Many of us were reminded in elementary school of not being a "tattletale" as if it were an annoyance to teachers to be told that a fellow student had misbehaved. Therefore, it is not surprising to the authors to discover that 25% of the students surveyed said that "A confidential system to report conduct without being identified" would be "very effective". This response was followed by 40% believing it to be "fairly effective". However, the question arises to this author as to if that would be a "doable solution" in the day when evidence is paramount to having proof of an infraction in any unethical situation (4)?

Lastly, 31% of the students believed that it would be "very effective" if the university had a zero tolerance policy regarding unethical behavior. This response was followed by 39% believing this method to be "fairly effective". How surprising to the authors that the total of these two indicators (70%) would seem to condone a "one strike and you are out" policy. It occurs to the authors that this number may be the students who are least likely to be unethical if they are advocating such a stringent system.

#### **CONCLUSIONS**

Students in this survey perceive some unethical conduct as more likely to occur than other. Fifty seven percent and thirty eight percent believe that conduct including "copying work" and "having others doing their assignments" occurred at this university, at a combined total of "likely" and "very likely" at 57% and 38% response rates. The authors believe the students perceive this type of conduct to occur with homework assignments rather than tests. Only 27% and 29% respectively believed that cheating on tests and plagiarism was "likely" or "very likely" to occur at this school. A much higher percentage of students believed that "group work" type of unethical behavior occurs at 54% and 62% respectively for

the responses of "allowing a student to get credit for group work although they did not contribute" and "putting your name on a group assignment although you made no contribution to the work". As for situations involving students not being in class, 58% of the student believe that it is "likely" or "very likely" that students will forge class rolls for others students, with only 30% believing that students are "likely" or "very likely" to use illness as an excuse to miss class. Finally, only 16% of the students surveyed believe that whistle blowing is "likely" or "very likely" to occur at this university.

In reviewing the possible initiatives that might be effective in controlling unethical behavior among student, the perception among the students themselves was that a "confidential system of reporting" and a "zero tolerance system" would be more effective than "teacher monitoring", "ethical discussions" or a "student code". Sixty five and seventy percent of the students, respectively deem having a "confidential system" and "zero tolerance" as being more effective. Additionally, 84% of the students believe that "public disclosure of unethical conduct" and 81% believe that "severe punishment" are more effective in discouraging unethical conduct rather than 59% believing in the use of a "written ethical code of conduct" as being more effective. The authors believe this to be a rather noble approach by the students. Perhaps it can be ultimately concluded that these students have the desire to be ethical and believe in stringent measures to monitor unethical behavior. Further research is needed to determine the effect various strategies would have on minimizing unethical behavior.

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# MITIGATING INFORMATION ASYMMETRIES THROUGH

# THE USE OF LOAN MATURITIES

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#### **ABSTRACT**

Given that small businesses are important drivers of the U.S. economy, particularly as employment vehicles for racial/ethnic minorities and women, we explore non-price loan terms, specifically, the loan maturity imposed on borrowers by lenders. This study is important because most of the research on group differences in lending focuses on loan denial rates or the pricing of credit as measured by loan interest rates. The results of this study show that differences in loan maturity terms do exist between ethnic and gender groups. The lower risk groups (White and male owned businesses) encounter shorter loan terms. The differences that do exist in loan maturity terms are partially explained by the length of the relationship between the lenders and the borrowers and by the interest rate associated with the loan.

#### INTRODUCTION

Small businesses are important drivers of the U.S. economy, creating millions of jobs and producing a relatively large share of the gross national product (Gebremariam, Gebremedhin, Jackson, 2004), yet they tend to struggle most in economic downturns and credit crunches (Croushore, 2007). They rely heavily on bank loans as they lack the track record, experience and financial stability necessary to raise capital via public debt or equity securities (Berger and Udell, 1998). In fact, the Small Business Administration cites that 65% of small businesses are primarily funded by banks and similar financial institutions. While the incidence of small business financing via banks and financial institutions is high, it is also important to note that these small business loans are deemed high risk to the lenders involved. Small businesses by nature are informationally opaque and many of them lack the capacity to provide detailed financial statements (Berger and Frame, 2007). As such, informational asymmetries between small business borrowers and lenders can result in moral hazard and adverse selection (Croushore, 2007).

A corollary issue is that small businesses are a valuable vehicle for employment options to racial/ethnic minorities and women. Studies have increasingly noted that entrepreneurship amongst Hispanics, Blacks, and females has continuously grown since the 1970s (Fairlie, 2004; Hughes, 2003). A recent report by the U.S. Small Business Administration's Office of Advocacy (2008) notes that immigrants (who are primarily of Hispanic origin) are 30% more likely to go into business for themselves when compared to non-immigrants. In a 2007 address to the U.S. Senate Committee on Small Business and Entrepreneurship, Senator John Kerry stated that minority owned businesses made up more than half of the two million new businesses started in the United States. He acknowledged that U.S. Census forecasts predict that by 2050, there will be 131 million new United States citizens, and the vast majority of these new citizens will belong to racial/ethnic minority groups.

Women in business should also not be ignored. Lowrey (2006) finds that female owned businesses made up about 30% of non-farm businesses and contributed almost one trillion dollars in revenue. Caputo (1998) also asserts that there are a growing number of women entering self-employment. Various push or pull studies have been put forth to explain this phenomenon, but generally, studies show that women turn to self- employment as they seek out their personal financial independence or attempt to create more flexible work schedules to accommodate family obligations (Delage, 2002; Green and Cohen, 1995). There is a clear need for new research on the financing options and terms available to women and minorities due to the vital role that small businesses play in the U.S. economy and the fact that women and minorities are actively involved in entrepreneurship.

Translating the analysis of information asymmetries to the lending arena, it is known that principal-agent issues exist. Borrowers (in this case, agents) attempt to convey their minimal credit risk by providing as much information as possible or by negotiating loan terms (opting for shorter financing periods, providing more collateral, etc). The principal (the lender) then takes the information and signals provided by the borrower and uses these to adjust contractual details (Spence, 1973). Exactly how much of a say borrowers have in negotiating their non-price loan terms, however, is inconclusive. First, there is no consensus on whether riskier borrowers prefer short or long term loans. Jun and Jen (2003) find that financially weak and financially strong firms will opt for loan maturities that either minimize their refinancing risk exposure or lower their interest obligations. They conclude that riskier borrowers tend to prefer long term loans despite the higher interest rates that accompany them, because they encounter greater exposure to the refinancing risks associated with short term loans. Diamond (1991), on the other hand, posits that while borrower risk plays a role in the type of loan maturity that is sought, weaker firms gravitate more towards short term loans. A lender is usually capable of discerning whether a borrowing firm is financially stable. If the lender suspects the borrower is indeed high risk, they will be inclined to increase the already high interest rate that is often associated with a long term loan. Substantially higher interest rates, then, would drive riskier borrowers toward short term loans.

Secondly, while the preferred loan maturity is still debatable, there is also evidence to suggest that the role a borrower has in determining their optimal loan structure is limited. Bodenhorn (2003), Boot and Thakor (1994) and Diamond (1991) find that the length of the relationship between the lender and the borrower helps determine contract renegotiation possibilities. Stronger borrowers with lengthier relationships are better able to signal their creditworthiness which in turn can help them minimize their debt expenses. Janjigian (1994), on the other hand finds that lenders often impose their will in order to minimize their own risk exposures to phenomenon such as interest rate risk. Lenders often deem longer term loans as riskier because they expose them to greater default, interest rate, and inflationary risk (Croushore, 2007).

Finally, there is a stream of research that shows that lenders can attempt to use loan maturity as a means to monitor riskier borrowers. More recently, research has shown that by shortening loan maturities, lenders can more closely monitor high risk borrowers (Diamond and Rajan, 2001; Berger et al, 2005; Ortiz-Molina and Peñas, 2006). Dealing with an imbalance of information is to be expected, however, lenders should exercise precaution in not imposing some of these practices unfairly amongst groups as they would be giving up key profit-making opportunities. Various studies have found that credit denial to underrepresented groups is far greater than denial to non-underrepresented groups. When minorities or females do obtain financing, they often encounter less favorable loan terms, particularly in the realm of interest rates (Blanchflower, Levine and Zimmerman, 2003; Cavalluzzo, Cavalluzzo and Wolken, 2002; Cavalluzzo and Cavalluzzo, 1998; Cavalluzzo and Wolken, 2005; and Schauer and Soden, 2001). It is

important to determine if monitoring through loan maturities is applied equally amongst borrowers and whether a borrower's gender or ethnicity might be factored into their risk assessment.

It is apparent how vital small businesses are in spurring economic growth and how they provide employment opportunities for minorities and females. As such, small business financing requires further research, in particular with regard to non-price loan terms and how lenders mitigate information asymmetries borne from the opacity of small business financials. This study focuses on the non-price loan factor of maturity and its application in small business loans. Whether loan maturity is self-selected or imposed by lenders, the purpose of this study is to investigate whether loan maturity differs between gender and ethnic groups. Any difference is then assessed to determine how firm, market, and loan characteristics might impact or influence the difference in loan maturity between groups. The study is important because most of the research on group differences in lending focuses on loan denial or approval rates or the pricing of credit as measured by loan interest rates. By exploring non-price loan terms, specifically, the loan maturity imposed on borrowers by lenders, the study contributes to research in small business financing and group borrower differences in lending.

The results of this study show that differences in loan maturity terms do exist between ethnic and gender groups. The lower risk groups (White and male owned businesses) encounter shorter loan terms, as predicted by Jun and Jen (2003). The differences that do exist in loan maturity terms are partially explained by the length of the relationship between the lenders and the borrowers and by the interest rate associated with the loan. Geographic proximity, firm age, credit score, competition, and loan amount do little to explain the difference in loan maturity terms across all gender and ethnic/racial groups.

# LITERATURE REVIEW

Akerlof (1970), Spence (1973) and Stiglitz (1975) note how adverse selection and moral hazard may be dealt with by the party that has additional information and the party that lacks the additional information. Their findings are indicative of the problems inherent within the lending industry where borrowers seeking out loans are at an informational advantage relative to the lenders making the loans. Akerlof (1970) detailed various methods for mitigating information asymmetries (and the problems of adverse selection and moral hazard that information asymmetry causes), including the use and implementation of guarantees such as loan covenants and collateral requirements. He also noted the opportunities to diminish information discrepancies that come about from experience, much like relationship lending between lenders and borrowers.

Spence (1973) presents the concept of using applicant signals in assessing relative risk levels. Such signals include lenders relying on credit scores, work experience and tenure, and certain "immutable characteristics" such as race and gender when assessing applicant riskiness. Stiglitz (1975) goes one step further and offers the concept of screening as a way to identify qualities deemed necessary. In this case, the less informed party is the one attempting to derive information about the more informed party.

Most money and banking books (Croushore, 2007; Ritter, Silber and Udell, 2009) often cite the use of collateral and loan covenants as a means to overcome or dissipate information asymmetries. Typically, borrowers know more about themselves and their business prospects than lenders. To circumvent adverse selection, lenders impose collateral requirements on their borrowers to protect themselves against default. To deal with problems that may arise from moral hazard, such as a business owner using loan funds inappropriately, lenders often include covenants in their loan contracts. Covenants are legally enforced contract addendums that require the borrower to use funds as agreed.

A new stream of research has begun to look at the use of loan maturities as a way to combat these asymmetries in information. Diamond and Rajan (2001) find that as borrower risk increases, the use of short term loans increases. Indeed, Berger et al. (2005) find that this holds for loans that do not use covenants. These studies allow us to conclude that maturity is indeed an instrument lenders can use to circumvent some of the negative information asymmetry issues they may encounter with borrowers.

Ortiz-Molina and Peñas (2006) differentiate themselves from mainstream maturity studies in that they focus on small business loans instead of debt securities. The small business environment is a high risk environment and one where information asymmetries prevalently exist (Berger and Udell 1998). Additionally, other lines of credit extended outside of the small business arena tend to have collateral that fully guarantees the loan, as is the case with auto or home loans. Ortiz-Molina and Peñas (2006) find that shorter loan terms are in fact utilized by lenders to minimize the risk exposure inherent in small businesses and the information asymmetries they create.

Two other studies that have also focused on the small business environment and how maturity structure differs for these types of firms are Scherr and Hulburt (2001) and Berger et al (2005). Scherr and Hulburt (2001) find that a small firm's loan maturity is affected by the maturity of the firm's assets, its capital structure, and default probabilities. They also find that the firm's growth options, levels of asymmetric information, and tax status do not affect loan maturity. Berger et al (2005), on the other hand, find that reducing information asymmetries through the use of information gathering and the use of small business credit scoring does factor into the time to maturity of business loans.

It is fitting to continue to study how financial institutions mitigate information asymmetries within the small business environment and to further develop the research on loan maturity structures as they apply to equal credit opportunities for all. Ortiz-Molina and Peñas (2006) find small businesses that use collateral, have better credit and financial stability, and are more informationally transparent usually qualify for longer maturities on their loans. The authors conclude that lenders prefer shorter maturities as a way to increase supervision of loans. Borrowers must submit to more frequent contract refinancing options, and lenders are able to manage information asymmetries better.

As it stands, lenders tend to work with minority business owners and female business owners far less than with non-minority and male business owners. In fact, of the 1,553 businesses analyzed in this study, only 46 are owned by Hispanics, while 22 are owned by Blacks. There are 1,358 businesses owned by men, while there are 193 female owned businesses (see Table 1). Since lenders are less familiar with minority and female business owners, they may view them as a riskier segment of the small business market.

Research has shown that discriminatory lending practices exist when approving/denying loans to minority or female business owners. It has also been shown that when some of these underrepresented groups manage to obtain financing, their interest rates are significantly higher than their non-minority/male counterparts (Blanchflower, Levine and Zimmerman, 2003; Cavalluzzo, Cavalluzzo and Wolken, 2002; Cavalluzzo and Cavalluzzo, 1998; Cavalluzzo and Wolken, 2005; and Schauer and Soden, 2001). If the same were to translate to other loan terms, it stands to reason that minority business owners may also encounter shorter maturities on their loans.

While the aforementioned studies have all focused on the fact that loan maturities are imposed upon borrowers, one cannot rule out that some borrowers may alter or choose their loan maturities willingly. Small business borrowers that are not financially sound and are deemed high risk by lenders may choose different maturity structures than small business owners that are financially stronger. Firms that are not as financially sound may be less inclined to obtain short term loans voluntarily because of risks inherent with eventual refinancing. They realize they can save money on interest expenses associated with shorter

loan terms, but they are unwilling to face the aforementioned risks (Jun and Jen, 2003). Indeed, Strahan (1999) finds that lower quality borrowers are more willing to accept high interest rates.

The converse, then, would find that financially sound firms would be more inclined to obtain short term loans because they are not as susceptible to the risks inherent in subsequent refinancing. They also have the advantage of the lower interest costs associated with short term loans. As such, less risky firms would more often opt for shorter loan terms. Janjigian (1994) finds that borrowers do indeed face the decision of opting for a long loan term as a way to reduce monthly debt obligations or a short term loan to facilitate lower interest costs over the life of the loan.

Just how much bargaining power a firm has to renegotiate loan terms is closely linked with the strength of the lending relationship that exists between the borrower and lender. Bodenhorn (2003) finds that a longer lending relationship usually provides the borrower with lower loan costs and a greater possibility of renegotiating loan terms. Boot and Thakor (1994) and Diamond (1991) also find that financially strong borrowers with longer lending relationships to the lender will attempt to signal their creditworthiness in attempts to lower interest rates. The longer lending relationship allows for more flexible contracts and efficient renegotiation of loan terms.

Diamond (1991), however, differs from the findings presented by Jun and Jen (2003) and Strahan (1999), in that financially unsound firms tend to gravitate more towards short term loans because of the difficulties inherent with obtaining long term loans. A firm's relative financial weakness is known by the borrower, but should also be evident to the lender. As such, the interest rates that may accompany long term loans will be even higher to reflect the additional risk borne by the lender. In order to avoid such high financing costs, weak firms would rather contend with potential refinancing issues associated with short term loans than with the higher loan costs associated with long term loans.

Certainly, literature on the use of loan maturities to contend with information asymmetries, whether imposed by the lender to limit risk exposure or selected by the borrower to minimize costs or circumvent future financing difficulties, is inconclusive. Some studies point to the notion that the riskier the borrower, the shorter the loan maturity, while others find that the riskier the borrower the longer the loan maturity. All these studies have assessed the relationship between borrower risk levels and loan maturities, but have only used financial positioning as a measure of the risk inherent in borrowers. There is an intangible risk associated with lending to groups of individuals to whom one is not necessarily accustomed to transacting with. Minority and female borrowers are overwhelmingly less prone to receive small business loans. This unfamiliarity may breed a sort of distrust or uncertainty about the risk associated with these groups as borrowers. There is no literature to date that has examined how minorities and females fare with the non-price loan terms on their small business loans when their ethnicity or gender is considered as a possible contribution to their overall risk level.

#### DATA AND VARIABLE DEFINITIONS

In order to look into loan term differences between minority owned businesses and white owned businesses and female and male owned businesses, I use the Federal Reserve's Survey of Small Business Finances (SSBF) to obtain information on small businesses with less than 500 employees. Information such as firm and owner characteristics, use of other financial services, recent loan activities, lender characteristics, and financial statements is provided. The information provided in the 2003 SSBF is slightly different from the information provided in the 1998 SSBF in that the recent survey provides demographic characteristics for as many as three of the business owners thereby providing more explicit information with regard to race/ethnicity and gender.

The 2003 version of the SSBF includes information on 4,240 small businesses in operation at the time the survey was administered in December of 2003. The actual data collection for this survey occurred between June 2004 and January 2005, and the firms interviewed are "non-governmental, non-financial, non-agricultural for profit" firms. The 4,240 firms are representative of firms in 72 different strata according to business size, census division, and rural or urban location. Due to missing data and imputed variables, there are 5 implicates for a total of 21,200 observations, however, imputed variables may differ from implicate to implicate.

Data imputation is used to predict the values of missing data by using non-missing data. The 2003 SSBF uses multiple imputation to address potential biases due to missing data. This is particularly important in a small business survey because it may be difficult to obtain operations and financial data for many of the businesses surveyed. Appropriately addressing missing data differences across gender and minority groups is also important because there is the possibility that response rates vary substantially across questions for these groups. Multiple imputation involves the generation of multiple values for each missing data, then using those values to iteratively assess survey data. By using multiple imputation, the SSBF creates five replicate datasets to appropriately deal with those cases where respondents did not know how to provide an answer or refused to provide one altogether. Non-missing values are identical across all five implicates, while imputed variables might differ.

Loan term differences across groups are analyzed using regression analysis and the decomposition method discussed below. The explanatory variables are grouped into firm specific characteristics, market characteristics, and loan specific characteristics. These variable groupings are selected based on the work of Ortiz-Molina and Peñas (2006) and Scherr and Hulburt (2001). They include the effect that relationship lending may have on maturity terms, as well as information on the financial health/default probabilities of the firm in question. Combining the variable suggestions from the two articles provides the most comprehensive insight into loan term decision. The groups to be compared are Whites and Hispanics, Whites and Blacks, and Men and Women. In comparing groups, the definitions for minority or female owned businesses as provided by the Small Business Administration are used. A firm is considered minority owned or female owned when at least 51% of the firm is owned by a minority or a female.

The dependent variable in question for all groups is the maturity assigned to their business loans. The variable is denoted in monthly terms, however, I further classify loans into two groups of long and short term loans. As per the Small Business Administration, long term business loans are those loans with a maturity greater than 12 months, while short term business loans are those loans with a maturity less than 12 months (Black and Rosen, 2008; Fraser, Rhee and Shin, 2002). The dependent variable then becomes a binary variable, where a value of one signifies a long term loan, and a value of 0 signifies a short term loan (denoted by Mat).

The firm specific characteristics include the length of the relationship the borrower has with a lender. The 2003 SSBF asks respondents to disclose how long they had conducted business with the lending institution at the time the loan was solicited. The answer provided is in months. Elyasiani and Goldberg (2004) find that relationships between lenders and borrowers increase the availability of funds and provide for more favorable loan rates. Bodenhorn (2003) notes that the longer a relationship exists between lender and borrower, the more likely that the borrower will encounter smaller credit costs and more frequent renegotiations of loan contracts. While I initially note that riskier groups (i.e. minority and female owned businesses) might be subjected to shorter loan terms as a way to increase contract renegotiations and monitoring by the lender, there is also the possibility that a longer lender-borrower relationship may actually serve to shorten loan maturities. The lengthier the relationship the borrower has with their lender, the more capacity they have to renegotiate terms (Bodenhorn, 2003). In the mortgage

industry, homeowners will often agree to shorter loan terms in order to reduce the interest owed on their loans. If this happens in the small business arena, perhaps borrowers with lengthier relationships to their lenders may also be rewarded with such options, prompting lower interest rates in exchange for shorter loan maturities.

The geographic proximity of the firm to the lending bank may also affect loan terms. The 2003 SSBF asks the respondents to disclose how many miles from their place of business the lending institution is located. Degryse and Ongena (2002) find that as the distance between the borrowing firm and the lending bank narrows, loan rates tend to decrease. The converse holds true for when the geographic distance between lender and borrower increases.

Another firm specific characteristic includes the age of the firm in years, which can be used to gauge the reputation and the financial prospects of a firm. The 2003 SSBF asks respondents how many years have transpired since their firm was established. Martinelli (1997) finds that firm age helps facilitate access to credit. Lenders are wary of new firms since they do not have an established history of repayment or business transactions from which to establish precedent. The longer a firm survives, the greater a reputation it builds. Finally, the financial health of the firm is assessed by its Dunn & Bradstreet credit score. This score predicts the likelihood of default for business borrowers. The score is used heavily by lenders in order to determine whether a loan will be provided and the terms and conditions imposed on given loans (Berger et al, 2005). In the 2003 SSBF, it ranges from a score of one to six, with one representing the riskiest firms and six representing the least risky.

The market characteristic used in this study assesses the amount of financial institution competition in the borrowing businesses' market. Berkovec, et al. (1998) and Cavalluzzo, Cavalluzzo, and Wolken (2002) both posit that discrimination is more evident in less competitive markets. Increased competition between financial institutions reduces the disparities in loan availability between minorities and whites. The Survey of Small Business Finances provides the representative Herfindahl score which sums the squared market share of banks/similar financial institutions (times 10,000) and is divided into three categories. A category of 1 represents a Herfindahl sum of between 0 and 1,000. A category of 2 represents a Herfindahl sum of 1,000 up to a sum of 1,799. The third category represents a sum greater than 1,800. The higher the category, the greater the level of competition amongst banks at the borrowing firm's location. While looking at the firm and its market characteristics is important, the terms of the loan in question should also be assessed. The dollar amount of the loan is included as a control variable, as is the interest rate on the loan in question.

#### **METHODOLOGY**

In this study, I look at what is traditionally used as a standard for pre-qualifications of loan applicants. When a borrower solicits a loan, they are often evaluated on criteria that include their credit (previous payment histories), their capital (how much money they can provide up front for their business endeavors), their capacity (their employment history and earnings) and the collateral they are able to provide as a guarantee for the loan. Based on the above, borrowers with similar backgrounds should have similar maturities imposed on their loans. Due to the fact that discriminatory practices have in fact been assessed in previous studies (Blanchflower, Levine and Zimmerman, 2003; Cavalluzzo, Cavalluzzo and Wolken, 2002; Cavalluzzo and Cavalluzzo, 1998; Cavalluzzo and Wolken, 2005; and Schauer and Soden, 2001), I look at whether minority and female applicants of similar characteristics to their non-minority and male counterparts will encounter different maturities imposed on their loans.

Any discriminatory practice would be due in part to the notion that lenders may qualify minority or female borrowers as being higher risk than non-minorities or males because of their unfamiliarity with the

groups. It is important to differentiate, however, that any type of discrimination evidenced may be more statistical than prejudicial. Statistical discrimination may arise due to the fact that most small business owners are white and male, and lenders, less familiar with minority and female applicants, may not be able to correctly assess their risk levels. Ethnicity/race or gender, in a sense, becomes a signal for identification and risk placement. Prejudicial discrimination occurs when lenders decline credit or offer less beneficial credit terms to individuals due to an outright dislike for a particular group (defined by gender or ethnicity/race).

It is imperative to understand whether lenders mitigate information asymmetries differently for different groups of individuals because of the implications this has on credit accessibility and firm performance for minorities and women. The Small Business Administration readily recognizes that small businesses often contend with credit rationing by lenders, and previous studies have shown how minorities and women often face less favorable price and non-price loan factors than their white and male counterparts. It stands to reason then that minority and female small business owners may have to contend with fewer numbers of available loans and less favorable loan terms. Many times, research into whether or not minorities or women encounter different lending practices focuses on the obvious price factors such as interest rates or the loan approval or denial rates of said groups. Very little focus has been placed on disparities in non-price loan factors, as most studies have focused on loan denial or approval rates and whether the price of the loan, through higher interest rates, is more costly for certain segments of the population (Blanchflower, Levine and Zimmerman, 2003; Cavalluzzo, Cavalluzzo and Wolken, 2002; Cavalluzzo and Cavalluzzo, 1998; Cavalluzzo and Wolken, 2005; and Schauer and Soden, 2001).

Group comparisons involve estimating regressions on the factors related to loan maturity terms, with separate regressions created for each group. The dependent variable is regressed against a set of independent variables, and the estimated coefficients for each regression, along with the group means, are used to develop the decomposition. Studying group differences is best done with a decomposition analysis, as opposed to a single regression with an identifying dummy variable to indicate race or gender. The latter assumes coefficients are the same for both groups and assumes differences are present only in the indicator variable for ethnicity/gender.

The Blinder-Oaxaca decomposition allows us to note how much of the difference in the dependent variable is accounted for by group differences in the independent variables. Jann (2008) provides information on this two-fold decomposition technique where explained and unexplained factors determine differences in the dependent variable. The model is written as follows

$$R = [E(X_W) - E(X_H)]'\beta^* + [E(X_W)'(\beta_W - \beta^*) + E(X_H)'(\beta^* - \beta_H)]. \tag{1}$$

The first part of the decomposition,  $[E(X_W) - E(X_H)]^{\circ}\beta^*$ , represents the part of the dependent variable differential that can be explained by differences in the independent variables. The second part of the decomposition,  $[E(X_W)^{\circ}(\beta_W - \beta^*) + E(X_H)^{\circ}(\beta^* - \beta_H)]$ , represents the part of the dependent variable differential that is unexplained by the independent variables. This unexplained component is usually indicative of discrimination (Jann 2008), but can also exist if variables which can contribute to the dependent variable differential are omitted. Once the decomposition is obtained, the results will indicate how much of the differential in maturity terms is accounted for by differences in the independent variables. Whatever is not accounted for by the independent variables is either unexplained or it is indicative of discrimination (Jann 2008).

To begin the comparison, I define two groups: White owned businesses (w) and Hispanic owned businesses (h). The dependent variable in question for both groups is the loan maturity of their business loans, classified as a short term loan or a long term loan. The dependent binary variable, denoted by Mat,

then takes on a value of one if the loan is deemed a long term loan and zero if it is deemed a short term loan. An analysis of the tabulated frequencies of the count data associated with loan maturity shows most observations (about 48%) fall under the twelve month frequency with the rest minimally distributed at later monthly intervals. As such, the variable lends itself to identification as a binary variable.

A more detailed example of the decomposition would be as follows:

$$Mat_w = a_w + b_w Firm_w + c_w Market_w + d_w Loan_w + e_w Ident_w$$
 (2)

$$Mat_h = a_h + b_h Firm_h + c_h Market_h + d_h Loan_h + e_h Ident_h$$
(3)

where Mat represents the long or short term maturity status of the loan. Firm represents a vector of firm characteristics that includes the relationship length between the lender and borrower in months, the geographic proximity of the firm to the lending institution in miles, the firm age measured in years, and the Dunn and Bradstreet credit score ranging from a value of one to six.

Market represents the Herfindahl score indicative of bank competition levels in the business's locale. Loan represents a vector of loan characteristics that includes the amount of the loan in dollars divided by one million and the interest rate on the loan. Identifying represents the identifying characteristic of gender for each group. The subscripts of w and h represent a White owned business and Hispanic owned business, respectively. The coefficients, b, c, d, and e, are estimated using regression analysis for White (w) and Hispanic (h) owned businesses.

The difference in the mean loan maturity across the two groups is represented as follows:

$$Mat_w - Mat_h = a_w + b_w Firm_w + c_w Market_w + d_w Loan_w + e_w Ident_w - (a_h + b_h Firm_h + c_h Market_h + d_h Loan_h + e_h Ident_h),$$

$$(4)$$

which can be rewritten as:

$$Mat_w - Mat_h = b_w(Firm_w - Firm_h) + c_w(Market_w - Market_h) + d_w(Loan_w - Loan_h) + e_w(Ident_w - Ident_h) + (a_w - a_h) + (b_w - b_h)Firm_h + (c_w - c_h) Market_h + (d_w - d_h) Loan_h + (e_w - e_h)Ident_h$$
 (5)

where  $R = Mat_w - Mat_h$  and R represents the difference in loan maturities between groups.  $E = b_w(Firm_w - Firm_h) + c_w (Market_w - Market_h) + d_w (Loan_w - Loan_h) + e_w (Ident_w - Ident_h)$  and represents the part of the difference in loan maturities between groups that can be explained by differences in the average characteristics of the White and Hispanic owned businesses. If White and Hispanic owned businesses had the same average firm, market, loan, and identifying characteristics, the explained portion of the decomposition would equal zero.

$$U = (a_w - a_h) + (b_w - b_h)Firm_h + (c_w - c_h) Market_h + (d_w - d_h) Loan_h + (e_w - e_h) Ident_h$$
 (6)

and represents the part of the difference in loan maturities between groups that cannot be explained. If the coefficients (a, b, c, d, and e) were the same for White and Hispanic owned businesses one could conclude that any difference in loan maturity terms would exist solely due to differences in firm, market, loan, and identifying characteristics of the groups.

The difference in maturities is equal to the sum of the coefficients for White owned businesses multiplied by the differences in average firm, market, loan, and identifying characteristics between groups plus the

sum of the firm, market, loan, and identifying characteristics for Hispanic owned businesses multiplied by the difference in estimated coefficients between groups.

Dividing E by R shows us what percentage of the difference in loan maturities is explained by differences in the firm, market, loan, and identifying characteristics of the businesses. Dividing U by R shows us what percentage of the difference in loan maturities remains unexplained (Shannon, n.d.).

The same model will be estimated to determine if differences between White owned businesses (w) and Black owned businesses (b) exist:

$$\begin{aligned} Mat_w - Mat_b &= b_w (Firm_w - Firm_b) + c_w (Market_w - Market_b) + d_w (Loan_w - Loan_b) + e_w (Ident_w - Ident_b) + \\ & (a_w - a_b) + (b_w - b_b) Firm_b + (c_w - c_b) Market_b + (d_w - d_b) Loan_b + \\ & (e_w - e_b) Ident_b \end{aligned} \tag{7}$$

and Male owned businesses (m) and Female owned businesses (f)

$$\begin{aligned} Mat_m - Mat_f &= b_m(Firm_m - Firm_f) + c_m\left(Market_m - Market_f\right) + d_m\left(Loan_m - Loan_f\right) + e_m\left(Ident_m - Ident_f\right) + \\ & \left(a_m - a_f\right) + \left(b_m - b_f\right)Firm_f + \left(c_m - c_f\right)Market_f + \left(d_m - d_f\right)Loan_f + \left(e_m - e_f\right)Ident_f \end{aligned} \tag{8}$$

# **RESULTS**

The descriptive statistics for the respective groups in Table 1 highlight differences, particularly with regard to the maturity on the loans provided to the business owners, the relationship length the borrowers have with their lenders, the age of the small business in question, the risk level associated with each business, the amount of the loan and the interest rates assigned to the loans.

The longer loan maturity Black business owners encounter contradicts the notion set forth in some studies (Diamond and Rajan, 2001; Berger et al, 2005; Ortiz-Molina and Peñas, 2006). They find that this non-price loan term can be shortened in order to facilitate more monitoring of riskier firms, particularly when these Black owned businesses have shorter relationship lengths with their lenders, are further geographically from the lending institution, are less established (as evidenced through the younger firm age) and have an overall riskier assessment as established by the Dunn and Bradstreet credit score. The average size of the business loans in question would also not warrant longer loan terms as the amount borrowed by Black owned businesses is much smaller than the amount borrowed by White owned businesses. The loan maturity for Black owned businesses, however, is consistent with the average interest rate they obtain on their loans.

A higher interest rate is usually associated with longer term loans as these are deemed riskier than short term loans (Croushore, 2007). The longer a lending institution is without its funds, the more risk it is exposed to. The risk return tradeoff warrants a higher return to the lender for contending with additional risk. It is also understood that lenders may opt for shorter loan terms in order to facilitate lower interest rates. The stronger the firm's reputation and the longer the relationship between borrower and lender, the more power the borrower has for negotiating its loan terms (Bodenhorn, 2003). This may be the case with White owned businesses that display lengthier relationships with their lenders and have more established businesses and less risky credit scores.

Data for Hispanic owned businesses show a similar situation. Relative to their White owned business counterparts, Hispanic owned firms on average were granted lengthier loan maturities despite the fact that they had shorter relationships with their lenders, had less established firms, and were deemed riskier per the Dunn and Bradstreet credit score. Hispanic owned business loan amounts were also substantially smaller than the loan amounts granted to White owned businesses. The one similarity between Black-

Table 1. Description of firm, market, and loan characteristics by race/ethnicity and gender

Variables		Race/Ethnicity			Gender	
	All	White	Hispanic	Black	Male	Female
Loan Maturity						
dependent variable)						
% Long term	57.1	55.6	67.5	90.9	56.3	59.3
( > 12 months) % Short term	42.9	44.4	32.5	9.1	43.7	40.7
% Short term (<= 12 months)	42.9	44.4	32.3	9.1	43.7	40.7
Firm Characteristics						
Relationship length	97.53	99.56	78.96	31.50	99.91	84.42
(months)	£2.02	52.07	42.02	63.45	<b>5</b> 0.00	CO 55
Geographic proximity to Bank (miles)	53.83	53.97	43.92	03.43	50.98	69.55
Firm age (years)	15.48	15.72	11.70	9.94	15.94	12.90
D&B credit score	3.69	3.73	3.39	2.45	3.72	3.54
Market Characteristic						
Competition	2.41	2.43	2.02	2.19	2.40	2.45
Loan Characteristics						
Amount of loan	0.32	0.33	0.12	0.09	0.35	0.15
(/1,000,000)						
Loan interest rate (%)	6.39	6.26	8.13	9.92	6.32	6.78
Gender						
Male (%)	84.66	84.72	83.10	84.34	-	-
Female (%)	15.34	15.28	16.90	15.66	-	-
Number of observations	1553	1484	46	22	1358	193

Source: Estimates based on the Federal Reserve's Survey of Small Business Finances 2003

owned businesses and Hispanic owned businesses is that they too encounter higher interest rates on average, relative to White owned businesses. As previously mentioned, the higher interest rates experienced by Hispanic owned businesses do correspond to the lengthier loan terms they obtain, as these longer loans are deemed riskier to the lender.

The data on male owned businesses indicates that on average they contend with shorter loan terms than female owned businesses. Male owned businesses also tend to have lengthier established relationships with their lenders, more established businesses (as evidenced by the larger firm ages), and lower risk credit scores. The loan amounts obtained by male owned businesses are significantly larger than the loan amounts obtained by female owned businesses, while the interest rates female owned businesses tend to average are higher than the interest rates offered to male owned businesses. This again contradicts the notion that the riskier firms (in this case, female-owned businesses) should encounter shorter loan terms in order to facilitate more frequent renegotiations by the lender. However, the higher interest rates female

owned businesses receive align with the longer loan terms they encounter, as longer loan terms are riskier and require a higher return to the lender (Croushore, 2007).

There is also a difference with regard to the level of banking competition that the various businesses encounter. White owned businesses are generally located in areas where there are greater concentrations of banks/financial institutions, while Hispanic and Black owned businesses are in areas where banking competition exists to a lesser degree. The situation between male and female owned businesses differs in that on average, female owned businesses are located in areas where there is a greater amount of banking competition, relative to male owned businesses.

In order to achieve a better understanding of loan terms across groups, loan maturity means are assessed for the racial/ethnic and gender groups when limiting the assessment to all loans under \$100,000 and then all loans under \$50,000. On average, White owned firms obtain business loans in the realm of \$330,000 while Hispanic and Black owned businesses obtain business loans that average \$120,000 and \$90,000, respectively.

The means tell a similar story when looking at loans under \$100,000. In this case, White owned businesses tend to obtain shorter loans with an average maturity of 44.8 months, while Hispanic owned businesses obtain loans with an average of 70.2 months and Black owned businesses obtain loans with an average of 48.1 months. Male owned businesses average 45.0 months on their loans while female owned businesses obtain loans with an average of 50.2 months. In the aforementioned instances, the "less risky" groups (White and male owned businesses) both encounter shorter loan maturities. This continues to contradict studies (Diamond and Rajan, 2001; Berger et al, 2005; Ortiz-Molina and Peñas, 2006) which contend that riskier groups tend to obtain shorter loan maturities for more frequent contract renegotiations between lender and borrower. The constant in this case is that the borrowers with the shortest loan maturities (White and male owned businesses) again have the lowest average interest rates on their loans. This follows the notion that shorter loan terms are less risky to the lender and therefore require a lower return (in the form of interest rates) for the lender (Croushore, 2007).

The situation changes somewhat, however, when loan maturity means are gathered for all loans under \$50,000. In this case, White owned businesses have average loan maturities of about 45.5 months while Black owned businesses have loan maturities of 48.4 months. Hispanic owned businesses, however, encounter shorter loan maturities of about 43.5 months. Male owned businesses average about 44.8 months on their loans while female owned businesses average about 48.5 months on their loans. Nevertheless, the fact that this situation only changes once leads us to believe that on average, less risky groups tend to see shorter maturities on their loans.

The decomposition results in Table 2a and b show that the differences between loan maturities that exist between White-owned businesses and Hispanic and Black owned businesses can be mostly attributed to the relationship length that borrowers maintain with their lenders. Almost 68% of Hispanic owned businesses have longer loan terms compared to 56% of White owned businesses, a 12 percentage point differential. Almost 12% of this differential is explained by differences in borrower-lender relationship length, and 8.3% by differences in interest rates across the two groups.

About 91% of Black owned businesses are likely to have long term loans, 35 percentage points above the average for White owned businesses. About 13% of this gap is explained by the relationship between lender and borrower, while 6% is explained by the interest rates obtained on the business loans. A similar story holds for the gap in loan maturities evidenced by male and female owned businesses. Female owned businesses obtain long term loans 59% of the time, while male owned businesses obtain long term loans

Table 2a. Decomposition of differences in loan maturity terms by race/ethnicity and gender

		Decomposition Analysis					
		Race/E	thnicity				
	Hispanic		Black		Female		
	Factor	%	Factor	%	Factor	%	
White loan maturity	0.5582		0.5582				
Male loan maturity	-				0.5619		
Specific group loan maturity	0.6754		0.9088		0.6080		
Difference	-0.1172		-0.3505		-0.0461		
Explained							
Firm Characteristics							
Relationship length (months)	-0.0143	12.2	-0.0471	13.4	-0.0108	23.4	
Geographic proximity to bank	0.0005	-0.4	-0.0005	0.1	-0.0006	1.3	
Firm age (years)	0.0074	-6.3	0.0106	-3.0	0.0068	-14.8	
D&B credit score	-0.0004	0.3	-0.0014	0.4	-0.0002	0.4	
Market Characteristic							
Competition	0.0120	-10.2	0.0070	-2.0	-0.0014	3.0	
Loan Characteristics							
Amount of loan (/1,000,000)	-0.0021	1.8	-0.0024	0.7	-0.0019	4.1	
Loan interest rate (%)	-0.0097	8.3	-0.0192	5.5	-0.0022	4.8	
Gender							
Female	-0.0004	0.3	-0.0001	0.0	-	-	
Race/Ethnicity							
Hispanic	-	-	-	-	-0.0004	0.9	
Black	-	-	-	-	-0.0001	0.2	
All included explained variables	-0.0070	6.0	-0.0531	15.1	-0.0108	23.3	

Source: Estimates based on the 2003 Federal Reserve's Survey of Small Business Finances

56% of the time. About 23% of this gap is also explained by the relationship between the lender and borrower and 5% is explained by the loan interest rates.

The same holds true for the explanation of the difference in maturity loan terms between men and women. The second most important factor has to do with interest rates. In all comparison cases, interest rates also serve to explain some of the discrepancies evidenced in loan maturity terms between groups.

While the results do not show that minority and female owned businesses obtain shorter maturities on their loan terms (ruling out the notion that they may be deemed riskier and therefore require more frequent loan renegotiations facilitated by shorter loan terms), it is evident that White and male owned businesses, with lengthier relationships and lower interest rates do find shorter maturities on their loans. This brings us back to the Bodenhorn (2003) study. The longer the relationship between lender and borrower, the easier it is for borrowers to suggest changes in loan terms. Shorter loan terms would be correlated with lower interest rates, following the notion that long term loans are deemed riskier by lenders and therefore require a higher return in the form of higher interest rates (Croushore, 2007). In

fact, White and male owned businesses, across the board and for different loan amount categories, universally see lower interest rates on their loans.

Table 2b. Decomposition of differences in loan maturity terms by race/ethnicity and gender

		Race/Ethnicity			Gender	
	Hispanic		Black		Female	
	Factor	%	Factor	%	Factor	%
Unexplained						
Firm Characteristics						
Relationship length (months)	-0.0633	54.0	-0.0165	4.7	0.0458	-99.3
Geographic proximity to bank	-0.0824	70.3	0.0085	-2.4	-0.0009	2.0
Firm age (years)	-0.1093	93.3	0.0535	-15.3	-0.1470	318.9
D&B credit score	-0.0980	83.6	0.1979	-56.5	0.1761	-382.0
Market Characteristic						
Competition	0.4143	-353.5	0.5478	-156.3	-0.0913	198.0
Loan Characteristics						
Amount of loan (/1,000,000)	0.0188	-16.0	-0.0038	1.1	0.0121	-26.2
Loan interest rate (%)	0.4643	-396.2	-0.2196	62.7	-0.0841	182.4
Gender						
Female	0.0676	-57.7	0.0296	-8.4	-	-
Race/Ethnicity						
Hispanic	-	-	-	-	0.0074	-16.1
Black	-	-	-	-	0.0085	-18.4
Constant	-0.7221	616.1	-0.8948	255.3	0.0381	-82.6
All included unexplained variables	-0.1101	93.9	-0.2974	84.9	-0.0353	76.6

Source: Estimates based on the 2003 Federal Reserve's Survey of Small Business Finances

#### **CONCLUSION**

The minority and female owned businesses in this study are riskier than their non-minority and male owned business counterparts as they have been established years and have lower credit scores. Coupled with that is the fact that lenders deal significantly less with minority and female business owners on the whole. On average, White owned businesses experience shorter maturities on their loan terms relative to Hispanic and Black owned businesses. Male owned businesses also encounter shorter loan maturities than female owned businesses. This contradicts the notion put forth by Diamond and Rajan (2001), Berger et al (2005), and Ortiz-Molina and Penas (2006), who argue that riskier borrowers usually find shorter loan maturities imposed on their loans as lenders attempt to mitigate their risk exposure.

The findings of this paper fall more in line with the results portrayed in Bodenhorn's (2003) study where firms with longer established relationships to their lenders might have more power to negotiate their loan terms in order to receive lower loan costs. Boot and Thakor (1994) and Diamond (1991) also find that borrowers may attempt to signal their creditworthiness by opting for shorter loan terms, demonstrating their ability to contend with higher monthly payments and unafraid of refinancing risks that lower credit quality borrowers may have to contend with (Jun and Jen, 2003; Strahan, 1999). These less risky firms know that by opting for shorter loan maturities, they can decrease their overall borrowing costs (Janjigian, 1994).

The limitations of the study undertaken in this paper include the small sample size evidenced by minority and female borrowers. In order to obtain the variables required for the analysis in the study, I forgo using the entire sample and limit my analysis to those borrowers who have been approved for loans within the past three years. This subsample provides the most detailed elements of the loan experience, but as such, it significantly limits the sample size. The disproportionate underrepresentation of Black, Hispanic, and female business owners (relative to nationally observed statistics) could be due to the fact that these groups have less access to credit. This could be due to lender hesitation to grant them loans, or it could be due to the fact that some of these groups do show some reluctance to seek out mainstream financing for business ventures (sometimes opting to provide their own savings or to obtain loans from family member).

Another limitation is that the database does not establish whether loan terms are imposed by the lenders or self-imposed by the borrowers; it is not evident if the non-price loan terms are chosen by borrowers in order to obtain more favorable loan terms. A pattern in the decomposition results is noticeable, however, where the gap between minority and non-minority owned businesses is mainly explained by the relationship length between borrower and lender and the interest rates imposed on the loans. The same findings are evident between male and female owned businesses.

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# USING AGENT-BASED MODELING TO SIMULATE THE FORECLOSURE CONTAGION EFFECT

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#### **ABSTRACT**

A foreclosed property can have a negative impact on the prices of other properties within its neighborhood and these reduced property prices can lead to further foreclosures within the neighborhood; this is known as the foreclosure contagion effect. This effect has been demonstrated, within the real estate literature, to occur. Traditionally, real estate research have used statistical regression to analysis this issues. The application of Agent-based Modeling and Simulation (ABMS) has risen in the last 15 years and has successfully been used to model complexity situations, e.g., the real estate market. ABMS offers a way to explore the impact of different factors on the real estate market without having to experiment on real-world systems. This paper looks at application of ABMS to investigate the foreclosure contagion effect.

#### INTRODUCTION

There were over 2.8 million properties given foreclosure notices in the United States (U.S.) in 2009 (Pollack et al., 2010) making the current real estate crisis is the worst the U.S. since the Great Depression. Through understanding the causes of the foreclosure, it might be possible to development governmental policies that help mitigate these causes and thus help decrease the number of foreclosures appearing on the market. One suggested cause of foreclosure spread has been labeled the "foreclosure contagion effect."

The foreclosure contagion effect is the negative impact on prices experienced by properties that are within the neighborhood of a foreclosed property. A property with a declining value has more of a chance of going into foreclosure and in doing so would decrease the value of the surrounding properties even further. This chain reaction of foreclosures could lead to a complete collapse of the property market. The traditional approach to researching this phenomenon is statistical regression have been employed by real estate academics (Rogers and Winter 2009); however, a recent Nature article has suggested that Agent-based Modeling and Simulation (ABMS) should be used instead (Farmer and Foley, 2009).

This paper reports the results gained from constructing an ABMS to investigate what impact foreclosures have on the surrounding property market. This is achieved by constructing a property market of 2,500 houses which is run for a 83 years at a monthly time-steps to determine the impact of various model parameters, i.e., local foreclosure appraisal discount and disposition time. This paper is divided into five sections. The first two sections give an introduction and background to the problem; the third section gives a brief description of the model and the final two sections present the results and conclusions.

#### **BACKGROUND**

The real estate market has a significant role in the nation's financial system which was made evident in the recent recession of 2007 through the present. Former lending practices allowed high risk individuals to obtain subprime mortgages. These subprime mortgages inundated the market which eventually produced a surge of foreclosures as subprime homeowners defaulted. The increase in foreclosures caused instability within the financial system which caused financial investment losses, high unemployment, and even more foreclosures. This positive feedback loop created one of the worse recessions in the history of

the United States. It is clear that the real estate market is a critical element to the health of the nation's financial system.

Foreclosures within the real estate market occur when the borrower can no longer fulfill the mortgage contract and eventually defaults. A legal process then begins which allows the creditor, typically a bank, to gain possession of the property and then sell it to a third party. The money received from the sale is applied to the remaining balance on the original loan. The foreclosure process is extremely detrimental for all entities involved. Lin et al (2009) finds that foreclosure costs are estimated anywhere from \$7,200 to \$58,759, while Rogers and Winter (2009) defines this window between \$27,000 and \$30,000.

Foreclosed properties usually experience gross neglected, abandonment, and vandalism which lowers the value and visual attractiveness of the property. It has been suggested that this decline in maintenance of a foreclosed property, and subsequence devaluation, are contributing factors to the contingent effect (Harding et al., 2009). Foreclosed properties are eventually listed for sale along with the other properties that are listed in the traditional fashion. Therefore, foreclosures add to the supply of properties that are contending for buyers; as a result, the excess supply can cause neighboring property values to decline.

#### **Previous Studies**

Previous research efforts to explore the foreclosure contagion effect within the real estate market use a hedonic regression methodology. Hedonic models decompose complex, incomparable entities into smaller, comparable constituents for analysis. Once decomposed, the constituents are evaluated to determine their contribution to the state of the original entity. In the case of foreclosure contagion, relationships between foreclosures and neighboring property sale prices are explored by decomposing sales prices with two of the constituents being the number and distances of foreclosures within the proximity of the selling property. This approach has been used to identify and quantify relationships between foreclosures and property values from datasets that contain real estate sale prices and foreclosure events (Immergluck and Smith 2006; Harding et al. 2009; Lin et al. 2009; and Rogers and Winter 2009).

The reason for using regression models when analyzing foreclosure effects is partially historical and partially due to the availability of techniques (Lancaster, 1966). Due to developments in computer technology over the last 20 years, analysis techniques like simulation have come more accessible and useful within the research community and thus might be more applicable to researching foreclosure.

#### **Appraisal Foreclosure Discount**

Various studies have been conducted to quantify the impact of foreclosures on the surrounding property values. For instance, Immergluck and Smith (2006) showed the impact from foreclosed property was about 1% of the property values within eighth of a mile. In contrast, Lin et al (2009) suggested the effect was 8.7% on property values up to 10 blocks away for 5 years. The differences in the results can be attributed to differences in the data sets used even though the data sets are somewhat similar. For instance, both papers draw the data from the Chicago region and both papers used regression based models. A separate study of data in the St. Louis County, Missouri by Rogers and Winter (2009) showed similar results to Immergluck and Smith's outcomes, and also used a log linear regression based model for its hedonic price model. Although the literature offers different values for the quantifying the contagion effect, they agree that the effect is local and that it is a function of time and distance.

# **Disposition Time**

The process by which a foreclosure gets resolved is a function of the state in which the property is located (Pence 2003; 2006). Judicial foreclosure states require the courts to get involved which substantially slows down the process. Alternatively, power-of-sale states allow the bank to sell the property without the court's supervision. To further compound the problem, states with a Statutory Right of Redemption indirectly delay the resolution of a foreclosure by effectively limiting the demand pool that is willing to

step forward to buy a foreclosed property. The reason is that this law allows a foreclosed upon property owner to regain ownership of the foreclosed property for a fixed period (up to 1 year), even after it has been sold to someone else.

The previously cited literature acknowledges that having unresolved foreclosed properties in a neighborhood causes a magnification of the foreclosure contagion problem. Empirically, the question is, "To what extent does the added time on the market cause an increase in the likelihood of a market collapse?" We seek to address this question by allowing both the magnitude of the foreclosure impact to vary as well as the foreclosure time on the market, called disposition time. We select a minimum value of 1 month and a maximum value of 14 to provide a sufficient range to see varying results.

# **Agent-based Modeling and Simulation**

ABMS is a simulation technique that has been recently advocated for use within economic modeling (Farmer and Foley 2009). Formally, ABMS is defined as a computational method that enables a researcher to create, analyze and experiment with models composed of agents that interact within an environment (Gilbert 2007; North and Macal 2007). The agents can be anything that can act autonomously and the environment is where the agents can act. ABMS has been applied to very diverse areas, from Electricity companies interacting within the energy markets (Bagnall and Smith 2005) to eggplant growth (Qu et al. 2010).

Real estate has a long history with agent-based modeling, Schelling invented ABMS when he constructed a model of housing segregation (Schelling, 1971). Schelling developed the model in an attempt to explain racial segregation within American cities. The model used a grid pattern as its environment and the agents were individual households. If an agent was surrounded by more than the tolerated numbers of other racial groups, then they would move. What was interesting about Schelling's work was that even with relatively high levels of racial tolerance among the general model population, segregation (or clustering of households) would still occur.

Schelling's result is an example of what is called as emergent behavior which can occur within ABMS. This is when micro-level details (i.e., the agent's racial tolerance levels), have macro-level effects (i.e., segregation of a population). This emergent behavior is one key benefit to using ABMS and is sometimes called a bottom-up approach to modeling. Emergent Behavior could occur due to the overwhelming complexity of a model, and as such, agent-based modelers try to keep the agent's rules as simple as possible to avoid this.

#### MODEL

The agents in our foreclosure ABM are the individual real estate properties. A number of variables are used to represent these heterogeneous properties within the model, i.e. geographical location, current market value, loan type, resident type, and purchase price. Once a property-agent is sold within the simulation, the agent is refreshed with the new owner's details and financial situation. The simulation contains 2,500 property agents that are equally spaced in a torus grid, as shown in Figure 1.

The purpose of this simulation was to explore the effects of foreclosures on the average property value and if these effects induced a complete market crash. A brief description of the model's mechanics is given here; a complete description of the model, including the mathematical formulae, is given in Gangel et al (2012a). To the best of our knowledge, there is no previous study using ABMS for foreclosure modeling, thus we have attempted to make the model as simple as possible for this initial application of the ABMS methodology. To maintain simplicity, at each time-step each agent considers only a limited number of factors when trying to mimic reality.

The simulation runs were for 1,000 months (83 years) with a time-step of one month. During each time-step, the property agents performed a series of different tasks. These tasks included updating the properties loan information; performing a pricing appraisal of the property; determining if the property would go into foreclosure, based on characteristics like if the property was underwater or if it was a rental property; and determining if the property would be listed for sale using a probability based on the property's Return on Investment (ROI). The simulation was implemented in Repast Simphony (version 1.2), an open-source ABMS software developer's kit (North et al, 2006). Repast Simphony was selected due to its superior computing speed and programming flexibility to other ABMS software. All simulations were run on desktop computer with a quad-core 2.33Mhz Intel processor and 4GB RAM.

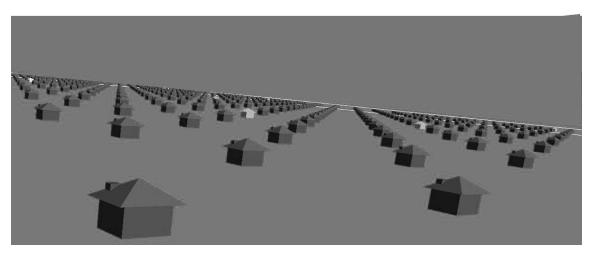


Figure 1: Screen from the Repast Simphony software of the foreclosure model implementation

Each simulation run was repeated 30 times for statistical significance and we only focus on the results relating to foreclosure discount factor and disposition time in this paper. Real interest rates from the last 30 years were used within the model. The model was validated through face validation of a Subject Matter Expert (SME) and sensitivity analysis was conducted using Latin Hypercube Sampling; details of the sensitivity analysis can be found in Gangel et al. (2012b).

# **RESULTS**

A sampling of results from the simulation runs is given in figure 2; these results focus on the impact of the foreclosure discount and disposition time on the average property values. These results were drawn from the same study presented in Gangel et al. (2012a, 2012b) though the discussion is unique to this paper. Figure 2 is composed on two key regions. The "lake" is the flat part at the bottom-right of the graph and it represents combinations of discount rate and time to foreclosure that cause the market to collapse, this is represented as an average house price of \$10 within our model. Once a catastrophic crash occurs there is no recovery of the property market. The "mountain" in the graph conveys market declines (but not failures) for the remaining combinations. It is clear from this graph that the relationship between disposition time and foreclosure discount is non-linear. If it were, the side of the mountain would slope down to the lake in the shape of a plane and there would be no curvature at all.

# Average Property Value at End of Simulation

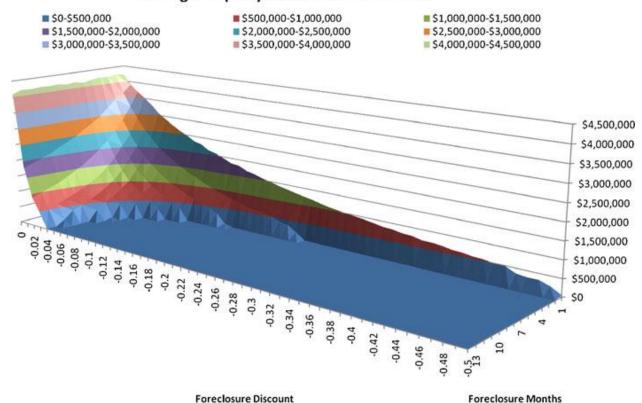


Figure 2: Graph depicting simulation results nicknamed the "mountain-lake graph"

What is most important about this analysis is the point at which the market turns from healthy to potentially unstable. If the research of Immergluck and Smith (2006) is to be believed, with a foreclosure impact factor of 1%, then we are not likely to see a complete property market collapse due to foreclosures. In contrast, Lin et al (2009) suggested the foreclosure effect was 8.7% on property values, which would mean that our results imply that there could be a complete market crash if disposition time was allowed to go above 10 months. Overall, our results show that letting foreclosed homes needlessly linger in the neighborhood causes an increasing foreclosure contagion problem—possibly to the point of market collapse.

Given the stochastic nature of the simulation and the number of properties involved, it was very surprising to us to observe such smooth results that are shown in figure 2. We behavior these smooth results give creditability to our results and are a demonstration of emergent behavior from the simulation.

#### CONCLUSIONS

This is the first study to apply agent-based modeling to the field of real estate and foreclosures. It began by building a simulation that reasonably tracks the intricate relationships that exist in the observable real world, which was validated by a SME. It was found that the greater the time a foreclosed property is allowed to remain on the market, the greater the probability the market will fail. Future research will incorporate social networks and the new phenomenon of "strategically defaulting."

In summary, no matter the politics or economic view relating to this topic, we can all agree a better understanding of real estate markets is ideal. ABM can be used to gain additional insight beyond the ability of traditional tools used in the past.

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# CHANGES IN POPULATION DENSITY IN COLUMBIA, SOUTH CAROLINA

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#### **INTRODUCTION**

This proposal describes a research plan to analyze changes in population density patterns for the Columbia, SC metropolitan area. The study will utilize U.S. Census data to estimate population density gradients for the metropolitan area for 1990, 2000, and 2010. The resulting gradients will be compared, with the a priori expectation that the gradients have declined over time, indicating a more dispersed population.

#### **BACKGROUND**

# **Population Density Patterns**

The generalization that population density declines at a decreasing rate as distance from the center city increases is consistent with intuition, economic theory, and careful empirical analysis. Imagine a view of a city skyline. It declines in a manner that could be described by a negative exponential function. Correspondingly, intuition would lead one to expect population density to follow this same pattern. Economic theory predicts this pattern partly because of the factor substitution that is evident in that skyline, but also due to substitution by consumers of housing space.

# The Monocentric City Model

Our understanding of urban land use patterns is rooted in the monocentric city model (Alonso, 1964; Muth, 1969; Mills, 1967). This model generates the equilibrium result that utility-maximizing households would require lower housing prices as distance from the city center increases to compensate for the higher commuting costs they incur. In response to lower prices per unit of housing space, households would consume more housing space and substitute away from other goods. All else equal, households would be more dispersed at more distant locations since they live in larger dwellings.

Of course, all else would not be equal. Specifically, this decreased willingness on the part of consumers to pay for a unit of housing space reduces the amount that profit-maximizing developers are willing to pay for a unit of land as distance from the city center decreases. Thus, the equilibrium price of a unit of land falls as distance from the city center increases. Consequently, builders use more land and less capital per household dwelling as distance from the city center increases.

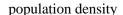
It is easier to deduce the effects of consumer and producer substitution if we start at the edge of development and move towards the city center. Households facing higher unit prices of housing would live in smaller dwellings, meaning they would consume fewer square feet of housing space. Developers would respond to higher land rents by using less land and more capital per household dwelling. They would accomplish this substitution by building taller residential structures. So each household would live in smaller dwellings and each dwelling would use less land as distance to the city center decreases. The result, as illustrated in the figure below, is that population density increases exponentially as we move closer to the city center.

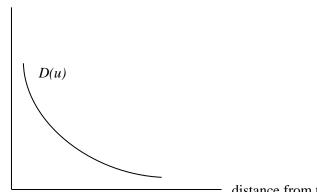
#### **Population Density Gradients**

The population density pattern in the figure below can be approximated by the function

$$D(u) = D_0 e^{-gu}, \tag{1}$$

where u is distance from the city center and  $D_0$  is population density at the city center (u=0). The parameter g, which measures the rate at which population density falls as u increases, is referred to as the density gradient.





distance from the city center (u)

The density function above can be transformed to

$$ln D(u) = ln D_0 - g u. (2)$$

Using observations of population density at various distances from the city center, regression analysis can be used to estimate g. So if u measures distance from the center in miles and g = 0.50, then population density is estimated to decline at 50% per mile.

# **Empirical Evidence**

Early estimates of population gradients using 1950 Census Data show that for a sample of U.S. cities the density gradient averaged 41% per mile (Muth, 1969). More recent studies show that density gradients in the U.S. (Mills, 1972) and abroad (Anas, Arnott, and Small, 1998) have fallen over time as cities have become more decentralized.<sup>1</sup>

#### DATA AND METHOD

The data requirements for this project are minimal. The U.S. Census Bureau publishes data on population and land area by census tract. These data will be collected and population density will be calculated for 1990, 2000, and 2010 for each of the tracts in the Columbia, South Carolina Metropolitan Statistical Area (MSA). This MSA includes six counties: Calhoun, Fairfield, Kershaw, Lexington, Richland, and Saluda. There are 251 census tracts distributed across these counties and the principal city of Columbia is located in Richland County.

<sup>&</sup>lt;sup>1</sup> The paper will include a more complete review of the evidence.

Census data also include the centroid for each census tract. GIS technology will be used to calculate the distance between the centroid of each tract and the centroid of the tract that contains the geographical center of the Columbia Central Business District (CBD).

Since the transformed density function (2) is linear, OLS regression estimates of the density gradients can be obtained for 1990, 2000, and 2010. Standard statistical tests will be used to determine if any differences in these estimates are statistically significant.

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# Economic Impact Analysis of Data Link in the North Atlantic Region

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#### **ABSTRACT**

This paper investigates the economic impact of North Atlantic (NAT) region Data Link mandate and implementing Reduced Lateral separation (RLatSM) in the NAT oceanic airspace. A detailed cost analysis is carried out to estimate the Data link mandate cost for all NAT operators based on a survey of 44 commercial operators. A computer simulation model North Atlantic Track System Analysis Model (NATSAM) was developed and used to assess fuel and time savings derived from implementing Data link mandate and reduced lateral separation across the NAT oceanic airspace.

# 1. OBJECTIVE

This paper examines the likely economic costs and benefits to commercial aircraft operators derived from the introduction of a data link mandate in the North Atlantic oceanic airspace as well as the benefit mechanisms available through the reduction of lateral and longitudinal separation minima.

#### 2. BACKGROUND ON NORTH ATLANTIC OPERATIONS

Nine States provide air traffic services in the NAT: Canada, Denmark, France, Iceland, Ireland, Norway, Portugal, the United Kingdom and the United States [4]. Commercial traffic represents the majority of operations in the NAT, with International General Aviation (IGA) primarily operating at high altitudes. A significant portion of traffic in the NAT takes place along a system of 5-7 nearly parallel tracks known as the Organized Track System (OTS), which includes traffic flows between North America (excluding Alaska) and Europe (and Middle East). The exact location of these tracks is updated twice a day (one for eastbound and one for westbound traffic) according to projected wind and meteorological conditions [3].

Most of the NAT airspace is out of the range of Very High Frequency (VHF) and radar. The majority of communications take place using High Frequency (HF) voice, which is subject to disruption, atmospheric effects, ambiguity in accents, frequency congestion, and a third-party relay between pilots and controllers.

One position report using HF voice is usually done every 10 degrees of longitude, or roughly once every hour during the flight. Due to the lack of surveillance and timely controller intervention capability, safety in the NAT is maintained by imposing large longitudinal (10 minutes) and horizontal (60 NM or 1 degree of latitude) separation standards [3].

# 3. BACKGROUND ON DATA LINK MANDATE

The implementation of the Future Air Navigation System or FANS-1/A started in the NAT in the 1990s. The FANS-1/A system has three main functionalities [6]:

- ATS Facilities Notification (AFN): used to initiate logon between aircraft and Air traffic Services (ATS) facility
- Controller Pilot Data Link Communication (CPDLC): enables direct data link communication between pilot and ATS facility using either pre-defined or free text message formats. Used for clearances, requests, acknowledgements, negotiations, etc.
- Automatic Dependent Surveillance Contract (ADS-C): automatic report of position, velocity, intent, and other information via a contract established between aircraft and ATS facility. It provides an alternative to voice reporting by sending automatic position reports via SATCOM

The International Civil Aviation Organization (ICAO), NAT Systems Planning Group (NAT SPG), identified the need to mandate the use of data link equipment on the basis of safety, to reduce the vertical risk in the NAT below the Target Level of Safety (TLS). A high number of Large Height Deviations (LHDs) in the region has been the main factor for not meeting the TLS in the vertical plane for some time. The FAA defines a LHD as "any vertical deviation of 300 feet or more from the expected flight level." ADS-C conformance monitoring could be used to detect deviations in the lateral and vertical planes from the cleared route and flight level.

The data link mandate plan specifies that all aircraft conducting flights in the airspace defined below shall be equipped with and shall operate CPDLC and ADS-C equipment as follows (meeting the requirements specified in RTCA DO-258A/EUROCAE ED-100A or equivalent, capable of operating outside VHF data link coverage):

- Phase 1 From 7 February 2013. The limits in the vertical plane have been defined from flight level 360 to flight level 390, inclusive, and in the horizontal plane, no more than two tracks within the NAT OTS designated as core tracks. The specified tracks shall be identified when the NAT Organized Track message is published.
- Phase 2 From 5 February 2015. In specified portions of the NAT Minimum Navigation Specification (MNPS) Airspace. The lateral and vertical extent of airspace that phase 2 will cover is still under definition.

# 4. COST ANALYSIS

#### 4.1 Major Data Sources

Current and planned data link equipage levels were gathered through a survey of major commercial operators. CSSI, Inc. led the effort, in collaboration with the International Air Transport Association (IATA) and the U.S. Federal Aviation Administration (FAA), to collect input on data link avionics equipage for 2010, 2013, 2015, and beyond. This was an unprecedented study, capturing information for 44 major airlines (representing 81.6 percent of NAT MNPS operations and 88.2 percent of commercial operations).

Costs to meet the requirements of the data link mandate were estimated based on equipage levels provided by aircraft operators and cost data from manufacturers. Cost data was gathered through a cost focus group of industry representatives, which included over 40 participants representing aircraft and avionics manufacturers, commercial airlines, International General Aviation (IGA) representatives, and all of the NAT Air Navigation Service Providers (ANSPs). This cost focus group provided first-hand cost information related to the equipment with data link avionics.

Researchers at MIT's International Center for Air Transportation (ICAT) developed a traffic forecast and fleet mix analysis for 2013, 2015, and 2020. Projections were developed using data samples from OAG Aviation and the Enhanced Traffic Management System database (ETMS). Baseline traffic operations for 2010 were derived from an ETMS sample from May to September. Finally, the OAG BACK Aviation World Aircraft Registry for June 2010 was used to make estimates of the fleet composition for those airlines that did not respond to the data link survey.

# **4.2 Major Assumptions**

- Airspace where mandate applies will be exclusionary. Only aircraft equipped with the technologies and systems described will be allowed to operate in that airspace
- This study is based on the Proposal for Amendment of Regional Supplementary Procedures Doc 7030/5 approved by the ICAO Council on January 4, 2012
- The cost analysis covers a five-year period, beginning with January 1st, 2010 and ending with December 31st, 2014. It is assumed that costs began to accrue in 2010 and that airlines will equip gradually while trying to comply with the data link mandate before phase 2 comes into effect, as this will be the more stringent phase
- All costs are presented in 2010 USD
- A discount rate of 7 percent is applied [2]
- Projections of costs and data link equipage availability from manufacturers are current as of 2012
- Projections of commercial and general aviation fleets and data link equipage plans are current as of 2010
- All avionics retrofits take place during scheduled maintenance to avoid prohibitive costs of taking an aircraft out of service to retrofit.

Assumed that 52 airlines not responding to CSSI / IATA equipage survey (10.1% NAT MNPS operations) show the same equipage trends as the 44 airlines responding to the survey (81.6% NAT MNPS operations)

#### **4.3 Description of Costs**

Initial costs are the largest costs for commercial operators, particularly costs for equipment, installation, and loss of revenue due to airplane downtime. Recurring costs were negligible in comparison. Recurring costs include maintenance, communications, training, and manual revision. For example, communication costs vary greatly depending on the type of contract that each carrier has with the communication service provider. Some airlines may pay per data link message, others per flight, or others may bundle additional services, such Airline Operational Communications (AOC). This analysis focuses on initial costs due to equipment and installation.

#### 4.4 Fleet and Data Link Equipage Assessment for Commercial Operators

To understand the number and types of flight operations in the North Atlantic MNPS airspace, a sample dataset of recorded operations spanning from May to September 2010 was used. This dataset included 213,219 flights with an average of 1,394 flights per day. 92.6 percent of the flights were commercial operations, 4.8 percent of the flights were IGA operations, and 2.6 percent were military. In 2010, approximately 50 percent of all flights in MNPS airspace were fully equipped to comply with the mandate. By 2013, almost 70 percent of flights in MNPS airspace are projected to be in compliance. By 2015, this number is expected to increase to 80 percent or more.

# 4.5 Status of Equipment Availability

In 2010, there were five commercial aircraft types which did not have a commercially available ADS-C and CPDLC solution. These included the Airbus 310, Boeing 747-100, Boeing 747-200, Boeing 747-300, and Boeing Douglas DC-10. In 2010, these aircraft types accounted for three percent of flights in NAT MNPS airspace.

#### 4.6 Results of Cost Analysis for Commercial Operators

This analysis estimates the costs that would result from aircraft gradually adopting the technologies necessary to meet the requirements of the data link mandate before phase 2 comes into effect on February 5, 2015. Equipage levels for 2010 (the first year of the analysis period) are used as the baseline for comparison.

A net present value (NPV) approach was used to distribute the costs of the mandate program for U.S. commercial operators as follows:

```
2010 – 0 percent costs

2011 – 10 percent costs

2012 – 10 percent costs

2013 – 20 percent costs (mandate phase 1)

2014 – 60 percent costs
```

2015 – 0 percent costs (mandate phase 2)

Prior experience implementing regulatory measures, such as Reduced Vertical Separation Minima (RVSM), shows that most operators willing to equip would wait until shortly before the rule enters into effect to retrofit. Therefore, the majority of the costs in the NPV analysis were allocated in preparation for phase 2 of the mandate in 2015.

Avionics procurement was the most significant cost for aircraft operators. Retrofit costs for commercial operators range from \$50,000 USD to over \$1 million USD per airframe depending on the original level of aircraft equipage. Most airframes needing retrofit are somewhere in between these two extremes. Three aircraft types (Boeing 767-300, Boeing 757-200, and Boeing 747-400) account for most of the total commercial retrofit costs (Figure 1). This is because such legacy aircraft are heavily used in the NAT and usually have low levels of equipage (Figure 2).

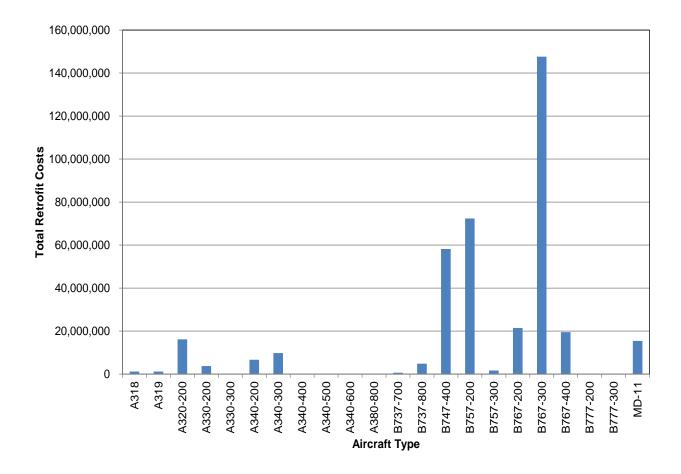


Figure 1: Total Undiscounted Equipment Costs per Aircraft Fleet Type. 44 Commercial Operators Responding to Data Link Equipage Survey, 81.6% NAT MNPS Operations.

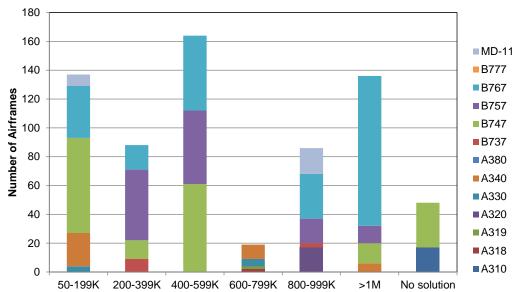


Figure 2: Details of Retrofit Costs per One Airframe. 44 Commercial Operators Responding to Data Link Equipage Survey, 81.6% NAT MNPS Operations.

Most commercial airframes needing retrofit fall within one of the following cost categories (Figure 3):

- a) Those needing only FANS-1/A retrofit (cost per airframe from \$50,000 USD to less than \$200,000 USD)
- b) Those having a medium level of equipage (cost per airframe from \$400,000 USD to less than \$600,000 USD)
- c) Those needing a full retrofit with FANS-1/A and pre-requisite systems (GPS, SATCOM, and Flight Management Computer FMC upgrade capable of supporting FANS-1/A). In this case, cost per airframe could be over one million USD

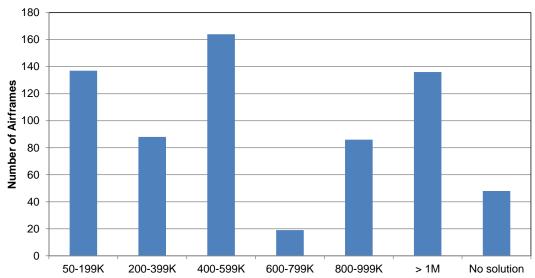


Figure 3: General Distribution of Retrofit Costs per Airframe. 44 Commercial Operators Responding to Data Link Equipage Survey, 81.6% NAT MNPS Operations.

Another significant cost for operators is aircraft downtime and installation. Downtime costs also vary greatly depending on the aircraft type and pre-existing equipage. For commercial operators, if an aircraft only needs installation of the FANS-1/A package, only a few hours of downtime are needed. Pre-requisite systems, such as an FMC upgrade would require an extra day of aircraft downtime. A complete SATCOM or GPS installation would take approximately 5 days and a full retrofit with all the systems would take 6 to 10 days.

In the cases when installation and labor are not included in the equipment costs, an additional \$15,000 dollars for one day of airplane downtime to \$90,000 dollars for a full retrofit will need to be added. Commercial operators would try to do their extensive retrofits during scheduled maintenance checks to avoid putting an aircraft out of service, which could be very expensive.

There are approximately 2,152 commercial airframes operating in the NAT. After accounting for those airframes that cannot be retrofitted due to lack of equipment commercially available, there are approximately 838 airframes that need some level of retrofit (Figure 4). For all commercial carriers, total retrofit costs are estimated to be \$464 million (2010 USD). This includes costs for equipment, installation and downtime. Avionics is by far the largest cost (Figure 5).

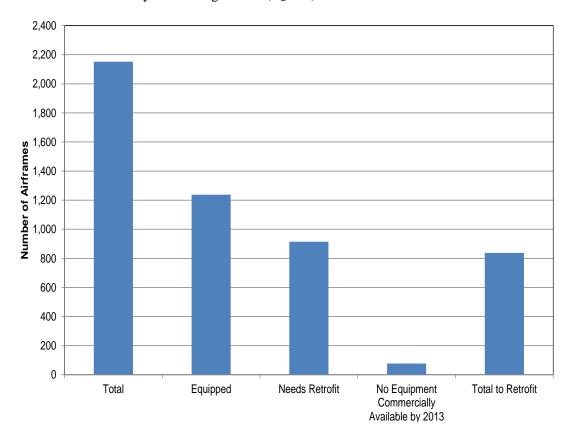


Figure 4: Total Retrofit Needs in 2010. Includes airlines responding to equipage survey (81.6% NAT MNPS Operations) and assumptions for airlines not responding to survey (10.1 % NAT MNPS Operations).

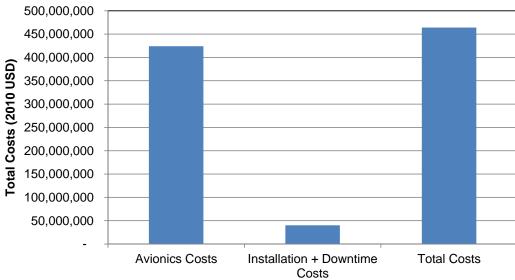


Figure 5: Data Link Mandate Costs for Commercial Operators (Avionics + Installation & Downtime). Includes airlines responding to equipage survey (81.6% NAT MNPS Operations) and assumptions for airlines not responding to survey (10.1 % NAT MNPS Operations).

If Iridium is used instead of Inmarsat when a SATCOM retrofit is needed, total retrofit costs are approximately 12 to 14 percent less. The ICAO NAT SPG concluded that "FANS 1/A (or equivalent) data link communications conducted over Inmarsat I3 Classic Aero, Iridium Short Burst Data and Very High Frequency (VHF) sub-networks have demonstrated acceptable performance for the use of data link services [5]."

Table 1 shows a detailed cost breakdown for U.S commercial operators, differentiating between avionics costs and the cost for downtime and installation.

	Total number of airframes	Number of equipped airframes	Number of airframes needing retrofit	Number of airframes with no equipment commercially available by 2013	Number of airframes to retrofit	Total avionics cost (2010 USD)	Total downtime cost (2010 USD)
CSSI / IATA Equipage Survey (44 Carriers, 81.6% NAT MNPS Operations)	1,740	1,062	678	48	630	\$305.3M	\$28.4M
Other Operators, (52 Carriers, 10% NAT MNPS Operations)	412	175	237	29	208	\$118.7M	\$11.8M
TOTAL	2,152	1,237	915	77	838	\$424 M	\$40.2M

Table 1: Detailed Cost Breakdown for U.S. Commercial Operators.

#### **4.7 Potential Impact of Fleet Retirements**

In addition to providing equipage information for their 2010 NAT fleet, airlines responding to the data link survey gave projections for the years 2013, 2015, and beyond. These projections carry a lot of uncertainty, as there are many economic and business factors that may affect final fleet decisions. The farther out these projections are, the more uncertain they are. The 44 NAT carriers responding to equipage

survey indicated that they expect to retire or replace 121 airframes by 2015. If this projection materializes, it would represent a cost avoidance of \$31.9 million (2010 USD) in data link retrofits.

## **5. BENEFITS ANALYSIS**

#### **5.1 North Atlantic Performance Benefits Model**

A computer simulation model called the North Atlantic Track System Analysis Model (NATSAM) was developed to assess fuel and time savings (or penalties) derived from implementing a data link mandate and reducing lateral separation to 25 NM in the NAT. The model consists of three modules:

- a) A continuous simulation module to model the aircraft performance across the complete flight from an origin airport to a destination airport;
- b) A track assignment module to perform heuristic or optimal assignments of flights entering the NAT track boundaries; and
- c) A wind module to account for wind conditions along the complete route

#### **5.1.1** Aircraft Performance Module

The benefits model employs the Euro control BADA 3.9 aircraft performance model that has been widely adopted in many airspace cost/benefit studies by FAA and Euro control [1]. The aircraft performance considers a typical flight across the North Atlantic as shown in Figure 6. The model estimates fuel and travel time cost matrices for each flight for various available routes. This process replicates a flight planning activity as it considers wind and fuel costs involved in the selection of optimal versus non-optimal NAT OTS tracks.

The performance calculations are carried out using numerical integration of the BADA 3.9 model with small numerical steps sizes in climb and descent (20 seconds) and a moderate step size in the cruise phase of the flight (3 minutes). The "to NAT Route" segment shown in Figure 6 consists of a climb and a cruise phase to reach the NAT track boundary. Typical detour factors for the first and final segments of the flight are obtained using the Enhanced Traffic Management System data (ETMS) and they are used to model realistic flight tracks from each origin airport to the NAT boundary points. The "NAT Route" segment shown in Figure 6 is flown at constant Mach number optimized for each aircraft. The "Beyond NAT Route" segment considers typical climbs performed by flights crossing the North Atlantic before reaching their destination (Figure 7). The aircraft performance module considers airline operational practices such as takeoff mass distributions as a function of stage length flown. The airline fuel and takeoff mass data was obtained from a survey of 779 flights collected by Airlines for America.

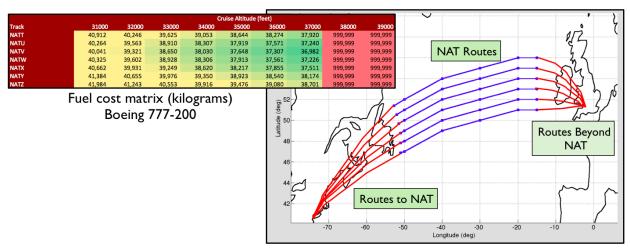


Figure 6: Sample Aircraft Performance Model Results. Boeing 777-200 Flying from New York Kennedy International Airport to London Heathrow International Airport.

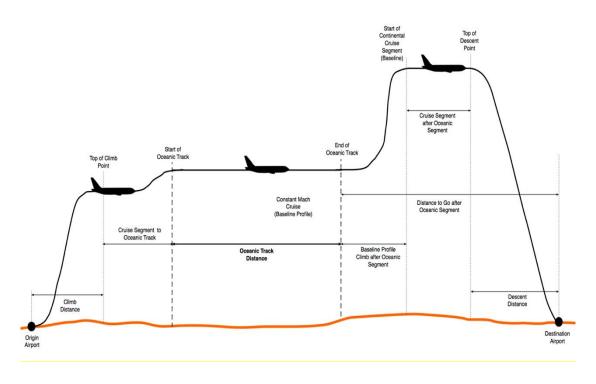


Figure 7: Typical North Atlantic Flight Modeled.

#### 5.1.2 Wind Module

The NATSAM model uses data from the National Center for Atmospheric Research (NCAR) Reanalysis Wind Model developed by the Physical Sciences Division of the Earth System Research Laboratory at the National Oceanic and Atmospheric Administration (NOAA). The Reanalysis model contains 6-hour and daily wind patterns over the North Atlantic using a 2.5 degree grid shown in Figure 8. The model provides winds from sea level conditions to 15,000 meters with a total of 19 pressure levels available. The NCAR wind model implemented in

NATSAM is interpolated in three-dimensions to obtain winds at any altitude flown by the aircraft in the North Atlantic OTS system. Figure 8 shows the winds aloft in the North Atlantic Region for the 250 mb pressure level (~34,000 feet). Seven Eastbound NAT OTS tracks are shown for the simulation day.

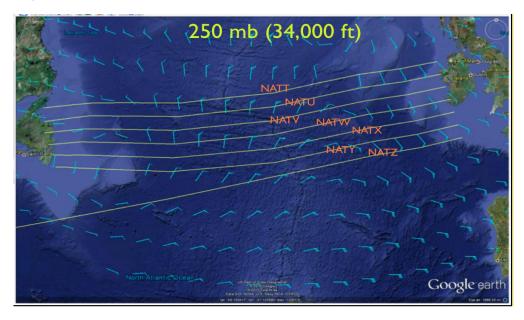


Figure 8: Wind Representation in NATSAM Model. Wind Data Source: NCAR Reanalysis Model.

Map Source: Google Earth.

# **5.1.3 NAT Track Assignment Module**

The NATSAM model has a track assignment module that assigns flights to NAT OTS tracks based on their relative costs compared to a wind-optimal track selected as preferred alternative. Whereas the aircraft performance module calculates fuel and travel times for all tracks and all flight levels likely to be used in the North Atlantic crossing, the track assignment module coordinates the assignment of tracks to each flight considering the demand levels for each requested track and flight level combination (Figure 9).

Currently, a simple heuristic algorithm assigns the least costly (fuel-based) track to a flight subject to track capacity constraints. For example, a flight requests a desired track and cruise flight level combination as it departs the origin airport. As the flight approaches the NAT OTS track boundary (Figure 9) air traffic controllers provide an updated track-cruise flight level combination that considers other traffic entering the NAT boundary at the same time. Each flight modeled has a wind-optimal fuel track as well as dozens of other sub-optimal solutions for the flight. These sub-optimal solutions are used when capacity constraints prevent the flight using its best wind-optimal solution.

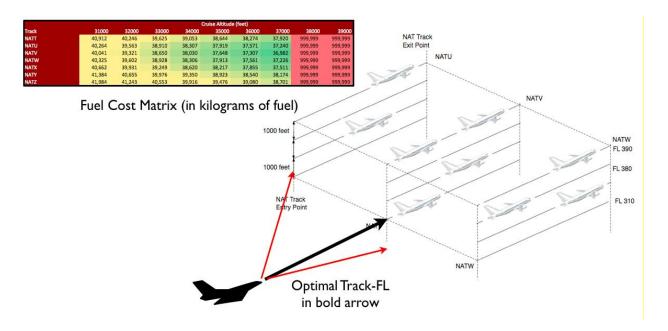


Figure 9: Tactical NAT OTS Track Assignment.

# **5.2 NATSAM Model Outputs**

The NATSAM Model produces numerous outputs that can be used to understand the benefits of the data link mandate and RLatSM. The model produces time-space events of NAT track assignments, summaries of flights assigned to a track-cruise flight level combination for a given day, and summaries of fuel and travel time metrics comparing equipped vs. non-equipped aircraft using the NAT OTS system.

The model produces detailed tables with results at the individual flight level including fuel used statistics, travel time statistics, airline, aircraft type, etc. Finally, the model can also produce summaries of statistics relevant to air navigation service providers. For example, summaries of the number of flights assigned to their requested tracks and cruise flight levels for a given simulation period. These statistics provide valuable insight on how many flights get their wind-optimal tracks and provide an opportunity to gage system performance of the NAT OTS region.

# 6. RESULTS

Benefits of the data link mandate (cases 5a and 7a) and reduced lateral separation (cases 5b and 7b) have been studied for two equipage levels. The current level of equipage in the NAT fleet is approximately 50% and Cases 5a and 5b represent a low level of equipage (55%) whereas Cases 7a and 7b represent high level of equipage (90%). The fuel consumption in these two cases is compared against the baseline scenario where there is neither data link mandate nor reduced lateral separation. Table 2 shows the assumed traffic levels and equipage for all modeled scenarios. The benefits and penalties for cases 5a, 7a (data link mandate scenarios) and 5b and 7b (reduced lateral and data link mandate scenarios) are shown in Table 3.

Case #	Operational Strategy	Traffic Level	Equipage Level
5a	Data link mandate Phase 2 – all OTS tracks; FL360, FL370, FL380, FL390; from 2015. Only	2017	55%
<b>7</b> a	data link equipped aircraft allowed to operate in this airspace	2017	90%
5b	Reduced lateral separation – ½ degree spacing in all OTS	2017	55%
7b	tracks; FL360, FL370, FL380, FL390; from 2017. Only data link equipped aircraft allowed to operate in this airspace	2017	90%

**Table 2: Modeling Scenarios.** 

	Case 5a
Benefits	\$56,630,704
Penalties	(\$114,167,562)
Net Penalties	(\$57,536,858)

	Case 7a
Benefits	\$76,229,803
Penalties	(\$66,624,673)
Net Benefits	\$9,605,130

	Case 5b
Benefits	\$74,140,315
Penalties	\$109,040,550
Net Penalties	\$34,900,234

	Case 7b
Benefits	\$88,359,944
Penalties	\$78,405,507
Net Benefits	\$9,954,436

Table 3: Benefits and Penalties for Case 5a, 7a, 5b and 7b.

As observed in Table 3, when the level of equipage is low (Case 5a at 55%) and a exclusionary zone is introduced where only data link equipped aircraft can operate, most of the unequipped aircraft are forced to take lower cruise altitudes compared to their wind optimum cruising altitudes. These translate into penalties of \$57.5 million in the year 2017. Case 7a represents a higher level of equipage (90%) which translates into a net benefit of \$9.6 million. This transition from penalties in Case 5a to benefits in Case 7a is due to the fact that more equipped aircraft are now able to operate in the exclusionary zone. 45% of aircraft in Case 5a have restrictions on cruising altitudes whereas only 10% of aircraft are restricted in Case 7a. Therefore most of the aircraft enjoy benefits in Case-7a whereas most of the aircraft are penaltized in Case-5a. Most of the penalties in both Cases are the result of Data link mandate which precludes unequipped aircraft to cruise at altitudes from 36000 ft. to 39000 ft, which is the most optimum altitude range. The results underscore the need to increase the equipage in the future, as the mandate is implemented.

Introducing reduced lateral separation allows the tracks to be spaced at ½ degree separation and facilitates the location of tracks in a more wind optimum fashion. This allows aircraft to fly more efficient profiles than ever and reduces their fuel burn and travel time. As observed in Table 3when reduced lateral separation is implemented together with Data link mandate, the net penalties for Case 5b are \$34.9 million and for Case 7b there is a net benefit of \$9.9 million. In both low equipage cases (5a and 5b), unequipped aircraft are vulnerable to heavy penalties if they are excluded from optimal altitudes.

Introducing reduced lateral and longitudinal separations in the NAT OTS increases the capacity and can help mitigate some of the penalties associated with the exclusionary airspace of the data link mandate, generating more benefits for data link equipped aircraft. Since reduced longitudinal separation is outside the scope of this study it is not discussed here.

#### 7. CONCLUSIONS

Costs and benefits have been calculated on a preliminary basis. These results indicate that a holistic approach to implementation of the data link initiatives is necessary and is similar to the portfolio approach being implemented under FAA's NextGen program. All in all, the data link initiative will provide safety and qualitative benefits to aircraft operators and ANSPs. Quantitative benefits in terms of fuel savings can be possible through initiatives such as reducing lateral and longitudinal separation minima, allowing more aircraft to achieve optimal flight profiles. Similarly, penalties for unequipped aircraft are mitigated with increasing data link equipage.

#### 8. REFERENCES

- [1] Base of Aircraft Data (BADA) version 3.9
- [2] FAA Supporting Documentation for the Economic Factors Used in Investment Analysis
- [3] ICAO, April 1999
- [4] ICAO North Atlantic Systems Planning Group (NAT SPG)
- [5] ICAO North Atlantic Systems Planning Group (NAT SPG), 48th report, June 2012, conclusion 48/10
- [6] ICAO North Atlantic Systems Planning Group (NAT SPG), May 2001

#### FORECASTING AIRLINE PASSENGER MILES

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#### **ABSTRACT**

This project utilizes classical forecasting techniques to predict international revenue passenger miles for U.S. air carriers. The data are monthly and seasonally unadjusted. The approach we employ involves stabilization of the variance of the series, trend fitting, seasonal adjustment through the use of the dummy variable method, and the autoregressive moving average (ARMA) cyclical representation. Forecasts are presented for the period following the end of the dataset. These forecasts mimic the time series properties of the air miles series very well. We produce forecasts in real time for the last five years of the data set and find that the model performs well as judged by traditional forecast measures.

#### INTRODUCTION

International air passenger travel was interrupted by the events of September 11, 2001. It is somewhat surprising to learn how quickly this series of international revenue passenger miles get back to trend following that interruption. Forecasting such a series is clearly important to air carriers as they attempt to predict utilization, costs, input requirements and the like for future years and months, but these methods may also be useful for other policymakers as they attempt to predict the requirement for other services and to assess the impact of other causes of disruptions in service.

# **DATA**

For this project monthly measures of international air revenue passenger miles of US carriers were collected for the range, January 1996 to November 2011. The source of the data is the Research and Innovative Technology Administration of the Bureau of Transportation Statistics [5].

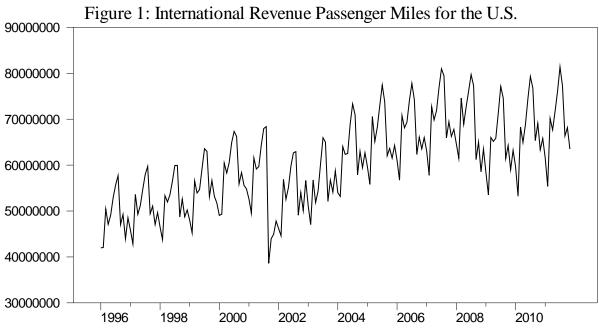
The series is shown in Figure 1. Several time series properties are easily observed from the figure. First, the series displays a mild (though significant) upward trend. Second, the repetitive seasonal nature of the data is obvious. Third, the effects on the series of the events of September 11, 2001 are clear with the sharp drop in the series at that date. Finally, we also observe that the variance of the series is positively related to its level.

#### METHOD AND ESTIMATION RESULTS

#### **Transformation**

The last observation from the previous paragraph led us to consider modeling in either the square root or the natural log of the series. These are the two most common methods for transforming a time series so that the variance is relatively constant. Figure 2 is the series in (natural) log form. The time series properties described above are still evident on Figure 2 with the exception that the variance of the series is

now relatively constant. The square root transformation (not depicted) did not stabilize the variance of the series as well as the log transformation.



50000000 - 40000000 - 1996 1998 2000 2002 2004 2006 2008 2010

Figure 2: Log of International Revenue Passenger Miles for the U.S.

18.3 - 18.1 - 18.0 - 17.9 - 17.8 - 17.7 - 17.7 - 17.8 - 17.7 - 17.8 - 17.7 - 17.

# **Choosing a Trend**

1996

17.6

17.5

17.4

The second step in modeling the series is to choose a trend to fit to the data in log form. We entertained a simple linear trend (though in logs, it's often called a log-trend) and a quadratic trend in logs as well.

2004

2006

2002

1998

2000

2008

2010

Standard complexity penalized model selection criteria were employed in choosing the remainder of the modeling. The two standard penalized likelihood selection criteria are the Akaike information criterion (AIC) and the Schwarz information criterion (SIC) represented as follows:

$$AIC = (2k/T) + log(\sigma^2)$$
 (1)

$$SIC = [k\log(T)/T] + \log(\sigma^2), \tag{2}$$

where k is the total number of estimated coefficients in the equation, T is the number of usable observations, and  $\sigma^2$  is the scalar estimate of the variance of the equation's disturbance term. In this particular case the AIC and the SIC are very nearly identical for the simple trend and the quadratic trend. We choose the more parsimonious simple trend for further modeling.

Also included in the trend model (and all subsequent estimations) is a "pulse" dummy variable to account for the drop in the series that occurs in September of 2001. We choose a pulse dummy because the series returns to trend relatively quickly and (as indicated later) the forecasting equation will eventually include autoregressive and moving average terms. It could, of course, be argued in favor of other dummy variable representations for the 9-11 effect.

#### **Modeling the Seasonality**

The seasonality of the series is modeled via a set of dummy variables. Eleven dummy variables (one fewer than the number of months, since each equation includes an intercept) were created and included in the regression.

Though the data are clearly seasonal by casual observation, we nonetheless also relied in the standard F-test and the values of the *AIC* and *SIC* to determine whether or not the series was subject to seasonal variation. As anticipated, a null hypothesis of non-seasonality was rejected resoundingly for the air miles data. (These results are available from the authors on request.)

Figure 3 depicts a fit to the data including the simple trend, the seasonal dummies and the 9/11 dummy variable.

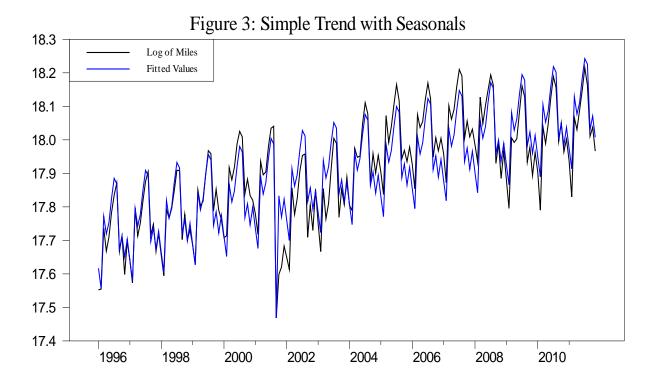
#### **Modeling Cycles**

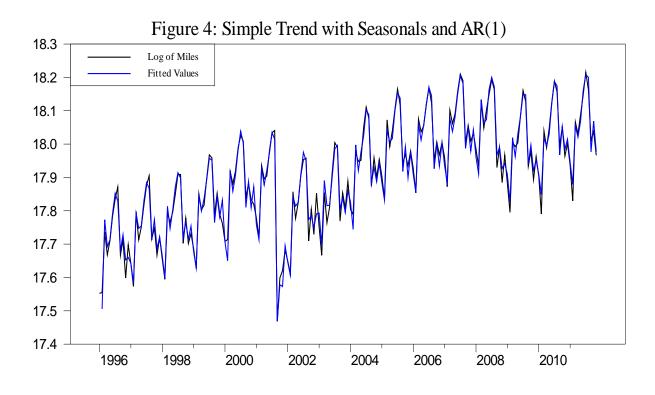
Notice that in Figure 3, the trend and seasonality are clearly well modeled, but the fitted values do not "cling" to the series when the series moves above or below the fitted values. That indicates that there are cycles in the data. A visual examination of the residuals from the estimation with trend and seasonality variables entered in the regression also reveals that the residuals exhibit autocorrelation—confirming the presence of cycles.

Examination of the autocorrelations and partial autocorrelations of the residual series reveals that the autocorrelations "tail off" and the partials "cut off" after lag 1. This behavior is indicative of a first order autoregressive representation, often called an AR(1), of the cyclical nature of the series. Thus we choose to add to the model that additional parameter estimate. Needless to say, the first-order autoregressive term is highly significant statistically.

The software we used in this research also allow for "automatic" choice for modeling cycles in the residual series. Using that procedure, based on the AIC and SIC, a model with the first-order

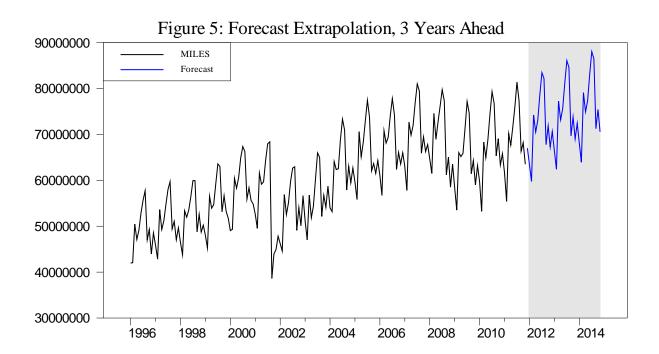
autoregressive *and* a first-order moving average term are chosen. We also use that model for forecasting with somewhat improved results. The graph of that model is nearly identical to figure 4, and thus not displayed.





#### FORECASTING RESULTS

As a first exercise in forecasting, we produced forecasts extending past the known data. These forecasts cannot be judged for accuracy (until time passes), but they should exhibit the times series properties of this data set. Figure 5 is the graph of the actual data series with the forecasts represented in the shaded area past the end of the data set. Note here that the transformation into natural logs has been "undone" by taking the anti-logs of the series and the forecasts.



In order to judge the forecast accuracy of a model, it is usually advisable to generate forecasts in "real time" for known values of the series. The idea is to estimate the model using a sub-sample of the data less than the full sample, produce forecasts from that model and compare the forecasts to the actual values. Here, we estimate the model from the beginning of the data through December of 2006 and then produce forecasts for twelve steps ahead (January 2007 through December 2007). Then the model is reestimated, adding January 2007 to the estimation period, forecasts are generated for February 2007 through January 2008. This method is called sequential updating. In this way we are able to produce 60 one-step ahead forecasts, 59 two-step ahead forecasts, and so forth. These forecasts can then be compared to the actual values of the series to assess forecast accuracy.

The results of that exercise are summarized in Table I. Forecasts at each horizon are compared to the actual values by means of standard measures of forecast accuracy. The definitions of these statistics are as follows:

$$Mean\ error = \frac{\sum (actual-forecast)}{T}$$
 (3)

$$Mean \ absolute \ error = \frac{\sum |actual - forecast|}{T}$$
 (4)

Root mean squared error = 
$$\sqrt{\frac{\Sigma(Actual-forecast)^2}{T}}$$
 (5)

Theil's 
$$U = \frac{RMSE \ model}{RMSE \ naive}$$
 (6)

Where T is the number of forecast periods, and the RMSE naïve represents the forecasts of no change in the series.

The mean error at one step ahead is approximately zero (the value of the series is about 18 working in logs, so the mean error of -0.0022739 working in logs is only -0.0001263 as a proportion). Also, at one step ahead, the RMSE is about .02161, or a little over one-tenth of one percent of the mean value of the series. That is very small. Theil's U indicates that this forecasting model is considerably more accurate than a naïve forecast.

As expected the forecast errors are larger the farther ahead you forecast in general and Theil's U shows that the forecasts from the model are superior to the last known value of the series. Theil's U increases considerably at 12 steps ahead. This is because there is not much trend in this dataset, and there is a significant amount of seasonality. For this reason, the actual value twelve steps ahead is generally very close to value twelve months prior. However, a Theil's U of .90 still considerably outperforms the naïve forecast.

Table I: Forecast Error Statistics, AR Model

		Mean			
Steps	Mean	Absolute	RMS Error	Theil's	Obs
Ahead	Error	Error		U	
1	-0.0022739	0.0176696	0.0216105	0.2125	60
2	-0.0041244	0.0216662	0.0259653	0.2132	59
3	-0.0057847	0.0252462	0.0303724	0.2157	58
4	-0.0073922	0.0296147	0.0348217	0.2169	57
5	-0.0089098	0.0328857	0.0385220	0.2268	56
6	-0.0107532	0.0343536	0.0404595	0.2123	55
7	-0.0124804	0.0370219	0.0428528	0.2503	54
8	-0.0142906	0.0378767	0.0440188	0.2671	53
9	-0.0160589	0.0389867	0.0452091	0.3123	52
10	-0.0178693	0.0404481	0.0463359	0.3661	51
11	-0.0196736	0.0410867	0.0467377	0.4199	50
12	-0.0214184	0.0414010	0.0471722	0.9024	49

Recall that the "automatic fit" for cycles chose a cyclical model with a first order regressive term and a first order moving average term, that is, an ARMA(1,1). We estimated that model as well. It is interesting to note that while the moving average term does not meet strict tests of statistical significance, the estimation does produce better forecasting results. Table II presents the same forecast statistics for the model with a first-order moving average term included. For most forecast horizons, the forecast improvements for the ARMA model are small, but at 12 steps ahead (one year) the forecasts are almost 7% more accurate. We do not have a ready explanation of that particular result.

Table II: Forecast Error Statistics, ARMA Model

		Mean			
Steps	Mean	Absolute	RMS Error	Theil's	Obs
Ahead	Error	Error		U	
1	-0.00159	0.017257	0.021093	0.2074	60
2	-0.00270	0.019996	0.024586	0.2018	59
3	-0.00392	0.022945	0.027927	0.1984	58
4	-0.00518	0.025938	0.031590	0.1968	57
5	-0.00636	0.028840	0.034690	0.2043	56
6	-0.00788	0.029886	0.036413	0.1911	55
7	-0.00929	0.032957	0.039326	0.2297	54
8	-0.01085	0.034156	0.040668	0.2468	53
9	-0.01242	0.035177	0.041964	0.2899	52
10	-0.01404	0.036377	0.043374	0.3427	51
11	-0.01571	0.036859	0.043743	0.3930	50
12	-0.01753	0.037056	0.043987	0.8415	49

Forecasts can be tested for "optimality" with respect to the data from which the forecasts were generated. This test is known as a Mincer-Zarnowicz (M-Z) [5] regression:

$$y_{t+h} = \beta_0 + \beta_1 y_{t+h,t} + u_t \tag{7}$$

where y is the forecast variable, h is the number of steps ahead, t is the current time period, and  $u_t$  is the white noise error term. The test for optimality is then the joint hypothesis that  $(\beta_0, \beta_1) = (0, 1)$ . The test is whether or not the forecasts are equal, on average, to the realized values of the series. The results of the M-Z test for the ARMA model at the one-step ahead horizon indicate that the model is optimal in the sense of Mincer and Zarnowicz. The calculated value of  $F_{(2,58)} = 0.453$ , with a p-value of 0.64, indicates that the estimates of  $\beta_0$  and  $\beta_1$  do not differ from 0 and 1 respectively.

#### **CONCLUSIONS**

This paper takes a classical approach to modeling and forecasting international airline passenger miles for US carriers. We identify trend, seasonal, cyclical components, and model the effect of the events of September 11, 2001 as a dummy (intervention) variable. The model performs well in terms of traditional forecast statistics, showing significant superiority to a naïve forecasting standard. The model also passes easily the Mincer-Zarnowicz test of optimality.

Forecasts such as those produced here can be adapted to, and be useful for, predicting individual carrier demand, airport use, personnel demand, and many other activities related to air travel. Models such as the one produced here are also useful in forecasting seasonal, cyclical, and long-term levels of variables of interest. Such estimations are also valuable in predicting the effects, both short-term and long-term, of interruptions in the series. In the case of international air travel, it is perhaps surprising how quickly the series seemed to have returned to trend following an unprecedented interruption.

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# EXPLORING THE OPPORTUNITY FOR PRICE BUNDLING OF THE ATTRACTIONS OF MYRTLE BEACH

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#### **ABSTRACT**

The Myrtle Beach area offers a broad assortment of entertainment and amusement options for visitors. This paper examines the possibility of price bundling of area attractions to offer a lower price to consumers. Two options are advanced: Targeted Selections and Broader Selections. Finally, implementation issues are addressed and discussed.

#### INTRODUCTION

This meeting of Southeast infORMS is taking place in Myrtle Beach, SC. The Grand Strand (a 60-mile stretch of beaches running from Little River, SC to Georgetown, SC) welcomes approximately 14 million visitors annually. Consistent with its positioning as a family destination, 62% of visitors are families that stay, on average, 5 days in the area [7]. During their stays, these visitors dine in 1,900 restaurants, stay in some 100,000 hotels and condo rooms, and enjoy 100+ golf courses, 46 mini-golf courses, 9 musical theaters, 6 major indoor or outdoor shopping areas, as well as a large and complex assortment of nationally known attractions and amusements.

The purpose of this manuscript is to explore the possibility of price bundling of the attractions in the Myrtle Beach tourism market. While individual firms have done price bundling of their company-owned attractions in the past, the idea of bundling across tourism operators will be advanced here. First, a review of the literature is provided, including a focus on price bundling in the tourism industry. Second, two approaches to price bundling are presented and an application to the Grand Strand market is provided. Finally, some structural challenges to a cross-operator price bundling package are discussed and possible solutions are recommended for consideration.

#### LITERATURE REVIEW

# **Price Bundling**

Price bundling is the practice of offering two or more products or services for a single package price. Marketers have the option of employing a pure bundling strategy (i.e., the products and/or services are only available as a package) or a mixed bundling strategy (i.e., the consumer can choose between purchasing the products and/or services individually or as a package). For purposes of this discussion, the focus will largely be on mixed bundling. There are two forms of mixed bundling [3]:

- 1. **Mixed-leader bundling**, also referred to as tie-ins, involves offering a discounted price on an additional product or service when a specified product or service is purchased at the regular price.
- 2. **Mixed-joint bundling** involves offering a single, discounted price when multiple products and/or services are purchased simultaneously as a package.

The economic motivation behind bundling is to increase revenue and, ultimately, profitability. Bundling increases revenue by generating increased revenue per customer transaction and/or by increasing the frequency of transactions. For example, with pure bundling, customers may pay a higher price for a package of products and/or services or they may purchase a competitively priced product more frequently due to the positive perception of the price/value relationship generated as a result of the bundled offering. With mixed bundling, the customer may purchase additional products and services as components of a package that they may not have elected to purchase otherwise. This is accomplished through the transfer of the consumer surplus from the product or service highly valued by the consumer to the additional products and/or services included in the bundled offering. The consumer surplus represents the difference between the reservation price (i.e., the maximum price the customer is willing to pay for a product or service), and the actual price paid [3]. So, for example, the buyer would have paid \$20 for entry into a preferred attraction but elects to buy the bundle for \$30 thinking the added attractions for the marginal \$10 are well worth it, particularly given the 'good deal' s/he received on the primary entry fee.

Effective marketers must consider the potential impact of bundling on profitability. With mixed bundling, the impact on profitability may be more difficult to discern. Revenue gains may be generated due to cross selling, which occurs when the buyer of one or more products and/or services purchases additional products and/or services as a result of the bundled offering(s). Additionally, revenue can be increased by the attraction of new consumers who find the bundled approach appealing. However, these revenue gains may be partially offset by sales to existing customers that may have purchased the products and/or services individually (at a higher price point generating greater revenues) but now take advantage of the bundled discount. As a result, it is important for marketers to closely monitor and estimate the cost of cannibalization that may occur as a result of a mixed bundling strategy [3].

It should be noted that a pure bundle approach may negatively impact short-term profitability, but enhance profitability in the long run due to increased customer loyalty and retention. In addition, if a firm's competitors choose to employ pure bundling strategies, it may become necessary for a firm to offer a comparable package of products and/or services to remain competitive [3].

#### **Price Bundling in the Tourism Industry**

Price bundling frequently occurs in the hospitality, travel, and tourism industry. Perhaps the most basic and frequent form of bundling occurs when a firm provides a combination of its own products and/or services as a package available to the consumer at a competitive price. For instance, a select-service hotel includes a 'complimentary' breakfast to each overnight hotel guest (i.e., pure bundling), or a fast-food restaurant provides a 'value meal' that includes fries and a drink along with a sandwich (i.e., mixed joint bundling. The bundling of tourist attractions within a single destination, which are operated by a variety of organizations however, is much more complex than creating value meals by a single restaurant company. Consequently, previous research related to the sale of travel packages through Online Travel Companies (or, OTCs) such as Expedia, Travelocity, and Priceline, may more closely parallel the bundling of tourism attractions by third-parties.

The online exchange of travel products and services has continued to grow over the past decade with the Expedia (an OTC) reporting that, in 2010, OTCs controlled fifty-four (54%) of all travel sales in the United States and thirty-eight (38%) of revenue share in the U.S., Europe, and Asian-Pacific regions combined [2]. Online Travel Companies attempt to lure travelers to their websites with the promise of substantial savings coupled with the convenience of one-stop shopping since all components of the vacation experience can often be booked as a single package. Research indicates that the purchase of bundled travel packages through OTCs, as opposed to purchasing the package components separately from the individual service providers, may provide savings to the consumer, with higher level of savings occurring when high quality hotels (four-stars and above), rather than lower quality hotels (one-to-threestars) are included in the travel package [4].

#### TWO APPROACHES TO PRICE BUNDLING FOR THE TOURISM MARKET

CityPASS and Smart Destinations, Inc. are two companies that currently provide discounted access to multiple attractions, utilizing a mixed—joint bundle format, in multiple major cities located throughout the United States and Canada. For comparison, an overview of these two operators is provided below.

#### **Targeted Selection Option: CityPASS**

CityPASS is a privately-owned company that offers bundled pricing on a small or targeted list of attractions in 11 major U.S. and Canadian cities. CityPASS identifies the top attractions in a market and then offers visitors a chance to visit all of these targeted attractions (4-7 attractions per city) for low price. Buyers typically save approximately 50% off of separately-purchased admission [1]. Currently, the CityPASS program is available in the following markets:

- 1. Atlanta
- 2. Boston
- 3. Chicago
- 4. Hollywood
- 5. Houston
- 6. New York
- 7. Philadelphia
- 8. San Francisco
- 9. Seattle
- 10. Southern California
- 11. Toronto

# **Broader Selection Option: Smart Destination (Go XYZ Cards)**

Smart Destinations, Inc. offers bundled pricing on a larger assortment of attractions in 9 major U.S. cities. Unlike CityPASS which offers a smaller-but—targeted list of attractions per city, Smart Destinations offers a much larger list of attractions for one fee. Buyers can then choose the specific attractions they Consumers typically save approximately 50% off of separately-purchased admission [6]. Currently, the Smart Destinations program is available in the following markets:

- 1. Boston
- 2. Chicago
- 3. Los Angeles
- 4. Miami
- 5. Orlando
- 6. San Diego
- 7. New York
- 8. Oahu
- 9. San Francisco

Table One provides an overview of the CityPass and Smart Destination programs for Boston and Chicago to illustrate the differences in their respective approaches.

**Table One – CityPass and Smart Destination Programs for Boston and Chicago** 

CityPas	ss Program	Smart Destinat	ion Program
Inclusions	Price	Inclusions	Price
BOSTON  1. New England Aquarium 2. Museum of Fine Arts, Boston 3. Museum of Science 4. Skywalk Observatory 5. Harvard Museum of Natural History OR Revolutionary Boston at the Old State House	Adult = \$46 Child = \$29 (3-11) Cost if Purchased Separately: Adult = \$90 Child = \$57  Estimated savings of 49% Pass is valid for 9 days after initial activation.	More than 58 attractions included. The TOP TEN highlighted attractions are:  1. New England Aquarium 2. Boston Duck Tour (original) 3. USS Constitution Cruise 4. Museum of Science 5. Fenway Park Tour 6. Paul Revere House 7. Freedom Trail® Walking Tour 8. Skywalk Observatory 9. Plimoth Plantation 10. Hop on/Hop Off Beantown Trolley	1-Day Adult = \$59.99 Child = \$39.99  2-Day Adult = \$79.99 Child = \$57.99  3-Day Adult = \$119.99 Child = \$93.99  5-Day Adult = \$164.99 Child = \$109.99  7-Day Adult = \$194.99 Child = \$144.99 Save up to 55% over regular admission rates.
CHICAGO  1. Shedd Aquarium 2. The Field Museum 3. Skydeck Chicago 4. Adler Planetarium OR Art Institute of Chicago 5. John Hancock Observatory OR Museum of Science and Industry	Adult = \$84 Child = \$69 (3-11)  Cost if Purchased Separately:  Adult = \$158 Child = \$136  Estimated savings of 52%  Pass is valid for 9 days after initial activation.	More than 26 attractions included. The TOP TEN highlighted attractions are:  1. Shedd Aquarium 2. SkyDeck Chicago - Willis Tower 3. Lake Cruise by Shoreline 4. Navy Pier - Metropolitan Pier & Exposition Authority 5. Grand Tour by Gray Line 6. Museum of Science and Industry Plus Omnimax 7. John Hancock Observatory 8. Adler Planetarium 9. The Field Museum 10. Art Institute of Chicago	1-Day Adult = \$71.99 Child = \$52.99  2-Day Adult = \$104.99 Child = \$74.99  3-Day Adult = \$134.99 Child = \$99.99  5-Day Adult = \$159.99 Child = \$119.99  7-Day Adult = \$179.99 Child = \$139.99 Save up to 55% over regular admission rates.

Sources: [1, 6]

#### TWO PRICE BUNDLING MODELS FOR THE GRAND STRAND MARKET

#### **Targeted Selection (The CityPASS Model)**

The Myrtle Beach area contains a great diversity of attractions and amusements. Using a targeted selection strategy, specific options must be identified. US News & World Report, for example, lists the following TOP TEN Best Things to Do in Myrtle Beach [8].

- 1. Myrtle Beach Beachfront (Free)
- 2. Mt. Atlanticus Miniature Golf
- 3. The Carolina Opry
- 4. Myrtle Beach State Park
- 5. Ripley's Aquarium
- 6. Alabama Theatre
- 7. Legends Golf Club
- 8. Family Kingdom Amusement Park
- 9. Myrtle Waves Water Park
- 10. NASCAR SpeedPark

The above list is <u>not</u> meant to advocate a CityPASS portfolio with these specific attractions. Rather, the intent is to illustrate the application of the targeted selections option. The presence of the Beach in Myrtle Beach is noteworthy. The area boasts of 60-miles of white sandy beaches that are free for all to enjoy. The beaches draw visitors to the community. It can be argued the beach represents a public good that is embedded in the product offering of all marketers in the area. However, all marketers compete with the consumer option to spend no money while having a lazy day sitting on the beach. So, the public good draws visitors to the area while concurrently presented very formidable competition to other attractions [5].

#### **Broader Selection (The Smart Destinations Model)**

Following the example of the Go Orlando Card (as Orlando is a similar family-destination filled with similar non-theme-park attractions), buyers would pay one price for admission to a broad cross-section of the entertainment portfolio of the area. The entire portfolio could be offered for one total price. And, if desired, some forced choice could be offered. A few examples are listed below:

- Pick one Dinner Theater Show: Pirates Voyage Dinner Theater OR Medieval Times.
- Pick one water park: Myrtle Waves OR Wild Water and Wheels.
- Pick two musical theater shows: Carolina Opry, Alabama Theater One Show, or Palace Theater, or Legends in Concert.
- Pick up to five rounds of Miniature Golf from an approved list of courses.
- Pick one round of golf from an approved list of courses.

**Table Two** provides an overview of the Go Orlando Card for illustration.

Table Two - Go Orlando Card

Inclusions on Go Orlando Card	Cost of	Projected Savings to
	Go Orlando Card	Consumers
<ol> <li>More than 48 attractions included. The TOP TEN highlighted attractions are:</li> <li>Wonderworks General Admission</li> <li>Gatorland: The Alligator Capital of the World</li> <li>Titanic: The Experience</li> <li>Boggy Creek Airboats Scenic Nature Tour</li> <li>Daytona International Speedway All Access Tour</li> <li>Fun Spot Action Park</li> <li>The Haunted Grimm House</li> <li>Kennedy Space Center Visitor Complex 2 Day Admission</li> <li>Ripley's Believe It Or Not! Odditorium</li> <li>Arabian Nights Dinner Theater</li> </ol>	1-Day Adult = \$79.99 Child = \$69.99 2-Day Adult = \$109.99 Child = \$87.99 3-Day Adult = \$184.99 Child = \$142.99 5-Day Adult = \$234.99 Child = \$182.99 7-Day Adult = \$274.99 Child = \$219.99	Save up to 50% over regular admission rates.

Source: [6]

Using the same pricing as the Go Orlando card, the price for a family of four (2 adults, 2 children) to attend all included area attractions for 3-, 5-, and 7-days are provided below:

- 3-day = \$656
- 5-day = \$836
- 7-day = \$990

Under this approach, families would have certainly of the cost of the entertainment for their family vacation by buying the bundle. And, these same families may visit a broader cross-section of the portfolio of attractions given it was on in their pre-purchased list of options. And, as noted in the literature review, the likelihood of these 'add-on' visits may be increased as the consumer 'spends' the consumer surplus realized.

# STRUCTURAL CHALLENGES TO IMPLEMENTATION

The Myrtle Beach tourism market consists of a large number of operators who each operate a single- or small-number of attractions. And, new attractions have been added recently (WonderWorks, Myrtle Beach Sky Wheel, and others) while and several others have undergone major renovations or theme changes (such as the former Dixie Stampede to the now Pirates Voyage Fun, Feast, and Adventure). This alone suggests that investors believe the market is very attractive for further development. The increase in entertainment options may increase the total visitors to the region, thus providing for increases in

profitability. If, on the other hand, the number of visitors remains constant, there are more operators competing for the same entertainment dollar and could push down unit profitability.

It is possible that a well-designed price bundling plan may bring more visitors to the region. However, a poorly designed program may result in operators serving the same number of guests but realizing lower total revenue to do so. And, any bundling plan advanced will require independent operators to achieve a high level of trust and cooperation to ensure the success of the program. Outlined below is a brief discussion of the key challenges to establishing a mixed-joint bundle of Myrtle Beach attractions as well as some recommended strategies to (hopefully) overcome them.

# Challenge #1: The Business Model of the Bundler

A CityPASS or Smart Destinations, Inc. (Go Myrtle Beach) approach to establishing a mixed-joint bundle of Myrtle Beach attractions typically involves the vendor, often referred to as an aggregator, to negotiate deep discounts, often of fifty percent (50%) or more, on tickets to the various attractions. In many cases, the aggregator may also negotiate access to these tickets, particularly for high demand attractions which may include a specific number of tickets for specific dates and/or last ticket availability. The aggregator collects payment for the bundle of services directly from the customer at the retail price of the bundle and remits payment to the vendors following actual consumption of the services. The aggregator retains the margin, or the difference between the retail price collected and the discounted prices paid to the service providers, as well as any package breakage. In this case, the breakage would be the aggregator takes in money for visits to attractions that are never visited. So, the aggregator pockets this amount.

The challenge with this business model is the deep discounts that must be offered by the participating attractions to participate in the bundle. Many Myrtle Beach attractions are small, local, and/or family businesses that operate on modest profit margins. Consequently, many of these firms may not be able or willing to offer the deep discounts required to participate in such bundles.

**Possible Solution:** Use of a Not-for-Profit Bundler such as a trade association to perform the bundling function (and sell the passes).

# Challenge #2: Myrtle Beach as a Beach and Golfing Destination

The top tourist attraction in Myrtle Beach is the beach, which has no access fee. In addition, many of the Spring and Fall visitors, in particular, arrive to golf on the more than one-hundred (100) golf courses in the area. Consequently, many tourists may plan to spend a major portion of their visit to the area on the beach or golf course and may be reluctant to invest a significant amount of their vacation budget on an attractions pass. Obviously, Myrtle Beach tourism attractions see increased business volumes when inclement weather moves into the area. As a result, area attractions, particularly attractions with operating hours in the morning and/or afternoon, may be less enthusiastic about redeeming deeply discounted passes on rainy or low temperature days.

**Possible Solution:** Use of Variable Compensation to participating attractions depending upon the timing of redemption or visitation by the pass holder.

#### Challenge #3: Seasonal Demand of Myrtle Beach

Myrtle Beach is a seasonal market with a peak season that runs from Memorial Day weekend to Labor Day weekend. The shoulder seasons, which are the peak golf seasons, run from mid-February through May and September through mid-November, with the off-season running from mid-November through mid-February. Demand for the various attractions varies by the season due to the changing demographics and psychographics of the Myrtle Beach visitor. Many of the attractions experience overwhelming demand from mid-June through early August and lagging attendance the rest of the year. One strategy

has been the use of local discounts offered during these non-peak periods of demand. So, these attractions may be more willing to participate in a bundle during their non-peak season and would rather opt-out during the season (when, assumedly, they have adequate demand).

Possible Solution: Adjust the portfolio or participating attractions based on season of year (and concurrent aggregated demand).

### Challenge #4: Variation in Cost Structures of Participant Firms in the Bundle

The various Myrtle Beach attractions have considerably different cost structures and ability or willingness to discount. For example, there is minimal incremental cost associated with a musical theater (Carolina Opry, Alabama Theater, Palace Theater, and others) other than guest ticketing and entry, exit, and services In addition, there is a wide variety of price points for attractions ranging from \$10 to over \$50 per person. High demand attractions, such as the Pirates Voyage, may not be willing to discount, particularly during the peak tourist season.

**Possible Solution:** Direct consumer choices to ensure broader visitation of attractions.

# Challenge #5: Calculating the Impact on Profitability

One challenge that marketers face when implementing discounting programs in an effort to increase revenue is to calculate the cost of cannibalized sales. In this case, the trading of a full-fare paying guest for discounted-fare guest. Absent the bundle, would consumers have been willing to pay the full retail price of the attraction? While service providers will be fully aware of the number of attraction passes that are redeemed at their specific location, it may be more difficult to determine whether this represents incremental or new business or if the attraction is discounting business that it may have received had the business not elected to participate in the attractions pass program.

**Possible Solution:** Appoint a trusted 3<sup>rd</sup> party facilitator such as local University or Foundation.

#### SUMMARY AND CONCLUSIONS

Price bundling has been an important part of the Myrtle Beach market for some time as hotels have worked cooperatively with local golf courses and Myrtle Beach Golf Holiday to merchandise golf packages and attract out-of-town guests. And, owners of related attractions (Ripley's, Burroughs and Chapin, etc.) have self-bundled their own attractions. What is advanced here is the potential to bundle separately-owned attractions into an attractive package for the nearly 14 million visitors who vacation in Myrtle Beach each year. It represents an interesting opportunity with some possible impediments to its implementation. In these pages, we attempted to provide frameworks for discussions by local leaders.

As visitors to the Southeast infORMS meetings in Myrtle Beach, we will be able to watch the market to see if such price bundling programs are developed and in what form it is done. That will be the subject of a future Southeast infORMS presented. Stay tuned!

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# How has Cuisine Identity Sustained the Fancy Food Markets Throughout the worlds Food Distribution Systems?

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#### **Abstract**

Despite some rough years, specialty food sales are strong According to the National Association for the Specialty Food Trade (NASFT) "2011 State of the Specialty Food Industry" report; retail sales increased 7.4 percent in 2010 over the previous year, well above the rate of inflation. Total sales of specialty foods were at \$70.32 billion with \$55.92 billion sales at retail, notes the study, the collaboration with market researchers Mintel International and SPINS. This research will examine how cuisine identity has continued to support and grow this multi-billion dollar business throughout the world food markets. By identifying multiple cuisines the argument can be made that the distribution markets themselves are able to sustain these styles of food through the lens of the cuisine and the distribution systems that support them. By researching the fancy food markets or specialty food offerings your average consumer and retailer can determine the overall importance of the cuisine identity as a starting point and sustaining effort in this mutibillion dollar a year food enterprise.

**Keywords:** Cuisine Identity, Cajun Food History, Fancy Food, Sustainability and Food Offerings.

## **Defining Cuisine Identity**

A cuisine's identity is certain set of cooking traditions, techniques, and specific ingredients associated with a cultural history within multiple geographical areas. Throughout the world, the diversity of cuisines is a direct reflection of the multi-cultural differences derived from many factors that are particular to a specific cultural area. For example geography, immigration, economics, trade, politics, religion and ethnicity all play some role in the development of a particular cuisine. All of these subjects act collectively to affect ingredients, traditions, and

styles, which in turn affect our eating habits, flavor preferences, recipes, and dining etiquette. They are the primary determinants that sustain the fancy food markets and distinction of a particular cuisine that is embedded cultural identity and food consumption patterns. Currently cuisine and cookery has in some form been modernized to create what is known world cuisine and fusion cuisine. These new identities are quite different from classical cuisine. These two new styles do not have defined geographical boundaries they both derive their identity through food that is rooted in the creation of ingredients and techniques that utilize styles and cuisines from multiple locations around the world. The term fusion cuisine is the major reason that new cuisines have even been developed. Considering the numerous factors that influence cuisine and its identity, learning about a particular cuisine requires nothing more than a glossary of ingredients and recipes from traditional dishes. What a person eats is usually examined within a cultural context by combining some form history, ingredient availability, and heritage of its people. Take for example Cajun Cuisine. It fuses together or combines a multicultural perspective by incorporating a history of food eating habits and ingredients from the Frenchspeaking Acadian or "Cajun" immigrants deported by the British from Acadia in Canada to Louisiana in the United States. It is also noted to be a rustic cuisine do to its simplicity in preparation. This identity or cultural component holds true in the development of many cuisines and their basic cultural structure. Locally available ingredients that are predominate to the region with simple technique and preparation. An authentic Cajun meal is usually a three-pot affair, with one pot dedicated tot the main dish, one dedicated to steamed rice, special made sausages, or some other seafood dish, and the third containing whatever vegetable is plentiful or available. With blends of roughly diced onions, carrots and celery the incorporation of or French style of vegetable blends traditionally called mire poix are fused in to create a multicultural cuisine.

#### **Food and Identity:**

Brillat-Savarin's aphorism, which everyone's sites: "tell me what you eat and I'll tell you who you are." This quote is used quite often because like other antonyms, the truth is in the quote. We understand food and identity in many different way, m and has a mostly it has to do with the individual. Many of us have raised children knowing that probably at a certain point in their lives, they will announce "I'm not going to eat that, I'm a vegetarian" is probably one of the first assumptions of individual identity or indicates that the parents are vegetarians and the kids say "I'm not going to eat meat". It's a way of differentiating yourself. You're a vegetarian, you're the, your free grain, your raw foodist. However you differentiate yourself is a bad hit you where some time he can be quite private but I believe that in America society, is quite public.(13) many Americans sedum cells as being immersed in a giant stewpot, coming out is potluck, and all of these different dishes coming to the American restaurant and home. Now there are other rigid concepts that have to do less with cooking and more with the ingredients: where there come from, where there gathered and what they mean: who grew them: are they organic or genetically modified in any way etc... And then all of a sudden we place ourselves in a situation where we

can all sit down at the same table and eat together anymore, everyone returned to their roots and unfortunately each group has its own garden. How do we make it so that we can serve that basically good meal for everyone without the option of vegetarian, or Hindu bar or kosher, macrobiotico or Moslem. What we need to do is say we are a community, we'll all eat together, maybe we're not going to partake of foods but were going to release sit down together and not identify ourselves to the marketplace that we choose, this seems to be the only logical reasonable conclusion.(14)

# **Sustainable Agriculture:**

Before the recent surge in food prices, three of the largest providers of food products in the world, Nestle, Danone and Unilever, realized that sustainability is critical to secure a constant, growing, and save quantity of agricultural raw materials. The companies came together in 2002 to form thus sustainability agriculture initiative, a nonprofit organization dedicated to actively supporting the development of sustainability on a global agricultural front, participators included stakeholders of all of the food supply chain.

The SAI platform today includes 23 corporate members with estimated sales of \$340 billion; they actively work to promote sustainable agriculture as a productive, competitive and efficient way of producing agricultural products, while at the same time protecting and improving the natural environment and social economic conditions of regional and local communities. SAI members are organized in crop/issue specific working groups including: coffee, dairy, fruit, potatoes vegetables-cereals, and water and agriculture. Working group members meet on a regular basis to share information and knowledge on sustainable agriculture practices. Each member company carries out in-house pilot projects on certain crops are populated issues in their supply chain. After completion of a pilot project a cost benefit analysis is carried out in order to assess the sustainability performance, and the results are widely disseminated. (17)

# **Sustainable Seafood Cooking Class:**

Fine dining sustainable seafood where, when and how are questions being asked by chefs across the country. In California Chef Jenn Felmty offers a three-part sustainable seafood cooking class at the sea rocket Bristol in San Diego. He instructs students on where to, when to buy and how to buy sustainable products. He focuses on what is available locally and in season these classes provide the student fulfillment on his environmental, and foodie sides. Sustainable seafood classes teach students how to entertain themselves friends and guests with a showcase of sustainable seafood dinners. Students prepare served and consumed a menu of truly local flavors, pure curing food directly from regional farmers, fishermen and ranchers. They focus on sustainable harvest seafood organic produce and pastured meats, local beers and local wines, providing the student with a sustainable fine dining experience (Voice). The United States is at the forefront of sustainable seafood with farms across the country providing consumers with a variety of fish and crustaceans, salmon, trout and oysters, clams, mussels etc.

The Monterey aquarium is an organization that is providing a tool to help and guide people in the search for sustainable seafood. The aquarium website contains "Seafood Watch", a program that provides the public with one of the best sources of national information on sustainable seafood. The website for Seafood Watch contains a pocket guide which is printable charts that discuss sustainable seafood that consumers can utilize in their area of the country. The guides are organized by regions Pennsylvania is in the southern region. Each region is categorized and charted so that the consumer can make a judgment as to alternatives for choices to avoid or dine on. The guides are changed and updated twice annually, so it is necessary to constantly monitor and reprint them. The guide provides consumers with recommendations for seafood to buy or avoid, helping businesses and consumer to become advocates for ocean friendly seafood. The website provides other information such as recipes, information about restaurants that utilize sustainable practices and iPod applications. An example of the guide is shown below:

# Select a Seafood Watch Pocket Guide

Learn more about our January 2012 updates

- Want to order a large quantity of pocket guides?
- Download Adobe Acrobat Reader

Carry the pocket guide that's right for your region to help you choose ocean-friendly seafood wherever you live or travel. **Click on your state on the map below** to determine the pocket guide that's right for you. If you live near a boundary between two regions, we suggest that you look at both pocket guides and pick the one that lists the seafood items commonly found where you live.



The general public tends to think of sustainable seafood, as fish that is farmer raised only. Farm raise fish however, does not appear on the unsustainable fish of Seafood Watch, because farm raised fish can actually harm the seas. Although while fish are not killed or captured in theory by forms, many of the byproducts of fish farms actually can be just as or more than harmful to see creatures and commercial fishing. For one thing the fish produce a lot of waste. The waste may sit in pens and dirty ocean water. Food and animal waste to collect and seriously damage the surrounding habitat. Also other fish and sea creatures can become trapped in nets and other fishing tools used to safeguard the farm fish. Many see farmers are however attempting to be more eco-conscious and fish farming may then often be an excellent way to be eco-friendly (McCammon).

# **Farmside Fine Dining**

Farmside Fine Dining adds an unexpected element to sustainability. The increasing popularity of dining farm side is bringing the best and freshest products to the dining table. For a unique experience the Colorado for Meadows, larks farm dinners offers a unique experience. Larks farm offers a partnership with local and regional farmers and creative ways. They evaluate the type of crops being grown at each farm and then create full meals out of these crops. Many farmers are happy to serve as the host or server, and proud to see their crops transformed into meals enjoyed by patrons from all over the world. This unique partnerships: rates and environment of community and sustainability that make sustainability special. An example of this experience can be found at BlackBerry farm utilize on site restaurants providing patrons with meals utilizing local products influenced by the Smokey Mountains as well as fine dining trends. They provide the consumer with comfort food as well as haute food. The farm has something for everyone, all created from seasonal crops grown at the farm (Stewart)..

There are many benefits to farm size dining, and one of them is the ability to incorporate community involvement and inclusion. In many cases resident and regional chefs will volunteer to create fine dining experiences at farm dining advance. This type of community involvement allows a relationship between sustainable farmers, the restaurant industry, customers and local and regional purveyors. This type of activity provides a conduit for continued community involvement and promotes organizations within the community to host farm dinners on participating farms. Sustainable fine dining is more than reducing the use of endangered products but involves farmers, local communities and the region. Farm side dining allows harmony between these competing units.

#### **Conclusion:**

Triple Michelin Starred Pierre Gagnaire, his approach to fine cuisine has it made him one of the world's most respected culinary practitioners today and that is why people are listening when he is waging an unusual campaign. He's trying to warn the consumer of fine dining that the environment cannot sustain the demands of worldwide audience for truly natural food products. Among his warnings: while fish will disappear in the next 5 to 10 years, what will remain will be farmed fish. Demand for certain species of fish will soon make them extinct. The list includes many species of shark and bluefin tuna. Exotic and in demand fruits and vegetables are becoming impossible to find there are dangers that restaurants without the best and most solid suppliers may have to close due to lack of ingredients. His bottom line is that suppliers just can't cope with the demands of good fine dining restaurants. He predicts large numbers of closing in the years to come along with prices that may double triple and quadruple for today's top level menu prices.(Burns)

# SOCIAL NETWORKING PRIVACY TOOLS: EASE OF USE AND DEGREE OF CONTROL

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#### ABSTRACT

This research explored the ease of use and degree of control for privacy tools available on social networking sites. Data was gathered from fifty web sites chosen on the basis on their popularity and usage. The number and type of privacy tools available were recorded. Overall, sixty-nine privacy tools were identified and categorized into four types of information, namely profile, personal, social and professional. Ease of use and degree of control were recorded using an applicable seven point Likert scale. In general while privacy tools were relatively easy to locate, there use was a much more arduous task especially for novice users with little knowledge about privacy settings. Additionally regarding degree of control, most privacy tools gave users little to no leverage to customize them to meet their specific needs. As the number of privacy tools for social networking continues to increase, this area of research becomes even more important to the issue of privacy on social networking sites.

#### INTRODUCTION

Social networking has become a global phenomenon; individuals use it as a landscape to exchange information (Boyd & Ellison 2008). Different types of information such as personal interests, social and professional information are shared in social networking sites (SNS) (Vasalou et al. 2010). In addition, a lot of personally identifiable information is collected during the account sign-up process (Bonneau & Preibusch 2009b). Past trends have shown that the information shared on SNS is vulnerable to many threats (Pilkington 2007). For instance, prospective and current employers (Finder 2006), educational institutions, and other third-party websites (Fogel et al. 2009) use the information on social networking websites for consumer profiling. In some cases it has resulted in damaging consequences for both SNS as well as their users (Rosenblum 2007).

The social networking organizations have been reactive and are increasingly developing several privacy tools to protect user information (Narayanaswamy & McGrath 2012). However, the privacy tools are useful only if the users know to apply them to protect their information. Inasmuch, social networking users are expected to act as system and policy administrators to protect their online content (Ahn et al. 2011). Thus, from a user standpoint it is not only imperative to understand the availability of various privacy controls but also learn how to activate and manipulate them in order to effectively protect their online content.

The main objective of this study is to explore the ease of use and degree of control with respect to various privacy tools available in SNS. The rationale is drawn from the technology acceptance research which contends that individuals intend to use a technology when it requires less effort and is perceived to be beneficial (Venkatesh et al. 2003; Venkatesh et al. 2012). These concepts are captured using ease of use, which refers to the degree of effort required to use the privacy tools, and degree of control, which is the leverage users have to manipulate the privacy tools. The ease of use and degree of control are analyzed for privacy tools available to protect personal, social and professional information. The findings provide implications for both users and SNS. From a user standpoint, we provide suggestions on the effort required to enable and handle various privacy tools which in turn suggest the extent to which his or her online information can be protected. From a social networking provider perspective, we provide implications on how to enrich various privacy tools in order to cater to user requirements.

#### **BACKGROUND LITERATURE**

Research related to social networking is continually emerging. Prior research has explored several issues related to social networking. For instance, a large body of research has focused on examining the factors that motivate individuals to participate in social networking (Boyd & Ellison 2008; Tufekci 2008). Another stream has explored user attitudes towards social networks with an emphasis on information sharing and disclosure (Constant et al. 1994; Livingstone 2008). Similarly some recent works have analyzed the relationship between cultural affiliation and social networking (Fogg & Iizawa 2008; Vasalou et al. 2010).

Specifically, research exploring social networking privacy issues has largely explored it from a technical perspective, i.e., how technical configurations can be enhanced to protect user privacy (Bonneau et al. 2009a; Huber et al. 2011). For instance, previous research has examined the content of privacy policies (Bonneau & Preibusch 2009b) and has analyzed the potential threats and risks of using social networking (Dwyer et al. 2007; Frankowski et al. 2006). A common agreement among most of the studies is that information shared on social networking sites is subject to various attacks that include spam, phishing and identity theft (Gross & Acquisti 2005; Huber et al. 2011; Jones & Soltren 2005). These studies depict the ease of extracting information from social networking sites. For instance, attackers could take photographs extracted from a friend's social networking pages and use them as personal signatures to create an authentic phishing message (Jagatic et al. 2007). The burden to protect online content is skewed towards the user rather than the social networking site (Dwyer et al. 2007). In other words, users must employ the privacy tools in order to protect their online content. Thus it is imperative to understand the factors that will trigger the user's intention to accept and use the privacy tools.

The technology acceptance and use literature contends that individual's intention to accept and use a technology is influenced by four key factors: effort expectancy, performance expectancy, social influence and facilitating conditions (Venkatesh et al. 2003; Venkatesh et al. 2012). Performance expectancy is defined as the degree to which using a technology will provide benefits to individuals in performing certain activities; effort expectancy is the degree of ease associated with individuals' use of technology; social influence is the extent to which individuals perceive that important others (e.g., family and friends) believe they should use a particular technology; and facilitating conditions refer to individuals' perceptions of the resources and support available to perform a behavior (Brown & Venkatesh 2005; Venkatesh et al. 2003; Venkatesh et al. 2012). In particular, this study extends two constructs to social networking privacy and contends that individuals' intention to use a privacy tool will depend upon the extent to which it is easy to deploy and the extent to which they can leverage it to maximize the benefits. To illustrate, an app installed by a user's friend could have access to the user's information even if the user does not install the app himself or herself (Barbara 2011). Even though it is possible for the user to opt out of sharing information with his or her friends' apps, many users "do not know to do this because they are not aware that the sharing is happening in the first place" (Barbara 2011). From a broader perspective, a privacy tool is beneficial only if the user can customize it to meet his or her requirements to protect his or her online content.

#### **METHOD**

A list of major social networking sites collected from Alexa, a web information company, as a part of a larger project was used to capture the ease of use and degree of control for each privacy tool. The sites

chosen in this study are consistent with prior research (e.g., Bonneau et al. 2009b) examining user privacy in social networking sites. In addition, these sites were examined to ensure accessibility and authenticity. Data was collected by one individual to ensure consistency of ratings. Following this, a generic user account was created to gain access into the social networking site and examine the privacy tools available to protect different types of user information. First, all the privacy tools available on each social networking site were recorded; overall a total of sixty-nine privacy tools were identified. Second, the ease of use and degree of control were examined for each privacy tool and coded using a seven point Likert scale. The scale for ease of use was (1 -- Extremely easy, 2 - Very easy, 3 - Easy, 4 - Somewhat easy, 5 - Difficult, 6 - Very difficult, 7 - Extremely difficult). Factors such as effort required to locate the tool and appearance (icon, text) were taken into consideration while determining the ease of use. Similarly, the scale for degree of control was (1 - Extremely customizable, 2 - Very customizable, 3 - Customizable, 4 - Somewhat customizable, 5 - Little customizability, 6 - Very limited customizability, 7 - Extremely limited customizability). Factors such as number of options, for example public, private, by invitation only, among others were taken into account to determine the degree of control. This was done for all the sixty-nine privacy tools.

#### **RESULTS & DISCUSSION**

Overall the social networking sites provided a wide array of privacy tools for users to protect their online content. However, most of the privacy tools have to be enabled manually. More interestingly, it was the user's responsibility to make sure the privacy tools remains active; it was not a one-time task. The SNS included in this study are listed in Table 1.

Ta	Table 1. Top Social Networking Sites			
	Social Networking Site	Category		
1.	Facebook	General-Purpose		
2.	MySpace	Gaming		
3.	Twitter	Micro-blogging		
4.	Bebo	General-Purpose		
5.	Habbo	General-Purpose		
6.	Tagged	General-Purpose		
7.	Okrut	General-Purpose		
8.	Friendster	General-Purpose		
9.	Badoo	General-Purpose		
10.	LinkedIn	Business-Networking		
11.	Hi5	General-Purpose		
12.	NetLog	General-Purpose		
13.	Flixster	Media recommendation		
14.	MyLife	Reunion		
15.	Classmates.com	Reunion		
16.	Last.fm	Media recommendation		
17.	Viadeo	Business-Networking		
18.	WeeWorld	Gaming		
19.	Xanga	General-Purpose		
20.	GaiaOnline	Gaming		

21.	SkyRock	General-Purpose
22.	MyYearbook	General-Purpose
23.	BlackPlanet	General-Purpose
24.	Fotolog	Photo-blogging
25.	FriendsReunited	Reunion
26.	LiveJournal	General-Purpose
27.	meinVZ	General-Purpose
28.	Sonico	General-Purpose
29.	Plaxo	General-Purpose
30.	StumbleUpon	Media recommendation
31.	Multiply	General-Purpose
32.	Hyves	General-Purpose
33.	BuzzNet	Media recommendation
34.	WAYN	Travel
35.	Care2	General-Purpose
36.	DeviantART	Media recommendation
37.	XING	Business-Networking
38.	MyOpera	Blogging
39.	OpenDiary	Blogging
40.	Livemocha	Language Learning
41.	weRead	Media recommendation
42.	ibibo	General-Purpose
43.	MocoSpace	General-Purpose
44.	CouchSurfing	Travel
45.	Nexopia	General-Purpose
46.	PerfSpot	General-Purpose
47.	Yonja	General-Purpose
48.	Bahu	General-Purpose
49.	Eons	General-Purpose
50.	ExperienceProject	Privacy-Specific

Table 2 shows the distribution of privacy tools related to profile, personal, social and professional information.

Table 2: Summary of Information Types and Associated Privacy Tools			
Type of Information	Number of Privacy Tools		
Profile Information	22		
Personal Information	24		
Social Information	13		
Professional Information	10		

Table 3. Privacy Tools Ease of Use			
Information Category	Average Scores	Standard deviation	
Profile	1.31	0.43	
Personal	1.39	0.45	
Social	1.15	0.26	
Professional	1.58	0.57	

Overall most of the privacy tools were fairly accessible; the ease of use average scores listed in Table 3 indicate that most of the privacy tools were easy to locate and activate. However, some privacy tools were easier to locate compared to others. For instance, privacy tools related to social information were apparent and could be easily activated. This is consistent with the existing trends which reveal that individuals increasingly use SNS to share social information such as photos and friendly blogs (Bonneau & Preibusch 2009b). On the other hand, privacy tools for professional information were a little harder to locate. These trends were common across most of SNS with little or no variation.

Table 4. Privacy Tools Degree of Control			
Information Category	Average Scores	Standard deviation	
Profile	5.01	1.48	
Personal	4.88	1.96	
Social	4.66	2.23	
Professional	4.11	2.31	

The average scores for degree of control listed in Table 4 indicate low customization of privacy tools. In general most privacy tools provided little or no leverage for users to customize them to meet their needs. Most common option was "private" or "public". Some of the major SNS like Facebook provided more options allowing users to specify who is able and not able to view the shared content. However, it was done for a narrow range of privacy tools. Surprisingly, privacy controls related to profile information had the lowest level of customization. For instance, the profile name and photo were always shown with no option to hide the visibility. This reiterates the point about the increasing growth in social phishing i.e., using photos on SNS to create authentic phishing messages (Jagatic et al. 2007). Moreover, some of the options for the user were stressful and very confusing. Users must be well versed with the terminology to determine the best way to protect their online content. While major SNS players like Facebook are making changes to their design and features to provide users more control over their information, most of them are still in trial and error mode.

Overall the findings imply that privacy in SNS is still emerging and does not offer complete protection of online data. With users sharing more information on social networking sites, these sites become an attractive target for both legal and illegal bodies (Boyd & Crawford 2011). More importantly, SNS users no longer have to worry just about what Facebook, Google+, LinkedIn and other social sites do with their database information; they have to worry about what SNS can enable others to do with it also. For example, organizations are using Facebook as a potential database for retrieving photos which in turn are used for consumer profiling (Chunka 2011). The surprising part is that no login was required to collect basic user information. While the privacy tools were easy to locate, applying them in the right manner was a horrendous task. There is a large learning curve for employing privacy tools; this is especially true for novice users (Vaknin 2011). As a SNS user, it is important to pay close attention to the details about

different types of privacy tools. The users must educate themselves about the privacy settings before uploading the information. SNS like Facebook are developing rich knowledge bases to educate users about privacy settings (Eldon 2011). The privacy paradox plaguing SNS is waning; it is time that users bore some responsibility for their actions.

In summary, while the SNS allow users to share different types of information, it is important for users to exercise some judgment to determine which information is safe on the social networking site. The SNS are deploying privacy tools at an increasing rate; however, not of all them are useful to protect online content. Most interestingly, the users must learn how to use the privacy tools in the correct manner failing which the privacy tool itself does not offer much help.

#### **CONCLUSION**

Privacy issues in social networking are a work in progress that urges the need for more research in identifying new solutions to protect user information. While the social networking sites are introducing new privacy tools to protect user information, not many of them can be fully leveraged. In other words, privacy tools were easy to locate and activate but customizing to meet specific needs was almost impossible. Future research can extend the findings presented in this study to explore how privacy tool ease of use and degree of control affects the quality of user information shared on SNS. This research hopes that the ideas presented here, along with the ease of use and degree of control findings, will be an important starting point towards enhancing privacy in SNS.

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# CULTURAL DIFFERENCES AND SOCIAL NETWORKING INFORMATION SHARING

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# **ABSTRACT**

This research proposal uses the five cultural dimensions proposed by Hofstede to analyze differences in cultural values of social networking users. These values have potential to affect the type and depth of information that individuals share on social networking web sites. Site selection for the study includes criteria such as number of users, language, and country of origin. Representative web sites for six countries for each of Hofstede's dimensions constitute the framework for the study. Findings of the study can help social networking sites and developers to flesh out appropriate strategies for promotion of information sharing. Results can also help with web site design that better meets the needs of the user and offers site features that the user wants. In general, this study has value in helping global users of social networking sites better appreciate and understand how to communicate effectively and professionally with those in another culture. This gives individuals a better background to be competent in the global virtual environment of today.

# **INTRODUCTION**

Social networking sites (SNS) have become one of the most popular mediums to share different information (Strater & Richter, 2007). For instance, prior research indicates that SNS have become a popular way to meet new people, to stay connected to family and friends, and to stay up to date on the world's current events (Boyd & Ellison, 2008). More specifically, people share different types of information which include personal, social, and professional information (Vasalou et.al., 2010; Narayanaswamy & McGrath, 2011; 2012). Thus, the success of social networking sites depends on how well people use them for information sharing (Boyd & Ellison, 2008; Vasalou et al., 2010).

Several different factors affect an individual's information sharing behavior. For example, previous research has indicated factors such as privacy settings, SNS design/features, gender, social pressures, and site popularity influence information sharing behavior (Grant, 2005; Boyd & Ellison, 2008; Vasalou et al., 2010; Narayanaswamy & McGrath, 2012). Preliminary research suggests that a person's motivation in using a particular social networking site is rooted in his or her personal experience (Vasalou et al., 2010). In particular, it has been noted that social experiences influence a user's preference of a site and, more specifically, what kind of information they choose to share. Personal and social experiences are formed based on the cultural values held by individuals (Hofstede, 1980; 1991). Thus, it is rational to argue that cultural values can influence the individual's intention to share information, including its type and depth. For instance, prior research has shown that certain countries are more reserved in disclosing informal information (Chow et.al., 1999). Accordingly, this study explores how an individual's culture can influence his or her intent to share personal, social, and professional information. The five cultural dimensions proposed by Hofstede, namely power distance, uncertainty avoidance, long vs. short-term orientation, individualism vs. collectivism, and masculinity vs. feminism (Hofstede, 1991), are considered to analyze the differences in cultural values. Given the effort rendered by SNS to promote users to share

information successfully on their sites (Tufekci, 2008), the findings from this study can help both developers and SNS not only to determine strategies that will help promote information sharing but also to enrich the site features and design to better suit their customer needs.

#### **BACKGROUND LITERATURE**

Prior studies have noted that cultural differences impact individual preferences and behavior (Hofstede, 1980; 1991). Hofstede (1980, p.5) describes culture as "a collective programming of mind which distinguishes the members from one group or category of people from another." He captured cultural differences using the five dimensions of power distance, collectivism/individualism, masculinity/femininity, uncertainty avoidance and long term/short term orientation (Hofstede, 1980; 1991).

Power distance (PDI) refers to individuals behavior regarding their interactions with elderly members - autocratic versus paternalistic (Hofstede, 1991). Individualism and Collectivism (IDV) represents a continuum defining the preference of people to belong to a loosely versus a tightly knit social framework. Uncertainty avoidance (UAI) is defined as the extent to which members of the society feel threatened by uncertain situations. It explicates the individual's willingness to accept risk (Hofstede, 1980). Masculinity/femininity values concern the extent of emphasis on work goals (earnings, advancement) and assertiveness, as opposed to personal goals (friendly atmosphere) (Hofstede, 1991). Finally, long-term vs. short-term orientation refers to how a society makes decisions and structures itself.

Previous studies have examined these cultural dimensions in various contexts. For instance, it has been noted culture values influence an individual's intention to accept and use technology (Venkatesh et.al, 2012). Within SNS research cultural values have been found to impact an individual's motives to join SNS, privacy controls preferences, and commitment to belong to a particular SNS group (Fogg & Iizawa, 2008; Joinson, 2008; Vasalou et al., 2010). However, none of the prior studies on SNS have examined the direct influences of cultural values on information sharing behavior. The information sharing literature reveals that individual information sharing behavior is influenced by various factors (Constant et.al., 1994). In particular, it has been noted that attitudes about information sharing depend on the form or type of information. Individual attitudes are formed based on their cultural values (Hofstede, 1991). For example, collectivist countries like China intend not to divulge information in openly sharing informal information venues compared to western countries (Chow et al., 1999). Similarly, individuals in countries with high PDI scores are hesitant to share openly sensitive information because they are respectful to the elderly members of the society (Frenandez, 1997). In addition, the members of high uncertainty avoidance societies exhibit more dependence on experts and prefer a more structured and rule oriented environment; thus they tend to share information only when they are sure that it is safe to do so (Hofstede, 1980). This study extends these perspectives to SNS and examines the impact of cultural values on individual information sharing behavior in SNS.

# **METHOD**

The first step is to identify a list of the top SNS based on various criteria such as the number of users, language (English-speaking), and country of origin among other things. The identified list will be verified with similar studies (Bonneau & Preibusch, 2009). The users will be categorized based on the country of origin, and the countries will be identified using Hofstede's index scores. Each cultural dimension has a high/low score. Three countries representing each "high" and each "low" will be chosen. This means that six countries represented each dimension from Hofstede's framework. Fifteen observations from each country will be recorded; thus a total of 90 observations will be collected for each

cultural dimension. Overall the analysis will be based on a total number of 450 observations. The total number of observations was determined based on prior studies (Vasalou et al., 2010).

# POTENTIAL IMPLICATIONS AND DISCUSSION

It is crucial for SNS to understand how different people use their sites to share information. It is expected that cultural values will influence individual information sharing behavior. In particular, each cultural dimension should display different information sharing patterns. For example, users from a higher UAI index culture would post a personal achievement or accomplishment as their "status." SNS could benefit from the information contained in this study in order to customize groups, site features, and even terminology to their various users. Individuals and companies alike can also be more sensitive to a user's preferences and ideas if this information is known. In conclusion, not only will users have a better appreciation for the global users of SNS, but they will also have a better understanding of how to communicate across cultures more effectively and professionally. From a broader perspective, the results of this study can help individuals to become more competent in the global virtual environment.

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# INTERNET SHOPPING IN RETAIL PARADISE: A RESEARCH AGENDA FOR SMALL ECONOMIES

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#### **ABSTRACT**

Significant advancement has been made to develop and promote small but major (island) economies to be regional hubs for e-commerce, online shopping has yet to fully establish itself. While most research in the field applied the Technology Acceptance Model (TAM) to Western countries; this study presents recent findings on actual online shopping in Singapore. Adding security concerns, Internet self-efficacy, product involvement, and trust to the TAM variables, the results confirm prior findings – and also show increased online shopping activity. Age, gender, occupation, and highest education level attained, however, do not affect online shopping participation. A specific conceptual model adjustment is suggested for small island economies – be it for online window shopping or for actual online purchases.

# INTRODUCTION

In the pursuit to be a regional hub for e-commerce, Singapore has been developing and promoting its Info-Communication Technology (ICT) capabilities, such as in the area of technological research and advancement, infrastructural development, and formulating favourable policies, to attract both businesses and consumers to adopt this new form of trade. It was even argued that the distinct nature of this city state gives it unique

characteristics that are favourable towards e-commerce. A highly educated and affluent population of 4-plus million is concentrated in a compact island of only 640 square kilometres, allows the country to enjoy significant economies of density in providing communication infrastructure to the whole population, thus readying Singaporeans to adopt an alternative channel in shopping (Wong, 2003).

Given the generally positive developments in Singapore, it is observed that "virtual retailing has yet to establish itself in a prominent position in the country's markets" (Liao and Cheung, 2001, pp.299). Actual online sales are well behind previous forecasts. Not only are business-to-consumer (B2C) online shopping transactions trailing behind business-to-business (B2B) transactions on the Internet, Singapore also lags behind developments in the area of online shopping in comparable countries (Liao and Cheung, 2001; Teo, 2002).

At the same time, literature in this field indicates that theory development is still incomplete. A review shows four major themes: (i) most of the research is based in Western countries, (ii) most research are based in large countries, mostly the US, in particular in applying the Technology Acceptance Model (TAM) to online shopping (Davis, 1989; King and He, 2006; McCloskey, 2003), (iii) while TAM is a well-established model, many, such as McCloskey (2003), have suggested the need for incorporating additional factors or integrating other theories with TAM to improve "its specificity and explanatory power" (Shang, Chen and Shen, 2004, pp.401; Hu, Chau, Sheng and Tam, 1999; Legris, Ingham and Collerette, 2003), and (iv) the literature shows that so far TAM has not been used to study the activity of product information gathering separately from the next step of the actual purchase, thus leaving a "blind spot" in this process, such as McCloskey (2003).

It is against this background that more research can add to knowledge by defining a specific research agenda along the following dimensions: (i) research based in a small developing or newly developed economy, (ii) to inquire the specifics of a small island environment, such as Singapore or Hong Kong, where logistics do not play a role from a customer perspective, (iii) to add new variables to the TAM model reflecting these environmental factors, and (iv) to study both the information gathering behaviour and the act of actual purchase.

# LITERATURE REVIEW

The review of literature focuses on the key Technology Acceptance Model and several other studies on user attitudes, product involvement and the online environment as the basis to explain the attitudes of online shoppers.

Information technology presents a potential to improve work performance (Curley, 1984; Edelman, 1981; Sharda, Barr and McDonnell, 1988) but these performance gains are not fulfilled given the users' unwillingness to accept and use such IT systems (Bowen, 1986; Young, 1984). User acceptance of information technology and its application has been studied since the mid-1970s, with this problem remaining persistent and important (Davis, 1989).

# Technology Acceptance Model

Davis (1986; 1989) relied on the general and well-established Theory of Reasoned Action (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980) as the foundation to build the Technology Acceptance Model (TAM) to explain the causal chain linking the external variables to the user acceptance and actual use of PC-based applications in the area of multimedia, image processing, and pen-based computing in a workplace (Davis, Bagozzi and Warshaw, 1989; Davis and Venkatesh, 1995). Davis (1986; 1989) proposed two theoretical constructs, **perceived usefulness** and **perceived ease of use**, as fundamental determinants of computer system use, likewise the acceptance of information technology. Perceived usefulness refers to whether people use or not use a computer application to the extent they believe it will help them with their work. Perceived ease of use then refers to the belief that the computer system is too difficult to use and the effort of using the computer application outweighs the benefits of usage.

TAM has often been used to explain and predict end-user behaviour and use of IT. Many studies have concluded that TAM yields consistent results in predicting the acceptance of IT, other studies have also suggested the need for incorporating additional factors or integrating other theories with TAM to improve "its specificity and explanatory power" (Shang, Chen and Shen, 2004, pp.401; Hu, Chau, Sheng and Tam, 1999; Legris, Ingham and Collerette, 2003).

King and He (2006), with reference to 88 published studies, conducted a statistical metaanalysis of the TAM as it was applied in various fields. The study found that TAM is a valid and robust model that was widely used due to its understandability and simplicity, and has wider applicability. The study explained that though TAM may be popular, it is imperfect, and not all TAM relationships were borne out in all studies.

Despite the fact that the original model was intended for use in an organisational context, the versatility of TAM is evident in the adaptation of the model to cover a myriad of different areas that are related to the use of IT in a variety of different settings. More importantly, Doherty and Ellis-Chadwick (2006) reviewed 265 journal articles on Internet shopping and revealed that TAM has been widely used as the basis to uncover consumers' perceptions, beliefs and attitudes. The authors termed these as 'character variables' as they were most likely to influence consumers' intention to shop online, thereby validating this study's use of TAM as the base model.

McCloskey (2003) adapted TAM in the study of electronic commerce and included **security concerns** as the additional variable. Additionally, the author proposed that the variables directly influence usage needs, which are the actual purchases made online. McCloskey's (2003) treatment of TAM provides advantages to develop TAM further and to adopt it as the basis for developing the conceptual framework. The author has shown that by adding variables to the model further refines it to suit the relevance of the specific study.

# Selected Studies on Online Shopping

Liao and Cheung (2001) found that the life content of products, or the extent to which products are essential to daily lives, transactions security, prices of the products sold, perceived vendor quality, IT education and Internet usage affect the willingness of Singapore shoppers to make purchases over the Internet.

Lian and Lin (2008) studied more than 200 undergraduate students in Taiwan on the effects of consumer characteristics on the acceptance of online shopping and it was compared among different types of product. The authors found that personal innovativeness of information technology (PIIT), perceptions of Web security and high product involvement positively affect user attitudes whereas increased privacy concerns has a negative effect. Internet self-efficacy has registered no significant impact which the authors attributed to the students' high level of proficiency in using the Internet as well as their regular contact with that technology.

Both Liao and Cheung (2001) and Lian and Lin (2008) appeared to be closely related in terms of the variables adopted. The relationships of some of the variables between the two studies are discussed:

- PIIT (Lian and Lin, 2008) closely relates to IT education and Internet usage factors in Liao and Cheung (2001) as both variables in the latter study are connected to and contribute toward PIIT, as according to its definition of willingness to try a new information technology (Agarwal and Prasad, 1998). However, PIIT was not considered in the study as Singapore is ranked high in e-readiness and has a high degree of Internet use. Also, given that TAM is widely used and it provides a more direct measurement of IT acceptance than PIIT.
- Internet self-efficacy (Lian and Lin, 2008) is associated with IT education and Internet usage (Liao and Cheung, 2001) factors as the former have defined Internet self-efficacy as "the belief of individuals in their capacity to organise and successfully execute Internet use" (Lian and Lin, 2008, pp. 51), which invariably involves IT education in furthering the use of IT and it is associated with the level of acceptance (pp. 53) and use. Internet self-efficacy appears to capture the essences of both IT education and Internet usage and thereby presenting itself as an all-encompassing variable that this study would adopt.
- Product involvement (Lian and Lin, 2008) corresponds closely to life content of products variable in Liao and Cheung (2001) as it has been defined as the relevance of a product to a consumer's need and want (Lian and Lin, 2008). Similarly, the price variable in Liao and Cheung (2001) would have an impact on consumer's need and want, following demand theory (pp. 303). Given that more extensive research was done on the product involvement variable than Liao and Cheung's (2001) life content of products variable, and that existing scales for the variable are available and easily adopted, this study will adopt product involvement for obvious reasons.

Liao and Cheung (2001) studied the effects and relationships between consumer attitudes and online shopping, just as B2C e-commerce is being introduced into Singapore. Given the passage of time, some of the factors would have become outdated or irrelevant. For example, Internet usage in Singapore has risen to about 74 percent of respondents who claimed to have accessed the Internet within the last one week, with more than 70 percent using it on a daily basis in 2007 (Infocomm Development Authority,

2008). This is compared to less than 50 percent of the Singapore population that have used the Internet in 2002 and less than 40 percent in 2001 (Infocomm Development Authority, 2004). Similar usage patterns are also observed in Hong Kong and this increased usage could also infer familiarity and confidence, perhaps reducing the impact of the IT education factor has on online shopping (Census and Statistics Department, 2008). However, this study is still relevant to the proposed topic and will be considered in the development of the proposed conceptual model.

Lian and Lin (2008) provide a good alternative reference to Liao and Cheung (2001) since some variables in both studies appear to be related in measuring similar outcomes. Though it is a good reference, Lian and Lin (2008) conducted the study on university students in Taiwan. Thus the gap exists as Taiwan, Hong Kong and Singapore are dissimilar countries in Asia, not only in terms of culture (Hofstede, 1997) but also per capita GDP (Central Intelligence Agency, 2008).

Despite the arguments above, the study by Liao and Cheung (2001) specifically examines the Singapore online shopping environment which corresponds to the aim of researching attitudes and behaviour of online shoppers in small island states. However, it is also argued that some of the variables in the conceptual model of Lian and Lin (2008) closely resemble that of Liao and Cheung (2001) and that the former would be a better reference given its recent publication. This gives rise to the possibility of adopting some of the variables identified by both Liao and Cheung (2001) and Lian and Lin (2008) to the modified TAM as presented by McCloskey (2003) so as to adapt and modify TAM further for use.

#### Trust

Jarvenpaa, Tractinsky and Vitale (2000) studied consumers' perceptions of **trust** in commercial stores on the Internet, a relatively new distribution channel, explained that trust would be critical when the consumer did not have control over the merchant or store, when the decision to be made was important and where the environment was uncertain.

A number of other studies investigated the variable of trust in online stores, such as Pavlou (2003) and Van der Heijden, Verhagen and Creemers (2003), generally found that the element of trust had a significant impact on consumers' willingness to shop online.

This study further argues that trust in online store is similar to the perceived online vendor quality variable as discussed in the study by Liao and Cheung (2001). Liao and Cheung (2001) found that perceptions of online vendor quality would positively influence shoppers' willingness to shop online such that they would feel 'safe about purchasing without worrying about lemons' (pp. 304), thus implying that shoppers' trust in the online stores would positively impact online shopping. As such, trust would replace the perceived e-vendor quality variable found in the study by Liao and Cheung (2001) as trust has gained more prominence in research and has readily available scales to be deployed.

# Gaps in Selected Studies on Online Shopping

McCloskey (2003) also noted the lack of research that distinguishes between information gathering and actual purchase. Wong (2003) explained the unique geographical and infrastructural characteristics Singapore has as compared to other localities, may actually limit the growth of online shopping as shoppers in Singapore may prefer to visit shopping malls and neighbourhood stores. The study of Singapore's online shopping scene by Liao and Cheung (2001), as well as other related studies (Lian and Lin, 2008; Wee and Ramachandra, 2000), also did not take this into consideration, which presents an opportunity for this study to investigate on. Extending this discussion, this study seeks to investigate if shoppers in Singapore tend to use the Internet for information gathering than making purchases online.

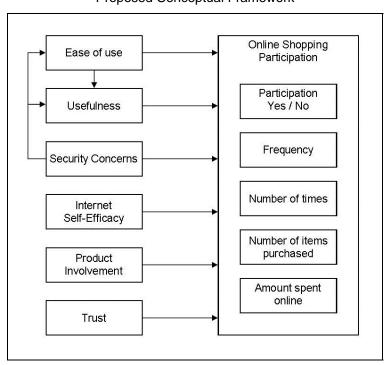
Liao and Cheung (2001) studied the effects and relationships between consumer attitudes and online shopping, just as B2C e-commerce was introduced to Singapore. Given the passage of time, some of the factors would have become outdated or irrelevant. The recent study by Lian and Lin (2008) provided a good alternative reference to Liao and Cheung (2001) since some variables in both studies appeared to be related in measuring similar outcomes. However, Lian and Lin (2008) conducted the study on university students in Taiwan which went against the argument of generalisability of the findings.

Other related studies have either been purely exploratory without the use of any theoretical models or statistical analyses, such as Teo (2002), or they have been built on unrelated, or even ad-hoc frameworks, such as Wee and Ramachandra (2000), Liao and Cheung (2001), and Lian and Lin (2008). In some cases, the studies did not explain the selection of variables at all, such as Lian and Lin (2008). Moreover, the selection of the various product or service types in Lian and Lin (2008) could be broadly classified into

specific product categories. Computer and computer-related products would appeal to consumers with specific interest in computers, whereas books, online news and magazines would appeal to those who have taken an interest in reading, which went against the authors' argument of generalisability of their findings.

Despite the arguments above, the study by Liao and Cheung (2001) specifically examined Singapore's online shopping environment which is in line with the aim of this study. However, it has been argued that some of the variables in the conceptual model of Lian and Lin (2008) closely resembled that of Liao and Cheung (2001) and that the former would be a better reference given its recent publication. This gives rise to the possibility of adopting some of the variables identified by both Liao and Cheung (2001) and Lian and Lin (2008) to the modified TAM as presented by McCloskey (2003) so as to adapt and modify TAM further for use in the study of online shopping in Singapore.

The original TAM states that <u>perceived usefulness</u> and <u>perceived ease of use</u> impact attitude toward use, which impacts behavioural intentions, which in turns impacts actual usage' of online shopping (McCloskey, 2003, pp. 49). This study uses TAM in its adapted form by McCloskey (2003), including <u>security concerns</u> and includes the variables of <u>Internet self-efficacy</u>, <u>product involvement</u> and <u>trust</u> from various studies to develop a new proposed conceptual framework for research.



Proposed Conceptual Framework

Source: authors

# STUDY AND FINDINGS

The aims of this research had been to explore the issues relating to the use of online shopping by shoppers in Singapore so as to better understand the factors that affect their adoption of this new form of technology. It further sought to uncover the attitudes of Internet users toward online shopping and the factors that influence them to buy online. With the knowledge gained, businesses can be better informed whilst developing strategies to establish or to improve their online distribution platform, at the same time, how to better integrate their existing business model with online shopping.

This study surveyed members of the Singapore public that were visiting an IT trade show and a consumer electronics shopping mall. This involved having the research assistants randomly intercept visitors exiting the trade show premise or shopping mall, and inviting them to participate in the pen-and-paper survey. Upon completion of the questionnaires, the participants deposited the questionnaires into a sealed box.

Trade show visitors that were not aware of online shopping, as well as those who qualified but declined to participate, were not given the paper questionnaires. A rejection rate of about 30 – 50 percent was registered. Shoppers who were qualified and accepted the offer to participate spent an average of 8 minutes to complete each questionnaire. A total of 198 questionnaires were returned over four days of the show.

Similarly, research assistants were deployed at the public walkways leading to Funan DigitalLife Mall shopping complex, a shopping mall dedicated to selling consumer electronic products, to solicit for more respondents. A rejection rate of about 40-60 percent was registered and total of 62 questionnaires were returned for this exercise.

Of the 260 returned questionnaires, it was reported that eight respondents returned incomplete questionnaires after informing the research assistants that they could not continue with the survey for various reasons. Despite this, a rate of return of about 97 percent was registered.

In the actual study, 252 questionnaires were collected and 248 were found to be usable which forms the final sample size. Thereafter, the 248 questionnaires were screened to ascertain the number of participants and non-participants of online shopping, based on the screening questions. Almost all the respondents (98.4%) have used the Internet to search for products, with a majority (31.9%) spending a few times a month on this

technology to search for information about the products of their interest. Out of the 248 respondents, there were 199 participants of online shopping while 49 had not used the technology to purchase products online.

# Socio-Demographics

Among the socio-demographics data analysed, there is a statistically significant relationship between <u>income</u> levels and the participation of online shopping (Pearson Chi-Square = 15.008, df = 4, p = 0.005). Age, gender, highest education level attained and occupation do not present any statistically significant relationships with online shopping participation, which is in line with the findings of Sim and Koi (2002), but not Teo (2006).

Descriptive Statistics - Income

	Participant of Online Shopping (% within the income category)	Non-Participant of Online Shopping (% within the income category)	Total
S\$25,000 and below	80 (71.4)	32 (28.6)	112
S\$25,001 - \$50,000	69 (88.5)	9 (11.5)	78
S\$50,001 - S\$70,000	23 (85.2)	4 (14.8)	27
S\$70,001 - S\$100,000	8 (66.7)	4 (33.3)	12
S\$100,001 and above	18 (100.0)	0 (0.0)	18
Total	198	49	247

Pearson Chi-Square = 15.008, df = 4, p = 0.005

Income levels do affect the intended outcome, that is, participation in online shopping. However, Teo (2002) presents the argument that lower income earners, such as students, might not have met the minimum requirements set by credit card companies for the ownership of credit cards, which is one of the main modes of transaction for online purchases. Sim and Koi (2002) also found that adopters of online shopping had higher income and were more likely to own credit cards that would facilitate these transactions. This is in line with the findings of Donthu and Garcia (1999) and Tan (1999) that discovered that participants of online shopping were older and wealthier than non-participants. According to an online shopping survey (MasterCard Worldwide, 2010), 26 percent of respondents cited absence of credit cards being one of the reasons for not participating in online shopping. This point should be asked in future online shopping studies.

From a broader perspective, income levels affect GDP at PPP, an indicator of the standard of living in an economy. As previously discussed, although Singapore ranked higher than South Korea, Japan, and Taiwan in GDP (PPP) (Central Intelligence Agency, 2008), these neighbouring Asian economies outperformed Singapore in terms of having greater numbers of their residents participating in online shopping (MasterCard Worldwide, 2010). This conundrum presented by this socio-demographic measure of income clearly demonstrates that other factors, to be discussed in subsequent sections, are at play in influencing shoppers in Singapore to shop online and income is just one part of the whole equation.

This study finds that age, gender, highest education level attained and occupation do <u>not</u> affect an individual's participation in online shopping. Though this contradicts Teo's (2006) study, this study argues that perhaps online shopping is far more pervasive now than before. Regardless of age, gender, education level and occupation, shoppers in Singapore are more willing to participate in online shopping in the current times, somewhat a reflection of changing lifestyles as people use more of the Internet for various purposes in their daily lives.

# **Experience**

The survey asked respondents to indicate the number of years in using the Internet and computer as well as the number of hours in using the Internet, computer and email per day. Of all these measures, <u>number of years of Internet use</u> (F-value = 4.786, df = 1, p = 0.030) and <u>number of hours of email use per day</u> (F-value = 8.355, df = 1, p = 0.004) presented statistically significant relationships with participation in online shopping.

Descriptive Statistics – Number of Years of Internet Use

	N		Std.	Std. Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
	IN	Mean	Deviation	Std. Elloi	Lower Bound	Upper Bound	IVIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	IVIAXIIIIUIII
Participant of Online Shopping	199	10.87	3.871	0.274	10.33	11.41	3	30
Non- Participant of Online Shopping	49	9.55	3.373	0.482	8.58	10.52	3	20
Total	248	10.61	3.808	0.242	10.13	11.09	3	30

F-value = 4.786, df = 1, p = 0.030

Descriptive Statistics - Number of Hours of Email Use per Day

	N	Mean	Std. Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	
	IN	ivieari	Deviation	Sid. Elloi	Lower Bound	Upper Bound	Willimum	IVIAXIIIIUIII
Participant of Online Shopping	199	3.30	3.379	0.240	2.82	3.77	0	16
Non- Participant of Online Shopping	49	1.84	2.059	0.294	1.25	2.43	0	8
Total	248	3.01	3.212	0.204	2.61	3.41	0	16

F-value = 8.355, df = 1, p = 0.004

On analysing the results for *number of years of Internet use*, an additional year of Internet use was seen in participants of online shopping, compared to non-participants. It could be assumed that with more experience in Internet use, it will likely increase the participation in online shopping, due to the familiarity with the technology, greater awareness of its different uses and applications, or simply due to an increased comfort level.

This study finds that the average number of years of Internet use for participants of online shopping is 10.9 years. Compared to Teo (2002), a majority of respondents of the online shopping study in Singapore conducted in early 2000s indicated they had used the Internet for about two to four years. In another later study, Teo and Liu (2007) reported that 19.6 percent of Singapore respondents had four years or less of experience with the Internet and about 18.2 percent had more than seven years. Evidently, this study finds that the number of years of Internet use has increased as the technology matures over time. The usage of the Internet appears to be a necessary experience for users to embark on more sophisticated usage, such as online shopping.

On analysing the results for *number of hours of email use per day*, the results show that there was almost twice the number of hours of email use per day for participants of online shopping as compared to non-participants. However, the numbers of hours of computer and Internet use per day were not statistically significant contributors to this purpose. This is an interesting finding as email use is not always contingent upon the existence of Internet connection, as in the case of inter-organisation email communications through Intranet or Blackberry systems, yet email use was significant as a contributor to online shopping participation.

According to McCloskey (2003), the number of hours of email use has no significant impact on any of the measures. However, the number of hours of Internet use did positively impact on the decision to buy online, the number of items to buy, the frequency to buy online and the amount of money spent in online shopping. Partially contradicting McCloskey (2003), Van Slyke, Comunale, and Belanger (2002), who in their respective studies found that both computer and email use had significant impact on the participation in online shopping. The authors explained that the lack of Internet experience might contribute to perceptions of online shopping complexity. Regardless of contradictory findings in the literature, shoppers in Singapore, as uncovered by this study, are more inclined to shop online if they gained more usage of the Internet and email communication, a situation that managers can capitalise on in developing their messages to their target audience.

# Online Shopping Experience by Participants of Online Shopping

Participants of online shopping are found to have shopped an average of 21 times in the past year. Comparing to Teo (2006), about 50 percent of respondents who shopped online made less than one purchase in a month from the Internet and about 40 percent made about one purchase in a month and that approximated to about 12 purchases in a year, which is also lower than the result presented by this study. This difference can be attributed to the maturity of the technology which might encourage more people to embark on online shopping now than before. Buying behaviour could have also changed, leading to more online shopping participants. It is also worthy to note that Teo's (2006) study is based on data collected in 2002, which is more than seven years old.

Descriptive Statistics - Number of Times Used the Internet to Purchase Products Last Year

	N	Minimum	Maximum	Mean	Std. Deviation
Number of times used the Internet to purchase products last year	199	1	1000	21.46	91.482

In comparing the number of items purchased, this study finds that about 27 percent of the respondents bought one to three items and about a quarter of the respondents bought more than ten items in the last year. In comparison to Teo's (2006) Singapore study,

about 43 percent bought about one to three items, 32 percent bought between four to six items, and less than five percent bought more than ten items. This shows that online shoppers in Singapore are buying more items now than before. Confirming this trend, the MasterCard Worldwide (2010) study showed that shoppers in Singapore purchased about five items in a quarter, which approximated to about 20 items in a year

Descriptive Statistics - Number of Items Purchased Online Last Year

	Frequency	Percent	Teo (2006) - Percent
None	0	0	8.1
1 – 3	68	27.4	43.6
4 – 6	42	16.9	32.1
7 – 10	28	11.3	11.7
More than 10	61	24.6	4.6
Subtotal	199	80.2	100.0
Non-Participants	49	19.8	
Total	248	100.0	

Of all these items purchased online, majority of respondents in this study spent between \$101 and \$300 in the last year. The next largest group spent between \$51 and \$100. About nine percent, or 24 respondents, spent more than \$1000 in online shopping. Seven years ago, Teo (2002) found that online shoppers were spending smaller amounts in online shopping some years back with a majority (34.3%) spending between \$21 and \$50 (refer to Table 4.19). This shows that online shoppers in Singapore are spending more now than in 2002. In McCloskey's study (2003) of shoppers in the United States, the average amount spent on online shopping was about US\$389 which approximated to about \$540 in Singapore currency using the prevailing exchange rate at the time this study was conducted.

Descriptive Statistics - Average Amount of Money Spent on Online Shopping Last Year

	Frequency	Percent	Teo (2002) - Percent
\$1 to \$20	8	3.2	8.5
\$21 to \$50	25	10.1	34.3
\$51 to \$100	47	19.0	30.5
\$101 to \$300	51	20.6	14.4

	Frequency	Percent	Teo (2002) - Percent
\$301 to \$600	26	10.5	1.7
\$601 to \$1000	18	7.3	3.4
\$1001 or more	24	9.7	7.2
Subtotal	199	80.2	100.0
Non-Participants	49	19.8	
Total	248	100.0	

The differences between Teo (2002; 2006), McCloskey (2003) and this study could be attributed to the use of different sampling frames of respondents in Singapore, and perhaps due to the difference in time frames. Both studies by Teo (2002; 2006) were based on data collected in 2002 by way of an Internet-based survey that was publicised through newsgroups, emails and certain websites, and the shopping environment in Singapore is different now as compared to seven years ago. McCloskey (2003) had her study based on students in the United States. Comparing the sampling choices, this study uses simple random sampling which is superior to the others in achieving results that are more generalisible, thus generating analyses that are more widely applicable to the population in Singapore.

From the data, it appears that shoppers in Singapore are buying and spending more on online shopping and this augurs well for retailers who have or are going to establish this new distribution channel for their products. All these results point toward a healthy online shopping environment and they also serve as indicators that online shopping is becoming more of a common practice than initially thought.

# <u>Product Categories Searched For by Non-Participants and Purchased by Participants of Online Shopping</u>

The top three product categories searched for by non-participants are: travel, computer hardware and software, and CDs and entertainment. The top three product categories purchased by participants are: clothing and accessories, travel, and computer hardware and software.

Descriptive Statistics – Top-, Second-, and Third-Most Purchase Product Category by Participants of Online Shopping

	Top-Most (% within top-most purchased category)	Second-Most (% within second-most purchased category)	Third-Most (% within third-most purchased category)
Books	17 (9%)	19 (10%)	23 (12%)
CDs and Entertainment	19 (10%)	25 (13%)	35 (18%)
Clothing / Accessories	48 (24%)	31 (16%)	19 (10%)
Computer Hardware and Software	36 (18%)	31 (16%)	20 (10%)
Flowers and Gifts	4 (2%)	11 (6%)	21 (11%)
Food and Drink	6 (3%)	11 (6%)	13 (7%)
Health and Beauty	8 (4%)	20 (10%)	12 (6%)
Home and Garden	0 (0%)	2 (1%)	1 (1%)
Insurance	2 (1%)	6 (3%)	11 (6%)
Travel	47 (24%)	36 (18%)	35 (18%)
Others	12 (6%)	7 (4%)	9 (5%)
Total	199 (100%)	199 (100%)	199 (100%)

Comparing to Teo (2006), the top three product categories bought were: books (26%), CDs and entertainment (18%), and travel (18%). In comparison to another empirical study in Singapore, Wee and Ramachandra (2000), the top three product categories were: books and magazines (39%), theatre and movie tickets (37%) and computer software (31%). The above comparisons show that travel (including airline tickets), computer hardware and software, as well as entertainment and leisure products, such as movie / concert tickets, CDs and entertainment, and books and magazines, are the recurring product categories over the past decade that consumers shop for over the Internet. Clothing and accessories is the new and popular product category uncovered by this study which might indicate that online shopping participants are moving beyond the recurring product categories. This might also indicate that new groups of consumers that seek clothing and fashion accessories have joined the growing number of online shopping participants and adopted this new shopping platform.

Retailers ought to be mindful in selecting and offering the right types of products for sale over Internet as data have shown that not all product categories are equally popular. It would also be relevant for existing businesses to consider if online shopping is something they should or should not be considering. The data provide guidance for managers who need to plan for the kind of products that they intend to offer in their virtual storefront so as to capitalise on the right product categories that would appeal to the shoppers.

# <u>Usage of Internet for Information Gathering (Window Shopping)</u>

The so-called "window shopping" hypothesis is for this research translated into the inquiry if there were more shoppers in Singapore that used the Internet to gather information about products than for the purpose of making purchases. The Binomial Test attempts to show the minimum threshold population participation rate for statistical significance, given the sample size obtained in this study. As a result, the "window shopper hypothesis" is not supported as the present 80.2 percent sample participation rate for online shopping participation is statistically higher (p < 0.001) than a postulated 75 percent population participating in online shopping.

Binomial Test of Participants of Online Shopping

Population Proportion	p - value
50%	<0.001
60%	<0.001
70%	<0.001
75%	0.031
76%	0.066

This study's 80.2 percent participation level differs from earlier findings of Teo (2006) which found that 42.5 percent of respondents were adopters of online shopping and 24.9 percent obtained by Wee and Ramachandra (2000). As such, there has been a two fold increase in online shopping participation as compared to previous studies.

According to Teo (2006), the percentage of online shoppers had increased over the years, which is not surprising given the advancement in the development of technological infrastructure and the high Internet penetration rate. The Infocomm Development Authority (2009) annual infocomm usage survey reported that 76 percent of households in Singapore have Internet access and the percentage of Internet users registered a record high of 69 percent. The survey also reported that the high percentage of Internet

users belonging to the age groups of 15 to 24 years old and 25 to 34 years old which, incidentally, correspond to two of the highest age groups of respondents surveyed in this study. Also, the same infocomm usage survey reported that the highest percentage of online shoppers belonged to the 25 to 34 years age group.

Even though Wong (2003) argued that the unique geographical characteristics of Singapore, the well-established infrastructure and transportation network, as well as the presence of many neighbour shops and easy accessibility to big shopping malls might negate the attractiveness of shopping online, there is still a growing number of online shoppers in Singapore. This study established that many shoppers in Singapore used the Internet to shop online, more than those who merely sought information about products or, in other words, "window shop" via the Internet.

# **FUTURE CONCEPTUAL MODEL**

McCloskey's (2003) conceptual model is useful in this discussion as it has been primed to address the subject matter and the scales have been modified to suit the application being addressed, which is online shopping. As such, the independent variables from McCloskey (2003) are: ease of use, usefulness and security concerns. Additionally, the dependent variables that measure online shopping from that same study are: whether there is participation in online shopping, the frequency of online shopping, the number of times online shopping is attempted, and the amount spent on online shopping. Here, McCloskey (2003) tried to measure the attitudes between users and non-users of online shopping by distinguishing if actual purchases had taken place or the respondents were merely browsing. This would be useful in discovering the attitudes and profile differences between the two groups of people, which addresses one of the dimensions identified earlier.

Upon review of Liao and Cheung (2001), Lian and Lin (2008) and the other studies mentioned, other variables are proposed to be included in the modified TAM (McCloskey, 2003) such as, Internet self-efficacy, product involvement, and trust to build on the existing knowledge, which addresses the dimension of adding variables to the original TAM so as to better reflect the specific environments.

The resultant model, a modified TAM that is combined with variables culled from various studies that are based in Asia, specifically small island states like Hong Kong and

Singapore, would adequately explore the nature of online shopping unique to countries with the reputation of being the shopping paradise in Asia. All these would adequately add to the findings presented in this study.

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#### WHAT IS NEXT WITH MICROSOFT OFFICE?

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#### **ABSTRACT**

Office 2013, Preview version, has a new look, new features, new collaboration tools, connectivity from multiple devices, and improved WebApps. The Ribbon interface remains but there are changes. Touch screen capabilities are now included with Windows 8. This session will provide an overview some of the new features in Office 2013.

#### **OFFICE 2013**

The Preview release of Microsoft Office 2013 (Office 15) has a new application interface but retains the Ribbon. P.J. Hough, the executive who leads the Office division stated in January 2012, "With Office 15, for the first time ever, we will simultaneously update our cloud services, servers, and mobile and PC clients for Office, Office 365, Exchange, SharePoint, Lync, Project, and Visio."

Office is finally meeting the cloud. When an application is first launched the default is to save to the cloud at SkyDrive. This enables access to everything from device to device so when the user switches computers all files will follow. Files can be saved locally as well.

With a touch screen enabled computer/tablet, this latest version enables touch, pinch and zoom. Applications will resize according to the device where it is being used.

Generally, Microsoft is looking at what they consider to be the modern office and have divided their latest offering to include Windows 8, the Cloud, Social networking and New scenarios.



http://www.youtube.com/watch?v=HXOTrRKAnAQ

As with every previous version, there are new icons for each of the applications.

http://en.wikipedia.org/wiki/Microsoft Office 2013



The Ribbon no longer is colored and has been resized to allow for touch screens and dual monitors.

The Preview is available for download from Microsoft and can be installed with Office 2010 running.



#### Word 2013

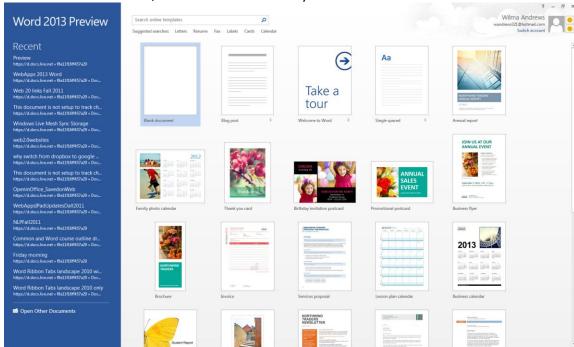
Word has two new tabs – Design and Developer (though Developer was also an option in 2007/2010). PDF files can be imported, edited in Word and then saved either as a Word file or PDF. Imported files will maintain formatting and that formatting can be edited. PDF files can now also be embedded in Word documents.

Online resources can also accessed and even embedded in Word documents. At Insert, a thumbnail of all opened Web resources can be viewed and selected to include the screenshot in the document.

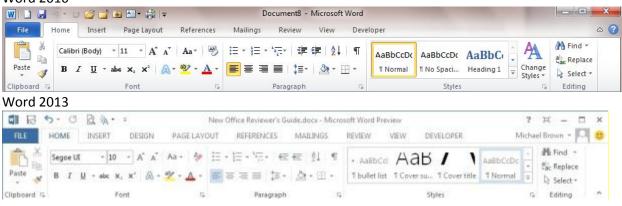
Co-authoring is much improved. You or others can work on a document stored on the cloud at the same time and pick the document back up later using another device.

One last bit of additional interface work is the new "reader" document view. This view is designed mostly for use on tablets with touch, and allows a user to view a file in read-only, flipping through its pages by scrolling left and right on the screen. The Reader view goes along with Microsoft's ambitions to make Word documents not just the way documents are created, but consumed. http://arstechnica.com/information-technology/2012/07/first-look-word-2013/2/

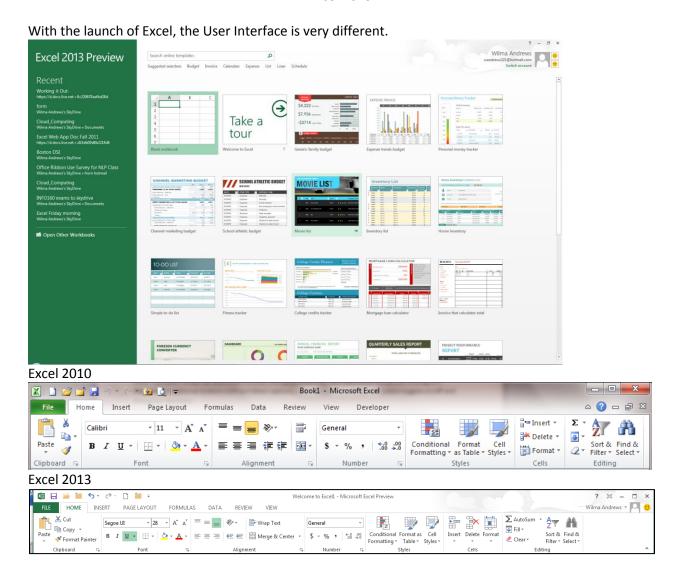
With the launch of Word, the User Interface is very different.



#### Word 2010



#### **Excel 2013**



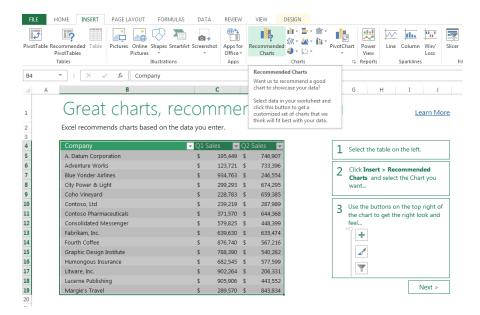
Excel sheet tabs are larger, square and colored. 66 functions have been added. One of which is "Formula text" which enables formulas to be "seen". Flash fill will

#### New functions.

Math and trigonometry, statistics, engineering, date and time, lookup and reference, logical and text functions have been added in this version. There are also Web service functions..

Excel has new filtering and Roman Numerals to Arabic conversion,

There are changes to charting features. At Insert tab there is a new Recommended Charts button and once a chart is created, there are new chart buttons to make changes to chart elements. Rich and refreshable text from data points or other text in data labels can be included and enhanced.



Tables have pivot charts and tables in the contextual tab. Pivot Tables and Recommended Pivot Table are suggestions by provided by Excel.

PivotTables have helpful recommendations now based on the data selected. You can also add additional tables for single and multi-table PivotTables. Timelines is an option now with PivotTables too. Standalone or decoupled PivotCharts are now options.

Flash fill - combines two cells based on what Excel anticipates the user intends to do.

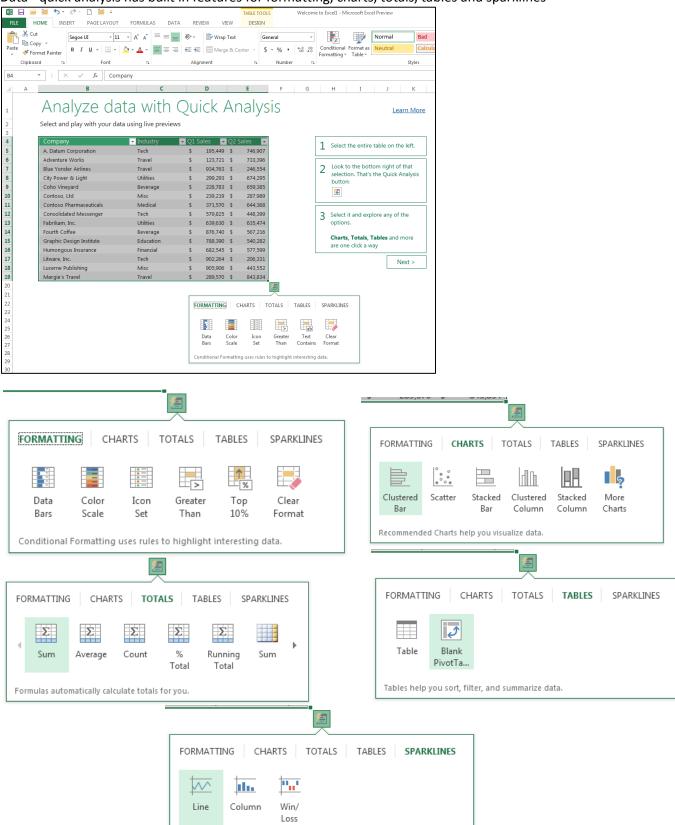
Slicers for PivotTables was first introduced in Office 2010. Now they can be used with tables, query tables and other data tables.

Each workbook will have its own window. This makes it easier to work on two workbooks at one time and makes working on two monitors easier. (Word has had this in previous version.)

Collaboration has been improved when using SkyDrive or Office 365.

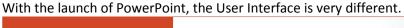
Select data and a Quick Analysis icon appears. Data analysis options popup. Quick Analysis has Live Preview in this version.

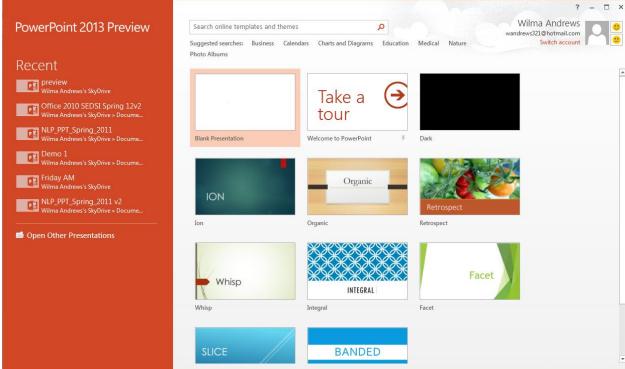




Sparklines are mini charts placed in single cells.

#### PowerPoint 2013

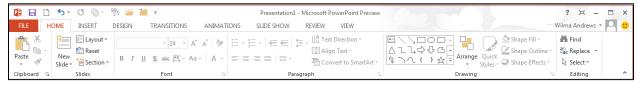




#### **PPT 2010**



#### **PPT 2013**



The Ribbon remains but a cleaner look is setup to be used on tablets and iPhones to enable swiping and tapping. Presenter view automatically adjusts for projectors.

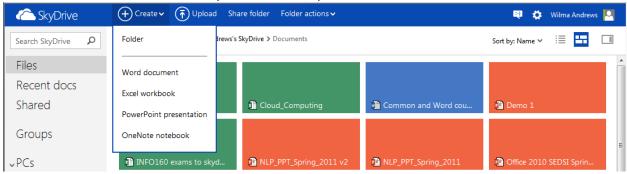
Presentation mode enables seeing the next slide and notes on screen while viewers only see the slides. Zooming in on slides is possible with a magnifying glass.

PowerPoint has new themes and transitions. Widescreens will be better able to view in a 16:9 layout. It is easy to change to touch mode which will enable making edits on tablets. The Notes section can be toggled on/off.

Charts are much easier to use. As in Excel, there are 3 buttons next to each chart where formatting changes can be made.

# WebApps

Cloud services and collaboration are greatly improved with many new features in the cloud WebApps. When first launched, there are many new features/options.



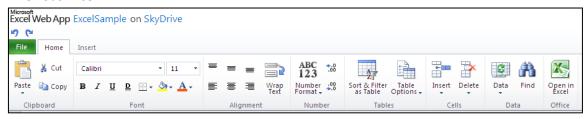
#### **Previous Word version**



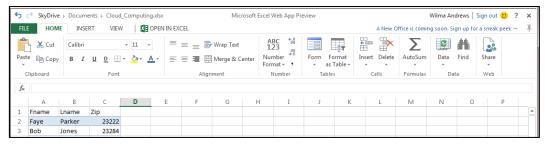
# **New Word version**



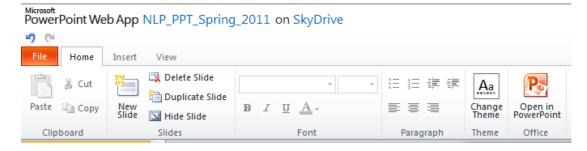
#### **Previous Excel**



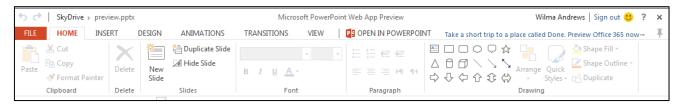
#### **New Excel version**



# **Previous PPT**



#### **Current PPT**



# METADATA: A REALISTIC APPROACH TO MANAGING DATA AS A CORPORATE ASSET

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#### **ABSTRACT**

Today, organizations spend more and more money on information, never knowing if it is accurate. We make decisions based on the information we collect. Therefore, managing data resources has become an important consideration for organizations. It is driven by a wide range of concerns, such as new database technologies, changes in work organizations, and social and economic reactions to a changing world. Metadata is the buzzword of the new millennium, but an important question remains. How can managers use metadata to support decision making? This research discusses and explores metadata's relationship to data and information and its transition to organizational knowledge. A discussion on metadata will follow.

# **INTRODUCTION**

Organizations have long been concerned with acquiring and maintaining their resources. Data in all its forms (raw data, interpreted data, knowledge, and expertise) is an informational resource that most organizations have had only limited success in managing.

A "client in the manufacturing industry experienced significant opportunity loss because of the poor quality of customer master data in its enterprise resource planning system. A

1

subset of large customers was labeled with an incorrect industry classification code, thereby causing it to be overlooked in the market segmentation analyses performed by the marketing department. The result was a lack of interaction with that customer segment in regard to promotions that would have generated an estimated \$5 million of revenue during the course of a year" (Hwang, 2001).

Metadata classification serves as a contextual foundation for organized metadata. In addition, process metadata is categorized to provide an operational level context that can be worked with in a specific, unique, or common ways by a corporation.

# **METADATA SOLUTION**

Managerial decision making stands to benefit from metadata (Even, Shankaranarayanan, & Watts, 2006). Therefore to manage cross-functional and cross-enterprise decision making with metadata solutions, this research groups decision making into three categories defined in the management literature: strategic (unstructured), tactical (semi-structured), and operational (structured) (Gorry & Morton, 1971). This will provide a framework for understanding decision making and the role of metadata as a tool.

#### **CONCLUSION**

In this paper, the author has started a discussion on the current situation regarding recourse to decision making in the area of metadata usage. Indeed, this paper has been a journey through the metadata research literature, viewed in a management framework for a comprehensive, interesting and informative discussion. The goal of an organization is to manage metadata in ways that supply accurate and coherent decision making, therefore becoming a realistic approach

2

to managing it as a corporate asset. The results of this research prove that metadata is a powerful and effective decision making mechanisms that is worth investigating farther.

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# MULTI-LEVEL SECURE ACCESS AND EDITING SYSTEM FOR BUSINESS DOCUMENTS

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#### **ABSTRACT**

As businesses continue to expand their operations across national boundaries, there is an increasing need for collaborative work between employees and business partners. However, if company documents and personal or identifying information of customers and employees are to be protected from unauthorized disclosure, access to stored documents must be controlled. This paper describes an Internet-based collaborative document sharing and editing system with security-leveled access control to stored documents. A fundamental goal of the system is to allow documents whose contents have varying sensitivity levels to be viewed and edited by authorized users with varying authority levels, while enforcing the required security constraints. The system allows documents in Office Open XML standard format to be segmented and stored in an embedded database management system, which controls access to documents. Once access is granted, users edit document sections using the corresponding familiar commercial off-the-shelf software.

Keywords: Business Documents, Collaborative Editing, Open Office, Java DB, Java Security

# INTRODUCTION

There is an increasing need for employees and business partners of organizations across the globe to collaborate and access the same collection of documents. In such an environment, there is significant risk of unauthorized disclosure of identifying information of customers, employee data, and other pertinent trade documents. This paper describes an Internet-based collaborative document sharing and editing system with security-leveled access control to stored documents. A fundamental goal of the system is to allow documents whose contents have varying sensitivity levels to be viewed and edited by only authorized users with varying authority levels, while enforcing the required security constraints. The system allows documents in Office Open XML (OOXML) standard format to be segmented and stored in an embedded database management system, which controls access to documents. Once access is granted, users edit document sections using the corresponding familiar commercial off-the-shelf (COTS) software. The multi-level secure system will permit businesses, employees and contractors to work seamlessly on the same documents without compromising confidentiality of information.

The solution approach supports sharing and editing of composite documents containing sensitive information in collaborative environments. As designed, the Multi-Level Secure Document System (MSDS) will allow documents to be partitioned into sections with varying sensitivity levels and to be viewed and edited by users with varying authority levels. In order to meet the fundamental goal of allowing documents whose contents have varying sensitivity levels to be viewed and edited by authorized users, the system is designed to meet the following technical objectives:

- Support multi-level documents where a single document may contain multiple sections of varying classification and compartmentalization into subject areas
- Maintain the confidentiality of documents such that users may never view sections of documents for which they do not have clearance or approval
- Allow users to load, edit, and save a document without disturbing sections of the document for which they do not have sufficient authority or approval
- Permit users with appropriate authority or approval to demarcate documents or part of documents into security-level-based sections
- Permit multiple users to work collaboratively by allowing concurrent access to the same documents
- Support the formation of collaboration groups or coalitions
- Enable users to have transparent access to documents that are located on various networks
- Permit documents to be formatted using various commercial off-the-shelf software

# SOLUTION APPROACH AND SYSTEM ARCHITECTURE

The solution approach is based on a multi-tiered architecture where documents in OOXML [2] format are managed by Java DB, which is a database management system embedded in the Multi-level Secure Document Java application. An Internet based interface system provides, through a single server, location transparent access to stored documents. Users who are organized into dynamic collaboration groups will have access rights based on their individual security levels, as well as rights inherited from the groups to which they belong. When authorized users gain access to the server, the documents and options displayed in the interface will depend on the security level of the individual requesting access. Whenever the user initiates a document access operation, the application filters the document and produces a constructed copy consisting of the appropriate sections. Users may edit documents in their workspace and save them back to the central storage.

The system has three tiers consisting of Web server, Java application, and Java DB for managing document data. From their web browsers, users connect to the application and subsequently gain access to relevant documents, through the web server. Access to documents is permitted only through the document application, which is invoked from the web browser. Figure 1 depicts the architecture of the system, and the components of the system are described in the following sections.

#### The Web-base User Interface

Users access the application and documents through a login process. After the authentication process, the Web server presents the document access interface, where the user can browse though a document list or perform a document search. The documents that are available to a user through browsing or a search query depend on the security level of the user. When two users with different security levels access the same document, they may see different paragraphs or sections of the document. The same underlying document may bear different names depending on the viewer; a document presented to the user may also consist of sections from multiple underlying documents.

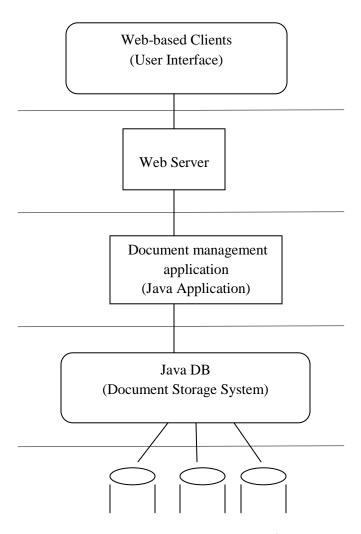


Figure 1: Overview Architecture of MSDS

# **Web Server**

The Web server controls access to the application through user authentication at login time, encryption of passwords, and presentation of web pages according to the user's profile. The server processes user requests by forwarding queries or operations to the application and by loading dynamic web pages. The server also runs the application, which allows users with varying roles to perform system and database management functions.

#### **Document Management Application**

The application consists of three main components, which loads document from storage, updates and stores document to storage, and allows subdocuments to be defined, respectively:

- The document generator retrieves document sections from storage and composes the sections based on defined document views and the requester's security level
- The document uploading component updates edited sections and paragraphs of the document as defined by the document views available to the user
- The View editor allows authorized individuals to define subdocuments and to assign security properties that dictate who may have access to the sections

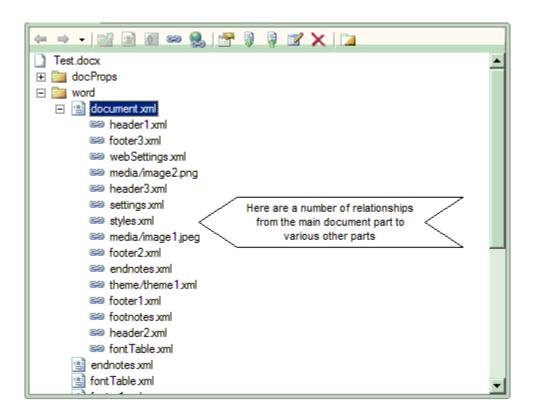


Figure 2: Main Document structure

#### **Document Format**

The ISO standard (ISO/IEC 29500-1:2011) [3] defines a set of XML vocabularies for representing wordprocessing documents, spreadsheets and presentations, based on the Microsoft Office 2008 applications. It specifies requirements for Office Open XML consumers and producers that comply to the strict conformance category. The Open Packaging Conventions specification defines the structure of Open Office documents. Word 2007 document, for instance, consists of three major components:

Part items: Each part item corresponds to one file in the un-zipped package.

Content Type items: Content type items describe what file types are stored in a document part; for example, image/jpeg denotes a JPEG image. This information enables Microsoft Office, and third-party tools, to determine the contents of any part in the package and to process its contents accurately.

Relationship items: Relationship items specify how the collection of document parts come together to form a document.

Figure 2, adapted from [10], shows a variety of parts that make up the main document part node (document.xml). Normally, zip files are used to implement the Open Packaging Conventions. However, we propose to store document paragraphs and other components in a Java DB (a SQL-based database management system). Using Java DB as the storage system allows us to store document parts in database tables, define views to expose only relevant document sections to different category of users, and to use DBMS access mechanisms to control access.

When an authorized user makes a request for a document, the Java application retrieves appropriate document part items and produces a constructed copy consisting of the appropriate sections. Because users may open any forwarded documents with COTS software (in this case Microsoft Office), they have to be presented in a valid Open XML format. Users may edit documents in their workspace and save them back to central storage, but the packaging and unpacking of the documents is transparent to the end user. Contentions arising from simultaneous requests for the same document paragraphs and sections are resolved at the table row level—row-level locking in Java DB is described in [9].

# Java DB

At the lowest level, documents or document sections are stored and managed using Java DB. Java DB is based the open-source Apache Derby database. Java DB is lightweight at 2 megabytes and embeddable within desktop Java technology applications. The MSDS application leverages the capabilities of Java DB, which is a powerful database storage system with triggers, stored procedures, and support for SQL, Java DataBase Connectivity (JDBC) software, and Java Platform. The features of Java DB are summarized in [7].

#### ACCESS CONTROL AND SECURITY FEATURES

Access to documents is initiated from a web browser; users are authenticated and presented with an application interface based on their security levels and collaboration grouping. The level of access is also defined by these roles:

- System Administrator This is the person who configures Java DB's system-wide behavior. Typically, this is a highly privileged user responsible for allocating machine resources, managing the network, configuring security, and actually launching the VM.
- Database Owner This is the person who creates and tends the databases needed by a particular application; the System Administrator can also serve as the database owner
- User This is a person authorized to use an application; that includes end-users, technical support engineers, and developers who maintain the application

# Java and Java DB Security

Security and access control is provided by Java DB as well as outside of Java DB. A summary of the defenses against threats provided by Java DB and Java is given in [8]:

- Java Security Using a Java Security Manager and policy file, the System Administrator can restrict the permissions granted to user-written code. The System Administrator can also restrict the permissions granted to Java DB itself
- SSL/TLS The System Administrator can require that SSL/TLS be used to encrypt network traffic between Java DB clients and servers, along the way raising an extra authentication hurdle
- Encryption A Database Owner can require that the data for an application be encrypted before being stored on disk. This makes it expensive to steal and corrupt the data
- Authentication Using usernames and passwords, a Database Owner can restrict access to an application's data
- Coarse-grained Authorization A Database Owner can divide an application's users into three groups: those with no privileges, those with read-only privileges, and those with read-write privileges
- Fine-grained SQL Authorization Via SQL GRANT/REVOKE commands, a Database Owner can further restrict access to fine-grained pieces of data and code

Thus, access is controlled at various levels:

- Authentication through user account and password control mechanism
- The operations allowed and documents displayed in the interface depend on the user's security level
- Users are assigned to collaboration groups where they inherit group rights
- The sections of documents downloaded at user request are dictated by the user's security level; the remaining sections of the document remain confidential
- The network locations of documents are transparent to the users; access is through the application which maps virtual documents to physical files.

#### RELATED WORK AND CONCLUSIONS

There has been considerable interest in document databases in which data is stored as JavaScript Object Notation (JSON) [4] documents and access provided most commonly through HTTP. A Microsoft Developer Network magazine article [5] gives an overview of the so-called NoSQL databases, including document databases such as Apache CouchDB. CouchDb [1] maintains each database as a collection of independent documents, and each document maintains its own data and self-contained schema. The work in [6] proposes the concept of "File View" for presenting different sections of files to various users, similar to the way relational database Views can present different views of an underlying database. The work reported in [11] defines the Secure Confidential Document Model (SCDM) in which a document may be chunked into logical blocks and access to documents traced. However, unlike the research and development reported in this paper, the focus of document databases, File View, and SCDM is not on collaborative editing.

This paper describes the architecture of a collaborative document management system with multi-level security. As businesses continue to expand their operations across national boundaries, the need for collaborative editing without exposure of sensitive personal identification information of employees and customers is expected to grow. The system is expected to improve productivity especially in corporations with global presence.

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# SOFTWARE SUPPORT FOR THE INNOVATIVE PROCESS IN ORGANIZATIONS

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# **ABSTRACT**

The vast amount of creativity and innovation literature offers numerous definitions and diverse perspectives on what creativity is and how an organization can be innovative. This research defines the link between creativity and innovation. Next it offers a vision on how the process can enhance viable options for innovative success. It is argued that currently there are many software features that can promote a relationship between creativity and innovation, which is necessary to have a positive outcome.

#### INTRODUCTION

The vast amount of creativity literature offers numerous diverse perspectives (Boden, 2004; Couger, 1996; Gardner, 1993) on what creativity is and how to get it. At its simplest form, creativity occurs anytime a person creates something new that has some kind of value. New products, a solution to a problem, a work of art are just a few ways in which creativity can manifest itself. This research looks at creativity in relationship to innovation and investigates how software tools can support both. The goal of the creative process is to create something new and when linked to an outcome of innovation includes a positive orientation towards making something better. Creativity that has an innovative

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outcome can lead to increased productivity and to increased wealth for a firm(Hessels, van Gelderen, & Thurik, 2008). The purpose of this paper is to explore the topic of organizational innovation.

# **CREATIVITY AND INNOVATION**

Many researchers have investigated the creative process. It is well established that it involves numerous phases. The phases are commonly described as first insight, preparation, saturation, incubation, illumination, implementation and verification (Brennan & Dooley, 2005; Cropley, 2006; Rank & Frese, 2008). Illumination is described as the "Ah-Ha!" experience. Saturation or preparation and implementation or verification is easily understood. Saturation or preparation is where you gather information and investigate a topic. The phase of verification or implementation is when you test an idea. Saturation, preparation, implementation and verification require conscious and more manageable actions. The other phases (first insight, incubation, and illumination) are more subconscious and seem somewhat more mysterious. They are unpredictable and less manageable. In business, creativity is not enough. It must be actionable. Inventions are the manifestation of creative actions. It is something new. Innovation differs from invention in that innovation refers to doing and/or using something in a new way. It is directly related to organizational change. In business and economics, innovation is the catalyst to growth and therefore very important to the survival of the organization.

# A FRAMEWORK FOR MEGA-CREATIVITY

After several years of exploration, the genex framework (Carroll, 2002; B. Shneiderman, 2000; Ben Shneiderman, 2002) evolved into the framework for mega-creativity which has four activities:

- Collect: Learn from previous works stored in libraries, the Web, and other sources.
- **Relate:** Consult with peers and mentors at early, middle, and late stages.
- **Create:** Explore, compose, and evaluate possible solutions.

• **Donate:** Disseminate the results and contribute to libraries, the Web, and other sources.

# THE ORGANIZATIOAL INNOVATION PROCESS

Research frameworks are attempts to capture and explain the complex, interdependent, and dynamic factors and processes that exist in our world. Mackenzie (2000) presents a process approach for the organization sciences that views organizational behavior as fundamentally a physical process, thus it is a sustained phenomenon or one marked by gradual changes through a series of states. This supports Shneiderman (2007) conclusion that creativity is a process. It is important to note that variables are often a form of the outcomes (results) that come from a process and are inherently causal (Mackenzie, 2000). This research proposes that innovation can be the outcome of the creative process(Mattia, 2011a, 2011b). Interestingly enough, factor research models are the most commonly used models in creativity research (Ben Shneiderman, 2007), and although they are useful to researchers, a gap exists in the study of the actual processes that produce the factors.

"The emphasis on close study of domain experts as they make discoveries has led many researchers to adopt case study, observational, and interview methods with small numbers of users over weeks and months. Their goal is to capture the processes that precede breakthrough incidents and to collect evidence that supports hypotheses about how software design features promote creative moments." (Ben Shneiderman, 2007)

Proposition 1a.. Organizations will be most effective at promoting creativity if they treat it as a process that evolves as gradual changes through a series of states.

Proposition 1b. Organizations will be most effective at innovation if they treat it as an outcome to the creative process.

#### A DIRECTED PROCESS FOR INNOVATION

After several years of exploration, the genex framework (Carroll, 2002; B. Shneiderman, 2000; Ben Shneiderman, 2002) evolved into the framework for mega-creativity and upon further research this

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study adapts the framework into The Directed Process for Creativity and Innovation which has five main activities:

- **Initialization:** Construct a base version of the idea, problem and/or system.
- Collect: Learn from previous and associated works on the topics stored in libraries, the Web, and other sources.
- **Relate:** Consult with peers and mentors at early, middle, and late stages.
- **Create:** Explore, compose, and evaluate possible options.
- **Innovate:** implements viable options successfully in practice.

It builds primarily on the mega-creativity framework by extending it with an innovative perspective and includes initialization as the first activity and innovation as the last activity which is defined as an implementation of a process that users work through for themselves successfully. It requires motivation on the organizations part. Software tools and how they are to be used are worked through by the users (Tornatzky & Fleischer, 1992) and directed by the framework. This is important because in a business environment we must manage the processes and ensure that they result in useful outcomes. Indeed, management includes the act of getting people and ideas together to accomplish desired goals and objectives using available resources efficiently and effectively. The problem has been that creativity and innovation activities have not been conducive to efficiencies and effectiveness in the short term.

# **DISCUSSION AND CONCLUSION**

Creativity and innovation should not be caught in the paradigm of the software support tools of the 1990s (word processor, spreadsheet, presentation, email), when there is a need for collaboration, reuse, living documents, and quicker authoring cycles in the twenty-first century. The promotion of creativity can be enhanced by allowing time and assigning the task each week for investigating a software tool. A repository of tools would have templates, wizards and creative examples. Allow an add-on product that focuses on creativity and innovation.

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In summary, creativity is a process that has long been seen as a mysterious (Boden, 2004; B. Shneiderman, 2000) Indeed, creative ideas are unpredictable and sometimes they even seem to be impossible. Yet they happen and are important to individuals and organizations. Shneiderman (2007) offers a slight shift in focus and terminology, when compared to Shneiderman (2002), but the goal still remains the same; to enable more people to be more creative more often. Three propositions were deduced from the literature and developed into a process that can strategically promote creativity and innovation. The research design is sound and therefore the prospects that it could actually be implemented are very good. Future research should follow Shneiderman (2007) and take into consideration the opportunity to enrich the research on creativity and innovation with methods that include process research, case studies, and interviews with small numbers of users over weeks and months. As a researcher, my goal (as I move forward) is ".... to capture the processes that precede breakthrough incidents and to collect evidence that supports hypotheses about how software support tools can used to strategically promote creativity and innovation.

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# Does the Supply Chain Model Provide a Direction for the Patient-Centered Medical Home (PCMH) Model?

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#### **ABSTRACT**

The Patient Protection and Affordable Care Act (PPACA), signed into law in 2010, contains two key imperatives for health care providers – reduce costs while, at the same time, improve the quality of health care. Major changes in the method of delivering health care are required, especially in improving the flow of patients and information among a variety of health care providers. This paper proposes that the supply chain model, used in the business community to improve the flow of goods, information and funds among supply chain participants, can be used as a model for use in improving similar flows in the Patient-Centered Medical Home (PCMH), one of the more promising approaches outlined in the PPACA.

#### INTRODUCTION

Health care is a topic of increasing concern to individuals, to health care providers, to insurance companies, and to politicians. Although there is widespread agreement that high quality health care for everyone is a desirable objective, there is equally widespread disagreement as to how to achieve that objective. The problem is not a lack of ideas; it is the lack of an approach that is appealing to a majority of the stakeholders involved.

On March 23, 2010, President Obama signed into law the Patient Protection and Affordable Care Act (PPACA). Known also as the Health Care Reform Act, this statute has far-reaching implications for the healthcare industry and all of its stakeholders, including patients, insurance companies, medical device manufacturers, and health care providers. There are two imperatives for health care providers: reduce costs while, at the same time, improving the quality of health care (Grout, 2010). While the literature provides many examples of successes, it also cautions that there are obstacles to the successful implementation of the techniques.

In general, some of the approaches hold promise for providing a seamless flow of patient services in the future, as contrasted with today's intermittent, often lengthy, movement of a patient through a sequence of doctors, tests and treatments with an inadequate flow of information and disjointed patient billings. These approaches, while not new, are part of the movement toward integrating patient care with the creation of integrated health systems. They have been organizational attempts, mostly to respond strategically to the quirks of the fee-for-service payment system. Better efficiencies and quality have been achieved through integrated health systems – these improvements are not being replicated fast enough in all areas of the country (Roggenkamp, 2010).

Sometimes it is helpful to use a model that has been successful in managing change as a guide. In this paper, we will use the supply chain model, which has proven successful in delivering products and services to consumers, as a reference against which to compare one of the more promising approaches in health care management – the Patient-Centered Medical Home (PCMH). Hopefully, what we have learned in managing supply chains can help to improve the management of PCMHs.

#### **SUPPLY CHAIN**

First, what is a supply chain? The APICS Dictionary offers the following definitions: A **supply chain** is the global network used to deliver products and services from raw materials to end customers through an engineered flow of information, physical distribution, and funds. The **supply chain community** is the set of trading partners and nominal trading partners that define a complete supply chain. **Supply chain design** is the determination of how to structure a supply chain. Design decisions include the selection of partners, the location and capacity of warehouses and production facilities, the products, the modes of transportation, and supporting information systems. **Supply chain integration** results when supply chain partners interact at all levels to maximize mutual benefit. **Supply chain management (SCM)** is the design, planning, execution, control, and monitoring of supply chain activities with the objective of creating new value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand, and measuring performance globally. (Blackstone, 2010)

Figure 1 shows the flow of manufactured goods along the supply chain, from raw materials to the ultimate consumer. In addition to the flow of goods, there is a flow of information and a flow of funds. For manufactured products, the transformation process converts physical materials (things), such as wood and steel, into finished goods, such as furniture and automobiles.

Figure 1 also shows the reverse supply chain, or reverse logistics, as it is often called. This is the flow of used goods back up the supply chain for reuse, remanufacture, or recycle, as appropriate.

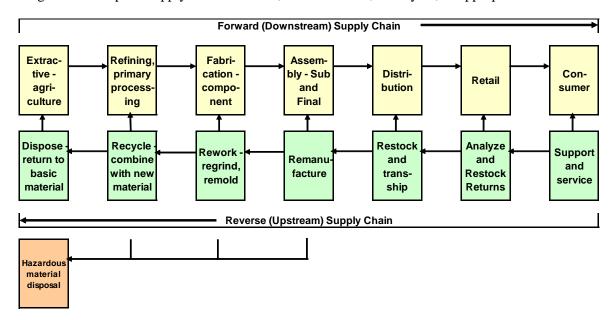


Figure 1. Manufactured Goods or Services Supply Chain

There is an abundance of literature about supply chain and their management; we will not review it in detail in this paper. Instead, we will concentrate primarily on the PCMH. However, before we can focus on the PCMH, we need to clarify the distinction between the PCMH and the Accountable Care Organization, another element in the ongoing health care movement.

#### **FLOWS**

Figure 2 illustrates the flows in a supply chain. The flow of goods and services tend to be linear from supplier to customer; the flow of funds is also linear, from customer to supplier. However, information can flow in both directions and may have numerous iterations or feedback loops as participants work to obtain or provide information needed by other members of the supply chain.

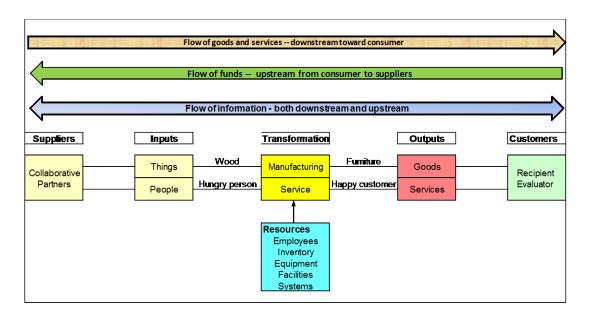


Figure 2. Supply Chain Flows

Figure 2 also shows that the supply chain concept can be applied to people, not just things. People can be transformed from a hungry person to a satisfied consumer, or a student can be transformed into an educated graduate. In the PCMH, there is a need to move patients, who are the inputs into the health care supply chain, smoothly along the steps in the care process. While this smooth flow is desirable, it does not yet exist in most situations. Figure 4 provides an example of this disconnect as it may exist in pre-PCMH conditions.

Both supply chains and PCMH are concerned with the flow of goods and services within their organizations. Figure 3 provides an example of how one treatment process – surgery for a knee repair – sometimes does not flow as smoothly as desired, or as shown in Figure 3. The patient first damages the knee and visits the emergency center, where she receives short-term treatment. The patient then checks in with her primary care physician, who may or may not recommend a final treatment or specialist. With or without the help from primary care, the patient finds a specialist/surgeon who recommends surgery. The specialist works with a hospital and schedules a time that fits both the specialist and hospital, but not always the best time for the patient. The surgery is completed and the patient then arranges for rehabilitation with a physical therapist, either through the hospital or a third-party service.

The goods flow (in this case, the patient) faces intermittent treatment, and sometimes, unexpected decision requirements, often beyond his or her normal capability to make. In addition, information (patient records) does not flow smoothly and funds flow is a frustrating experience because of multiple, sometimes unexplained, billings. Since the healthcare system is driven by fee-for-service payment, there is little financial incentive to economize on service delivery (Roggenkamp, 2010).

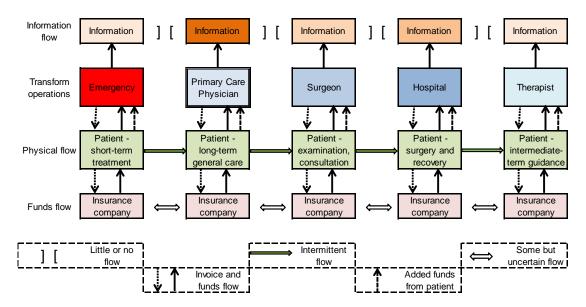


Figure 3. Supply chain flow for a knee repair patient

# **Adapted from Crandall 2011**

The need to improve the coordination of patient treatment for a wide variety of general care or specific ailments is the driver for the PCMH. (Roggenkamp, 2010) This approach has multiple options or variations, and each is designed to improve patient care and reduce costs by providing the patient with some form of collaborative arrangements between primary care physicians, specialist physicians, and treatment centers, such as hospitals and home health centers.

#### PATIENT-CENTERED MEDICAL HOME (PCMH)

Next, what is a PCMH? The American College of Physicians (ACP) offers this description: "A Patient-Centered Medical Home is a team-based model of care led by a personal physician who provides continuous and coordinated care throughout a patient's lifetime to maximize health outcomes. The PCMH practice is responsible for providing for all of a patient's health care needs or appropriately arranging care with other qualified professionals. This includes the provision of preventive services, treatment of acute and chronic illness, and assistance with end-of-life issues. It is a model of practice in which a team of health professionals, coordinated by a personal physician, works collaboratively to provide high levels of care, access and communication, care coordination and integration, and care quality and safety." (ACP, 2011)

Birk (2011) summarized the principles reported by the American Academy of Family Physicians, American Academy of Pediatrics, American College of Physicians and American Osteopathic Association as:

- An ongoing relationship for each patient with a personal physician trained to provide firstcontact, continuous and comprehensive care.
- A team of individuals led by the personal physician at the practice level who collectively take responsibility for the patient's ongoing care.
- A focus on providing for all of the patient's healthcare needs or taking responsibility for appropriately arranging care with other professionals.

- Coordinated, integrated care across all elements of the health care system, including subspecialty care, hospitals, home health agencies, nursing homes and the patient's community.
- An emphasis on quality, safety and the attainment of optimal outcomes.
- Enhanced access to care through open scheduling, expanded hours, and new options for communication between, their personal physician and practice staff.
- Payment that reflects the added value of a patient-centered medical home to patients.

As the name implies, the PCMH is designed to provide a single site where a patient could receive treatment for any, and all, of their medical needs, by working through their primary care physician. It would link together care providers of all kinds, in a collaborative, or contractual, relationship that would be patient-friendly. The primary care physician is responsible for coordinating and managing the care needs of the patients. Payment for all care needed by the patient comes through the medical home which arranges for the care needed and "brokers" the care obtained from the various providers (Roggenkamp, 2010). Today, the patient faces a number of administrative hurdles – physician selection and evaluation, scheduling surgery and rehabilitation, sorting out multiple billings, and contact with insurers, to name a few. These would be removed from the patient's direct responsibilities in a medical home infrastructure. By simplifying these steps in the treatment process, patient care would be enhanced and costs reduced.

At the Primary-Centered Primary Care Collaborative (PCPCC) Stakeholder's Conference, Boeing reported the results of their medical home pilot project launched in 2007. It involved three large medical groups covering 740 patients who were considered medically complex because they had an average of four different medical conditions. The pilot project reduced emergency room visits and hospital admissions, resulting in a 20 percent net savings in medical costs among patients in the medical home. The project also increased employee and physician satisfaction rates (Arvantes, 2010).

Figure 4 shows the graphical concept of a PCMH, where the patient is surrounded by all of the services needed during a lifetime. "The concept of patient-centered *medical homes* offers a structure for integrating innovations that can transform the delivery of healthcare. In this model, each patient develops an ongoing relationship with a primary care physician supported by a team of caregivers. An integral feature is the electronic medical record, which facilitates coordinated communication and decisions. Access expands beyond the traditional physician office visit to satellite services tailored to individual needs. Services center on whole-person care, including wellness and preventive counseling, as well as acute and chronic care. Adoption of the patient-centered *medical home* transforms healthcare delivery into a system that benefits everyone." (Berry and Mirabito, 2010)

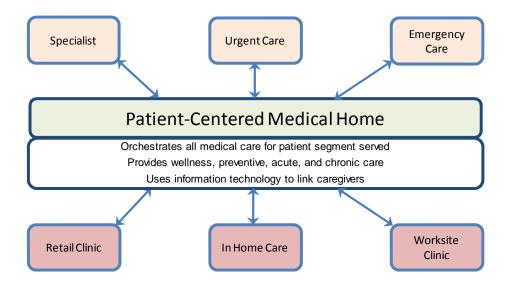


Figure 4. Integrating a Patient with Their Medical Home (Adapted from Berry and Mirabito, 2010)

With this basic understanding of the two programs, we can compare and contrast them in the following sections.

# COMPARISON OF SUPPLY CHAINS AND PATIENT-CENTERED MEDICAL HOMES

Table 1 provides an overview of the flows in each.

Table 1. Comparison of Flows between Supply Chains and PCMH

Supply Chains	Patient-Centered Medical Home
In the forward supply chain, <b>goods and services flow</b> from the raw materials source to the ultimate consumer. There is also a reverse supply chain, in which used goods are reused, remanufactured or recycled. This forward and reverse flow is called a "cradle to grave" product cycle.	In the PCMH, the flow concept can be applied to the individual patient, who moves among care providers who provide a variety of services to prevent or mitigate illnesses or other negative impacts on the patient's physical and mental wellbeing, also a "cradle to grave" approach.
Information about products and services flows among the supply chain participants to enhance the flow of goods and services by helping to reduce costs, improve quality, reduce response times, and increase the flexibility of the flow of goods and services. It requires information technology connectivity among all participants.	The patient's medical history and related information flows among the health care providers in the PCMH, in order to make diagnoses and treatments most beneficial to the patient. The results should include reduced costs, improved quality, reduced response times, and flexibility in treatments.
Goods and services flow from supplier to consumer;	Funds flow in a PCMH is expected to be more

**funds flow** in reverse from consumer to supplier. In a supply chain, this is straightforward. The amount paid is based on an agreed-to selling price and is usually confined to a dyadic relationship between one customer and one supplier.

complex because of the existence of insurers who pay a portion of the charges, while the patient pays the rest. At present, the distribution among fee-for-services, managed care and outcomes is still evolving in each PCMH.

#### GOALS AND OBJECTIVES

Supply chains and PCMH have similar goals and objectives, as summarized in Table 2.

Table 2. Comparison of Goals and Objectives

	Supply Chain	РСМН
Primary goal	Provide the best value of goods and services for the ultimate consumer	Provide the best health care services for the individual patient
Scope of operation	Manage products and services throughout their life cycles – a "cradle to grave" approach	Manage the health care services for a patient throughout his (her) life span, or "cradle to grave."
Direct objectives	Reduce costs, improve quality, reduce response time, and improve flexibility and product customization	Reduce costs, improve quality, reduce response time, and improve diagnosis and treatment for individuals
Generic objective	Reduce waste of any form in the supply chain – lost time, excess resources, duplication and the like	Reduce waste of any form in the treatment of patients – delayed diagnosis, duplicate or conflicting treatments, prevent or reduce the effects of chronic illnesses, and the like

While not identical, the goals and objectives appear to be closely aligned. The major difference between the two is that supply chains process inanimate objects while a PCMH processes human beings. As such, supply chains have control over much of the life cycle of a product or service; a single PCMH rarely has control over the entire life cycle of an individual.

# **OPERATING CHARACTERISTICS**

In this section, we compare some of the operating characteristics of supply chains and PCMH to show there are many similarities.

# Acts like a system

Both supply chains and PCMH require a systems approach. They must fit together a number of elements in order to function effectively. Supply chain link multiple sets of suppliers with customers with both information and physical movement of goods or services. PCMH links multiple sets of health care providers with patients with both information and the physical movement of patients. In both cases, the linked entities work with each other to achieve the desired outcomes.

# **Requires Collaboration among participants**

While the system links diverse entities together, it takes collaboration among those entities to be effective. After participants have first learned to communicate, coordinate, and cooperate, collaboration can be achieved. This is true for supply chains and it is equally valid for a PCMH. Groups that previously operated separately must now learn to work together.

Collaboration implies cross-functional team members working together. This includes health care providers, insurers, administrators, and patients. This represents individuals, or functional areas, that have different goals and processes, not necessarily easily accommodated within the same working arena. However, the PCMH envisions this collaborative environment.

A logical approach to achieve efficiency has been to separate physicians from the administrative support group. This allows physicians to use their training and interests in patient health care and not worry about filling out forms or billing patients. While a well-established approach, the two groups must work together to assure high quality care. Crabtree, McDaniel and Nutting (2008) maintain that the dual approach is no longer sufficient for contemporary primary care practice because it perpetuates an outmoded practice and inhibits the emergence of the medical home.

# Responsible to multiple stakeholders

Supply chains have multiple stakeholders – the individual company participants, the ultimate consumers, financing institutions, shareholders, insurance companies, regulatory agencies, and employees. The PCMH also has similar stakeholders – the patient, the various health care providers, insurance companies who pay some of the charges, government regulatory agencies, and certification or licensing agencies.

# Local versus global

Supply chains have moved from being localized to being global. They link suppliers and customers throughout the world. A PCMH will tend to be more localized, if possible, just for the convenience of the patient. However, they will also consider more remote health care providers when the situation warrants seeking more specialized services.

# Provide for all members of the supply chain/medical home

In a supply chain, it is often difficult to decide how best to equitably allocate the costs and benefits of a change in the structure or processes used. Often this is the result of an improvement initiative, such as the introduction of a new technology like RFID. The same dilemma awaits the PCMH when a group diagnosis results in a cure, or reduced hospital visits, for a chronically ill patient. How does the PCMH allocate the benefits among the group?

# Use outsourcing to obtain best results

Supply chains have made widespread use of outsourcing, often offshore outsourcing, to achieve reduced product or service costs, and reduced investment requirements. A PCMH is designed to enable the primary care physician to outsource services to a variety of other health care providers, as needed to best serve the patient.

# Virtual integration versus vertical integration

Supply chains have come into focus as companies have moved from vertical integration (they owned a substantial portion of the supply chain) to virtual integration (they outsource much of the supply chain activities). A PCMH represents a possible opposite movement in ownership. In the past, the variety of health care providers operated separately, or in "silos," to use a currently popular term. In a PCMH, some of the health care providers are coming under a single ownership, as when physicians become employees of a hospital or a combined medical practice.

# Payment for outcomes, not for individual services

In a supply chain, customers pay for a product or service they have selected for a specific purpose or use. In effect, they pay for an outcome (a use). One of the criticisms of the health care field is that patients pay for a service, not an outcome. Some point to this method of payment as a cause of excessive or duplicative tests and treatments. A PCMH will need to put more emphasis on payment for outcomes, not just services. (Miller, 2010)

#### COMPONENTS ARE DYNAMIC (CONSTANTLY CHAINGING)

Supply chains face a myriad of changes. At some point, suppliers, customers, products, processes, competitors, economic conditions, technologies, societal trends, government regulations and company management may impose new requirements on supply chain managers. The same is true for a PCMH. Components affecting it are continually changing and the primary care physician must be well informed in order to cope with those changes.

There is a need for continuous improvement. While the efforts in improving operations in supply chains has been an ongoing effort for decades, formal programs in health care are relatively new. In fact, some of the techniques developed in manufacturing have been successfully applied in health care.

Because of space limitations, we will list only a few of the many lean and Six Sigma applications we found in the literature. They include:

- Hospital discharge process with Six Sigma methods (Allen et al., 2010)
- Applying Six Sigma to improve efficiency, timeliness and quality of care in an internal medicine residency clinic (Fischman, 2010)
- Involving physicians in lean Six Sigma (Caldwell, Brexler and Gillem, 2005)
- Improving home health care (James and Kovach, 2009)
- Reduce waiting times in emergency departments (Johnson et al., 2004; Schooley, 2008)
- Reducing hospital medical errors (Kumar and Steinebach, 2008)
- Reducing variability in the delivery of clinical services (Lloyd and Hoslenback, 2008)
- Improving hip replacement procedures (Peltokorpi and Kujala, 2006)
- Improving congestive heart failure care (Wu and Liu, 2010)

These examples show the wide range of applications of lean and Six Sigma in both large and small organizations.

The benefits from the use of lean and Six Sigma programs include cost savings, quality of care improvement, reduction of stay in hospitals, increased collaboration between administrative staff and care providers, simplification of administrative procedures, and increased patient satisfaction.

While there are a number of successful implementations of lean and Six Sigma, their adoption is fragmented and often confined to larger organizations. One study, from the American Society for Quality, surveyed 77 hospitals. Of those surveyed, 53 percent reported some level of Lean deployment, while 42 percent reported some level of Six Sigma deployment. However, only 4 percent reported full deployment of Lean and only 8 percent full deployment of Six Sigma (Ziegler, 2009)

# CONTINGENCY THEORY (ADAPT TO THE CURRENT CONDITIONS)

Companies have multiple supply chains because they have to adapt each supply chain to some variation in their products and processes. Supply chains fit their design and operation to fit the situation. A PCMH must do the same. One PCMH is different from another; therefore, the composition of a PCMH must adapt to its own unique situation. There is evidence that a PCMH can achieve positive results when properly adapted to fit the situation. Healthcare is a highly complex and variable need. Patients are heterogeneous and this requires a flexible delivery model that offers patients multiple paths to assistance when and where they need it (Berry and Morabito, 2009).

# SUPPLY CHAIN MASTERS AND PRIMARY CARE PHYSICIAN

According to James A. Pope, supply chains need a chain master. "The chain master is the firm or division that controls the supply chain. Control may range from dictating the flow of goods or services through the chain to being a benign controller by virtue of some characteristic that makes it a controller. Firms are not elected or appointed to the role of chain master. They can emerge as the chain master for any one of a number of reasons: market share, size, technology or control of channels." (Pope, 2011)

The primary care physician is the PCMH master because she (he) manages (plans and controls) the flow of patients among the services provided by the PCMH. The primary care physician attempts to see that the patient receives the right treatment at the right time by the right care provider, and at the right price.

# **BENEFITS (ECONOMIC AND EMOTIONAL)**

The benefits for the ultimate consumer from effective supply chain design and management include products and services of greater value, either in the form of reduced costs or increased utility. There are also less tangible benefits such as increased customer loyalty, reduced negative effects on the environment, improved social benefits and a better match between demand and supply.

The PCMH is also designed to provide some tangible benefits. One of the primary benefits is expected to be a reduction in health care costs, from reduced duplication and a reduction in the need for more expensive treatments as the health of individuals is improved.

A second economic benefit is that primary care physicians, as the coordinator of PCMH services, will be compensated for this added responsibility. One of the disturbing trends is the movement of physicians from primary care to specialists. This change is even occurring in the educational system in that fewer medical school graduates are opting for primary care practice. (Christiansen, 2008)

A final, and probably the most important, benefit is the increased wellbeing of individual patients. As the quality of health care treatment continues to improve, patients will live longer and with fewer health problems.

# **OBSTACLES TO THE PCMH**

Just as with supply chain design and implementation, success for a PCMH faces a number of significant obstacles.

A complex system that requires patience and skill to implement

Figure 2 begins to show the complexity of a PCMH. Not only are there a number of entities involved, a PCMH must reconcile the different interests and objectives of each entity into a functioning unit. Each entity must work together with other entities to achieve a common goal. Just as supply chains have taken years to form into effective, although not perfect, organizations, it may take years for the PCMH concept to take root in today's diverse societies.

One of the major barriers is the lack of electronic medical records (EMR). The United States Congress included a formula for both incentives and penalties for the EMRs as part of the Health Information Technology for Economic and Clinical Health (HITECH) Act, enacted as part of the American Recovery and Reinvestment Act of 2009 (Wikipedia 2011). Although their availability and use offer demonstrated benefits, many, if not most, medical practices have not fully implemented EMR. Some lack the motivation or resources; however, one of the problems is that of incompatible information systems between users, a chronic problem when integrating interorganizational information systems (Berry and Marabito, 2009).

# **Resistance from special interest groups**

New ideas have supporters; however, they also have resistors. No change goes unopposed. This is true for PCMHs. Some entities have their own agendas and resist any threat of change. Others may sincerely question the validity of the PCMH. Len Nichols, economist, New America Foundation, states: "The people who claim that these models (medical homes) don't work are stuck in defending the status quo, fee-for-service, unaccountable model. They're just afraid of change, that's part of it, but they don't want to move to a world in which they're going to be held accountable and things are going to be measured." (Miller, 2010)

# **Resistance from physicians**

Physicians, especially primary care physicians, are at the center of the PCMH. Without participation and support from physicians, the concept has no chance of success. Leigh Ann Becker, Managing Editor of Family Practice Management reports that the PCMH idea has put primary care at the center of most health care reform discussions. While the concept of patient-centered care, technology-enabled practice and insurer-paid care management is not new, packaging it as a PCMH has earned support from a coalition known as the Patient-Centered Primary Care Collaborative (PCPCC). The PCPCC is a group of large employers, primary care societies, national health plans, patients' groups and others who endorse the PCMH concept. Notable members include IBM, Wal-Mart, the American Association of Retired Persons (AARP), the American Cancer Society and the primary care societies, including the American Academy of Family Physicians (AAFP). The American Medical Association (AMA) has endorsed the principles developed by the PCPCC. (Becker, 2009)

Although the PCMH concept and some of the guiding principles are gaining support, moving to a PCMH operation is still a challenge for many primary care physicians, especially those with individual or small practices. There are at least two major barriers to full acceptance and practice: (1) It takes a lot of work to qualify as a PCMH, and (2) there is no certainty that additional compensation is assured.

The National Committee for Quality Assurance (NCQA) has launched a patient-centered medical home designation to motivate insurers to develop pilot projects. Payers will limit participation to those physicians who have been designated, by NCQA, as patient-centered medical homes. To qualify, a physician must meet established standards of:

- Access and communication
- Patient tracking and registry functions

- Care management
- Patient self-management support
- Electronic prescribing
- Test tracking
- Referral tracking
- Performance reporting and improvement
- Advanced electronic communications

Practices will have to spend a great deal of time to implement changes and gather the documentation the NCQA application requires. AAFP surveys indicate most practices have a long way to go. (Becker, 2009)

Although most physicians are dedicated to improving health care, at some point they have to consider the return on their investment. At this point in time, there is not a clear resolution as to how the primary care physicians will be compensated for their additional responsibilities and efforts. One physician, who moved, after 28 years, from a small-town practice to an urgent care clinic in a larger city says: "We should not buy into the concept if we are believing the system will reward us for it. The only reason for doing all this is for the joy of service in patient's lives and the relationship opportunities it gives." (Becker, 2009, p.16)

Table 3 reports the result of a survey of small physician practices and their use of PCMH practices. As can be seen from the results, there is not yet widespread use.

Table 3. Use of PCMH Processes by Physician Practices

Level of Participation by Size of Participation by Process Practice	
1-2 MDs 18.6%	Primary care teams 28%
3-7 MDs 26.2%	Electronic medical records 26%
8-12 MDs 26.6%	Electronic access to clinical information 71%
13-19 MDs 32.7%	Electronic prescribing 28%
All practices 21.7%	Chronic disease registries 9%
	Nurse care managers for chronic disease 3%
	Physician use of email 9%
	Group visits with patients 10%

Berry and Morabito (2009, p.168) echo this concern that: "Procedural care is lucrative; consultative care, such as counseling patients about healthier lifestyles, is not." Although hopes are high, family physicians are understandably concerned about the future success of the PCMH.

# **Culture change among patients**

We have described some of the changes expected from health care providers. However, the individual patient may be one of the most resistant to the pursuit of a healthier life style. The patient may be asked to change eating habits, exercise more, worry less, avoid non-prescribed drugs or medications, make regular visits to, and follow the instructions of, the primary care physician. Some will view this as not only uninviting but also an intrusion on their individual rights.

# Concerns about information security and privacy

Supply chain partners worry about the security and privacy of their information. Participants in a PCMH will have the same concern. As medical records are circulated among a wider range of health care providers, it increases the risk of unauthorized access to those records. Information technology professionals are faced with a gigantic challenge.

# **Need to Implement Continuous Improvement Programs**

Despite the evidence of successful use of lean sigma techniques, a number of obstacles prevent widespread adoption. They include, but are not necessarily limited to the following:

- It is difficult to measure quality in health care; therefore, it is difficult to determine that programs such as Lean and Six Sigma produce favorable results (Colvin, 2010)
- Some organizations have dual organizations a physician and staff divide that creates silos within the organization and prevents effective new program implementations (Crabtree, McDaniel and Nutting, 2008)
- One review of healthcare implementations reported the following impeding factors to the implementation of Six Sigma: lack of financial resources, lack of human resources, lack of time, lack of leadership, poor training, poor project selection, and internal resistance (Taner, Sezen and Anthony, 2007)
- A study of lean applications reported the following implementation issues: Healthcare employees are busy and do not have the time to work on problem solving; lack of management support; need to establish a coaching network; and the temptation to skip steps in applying the technique (Lean Healthcare West, 2010)
- One study advocates the use of mistake-preventing tools such as poka-yoke and jidoka, widely used in quality improvement programs, as a means of reducing errors that may prove fatal to patients (Grout and Toussaint 2010)
- There is a need to adapt the terminology and methodologies from the manufacturing environment to the healthcare environment
- While physicians are sympathetic to the need to improve the quality of patient care, they may not accept that Lean and Six Sigma are the best approach. Often this is the result of not being an employee of a hospital or other care provider organization.

While these obstacles are formidable, the recently enacted Health Care Reform Act may motivate many organizations to more actively search for acceptance of new ideas, or old ideas repackaged to meet today's needs.

# **Need to Shift from Illness Treatment to Illness Prevention**

A PCMH would take a holistic view of patient health, with as much concern about prevention as cure. One study reports that American medicine is out of balance, putting too much emphasis on treatment of disease (which pays physicians the most and is a tangible activity) and too little on prevention of disease (which pays less, if at all, because of its intangibility. Yet a high percentage of deaths are from

modifiable behavior patterns such as poor diet, lack of exercise, substance abuse and failure to deal with stress (Berry and Mirabito, 2009).

# Need to measure overall quality of health (outcomes)

Supply chain managers strive to measure the effectiveness of their supply chains. It is a far greater challenge than measuring the effectiveness of the individual company operations. At least, in business supply chains, the measures of income and return on investment offer some well-established reference points. There are few established tangible measures for health care. Developing these measures is another of the challenges for the PCMH movement.

According to Paul Grundy, MD, president of the Patient-Centered Primary Care Collaborative (PCPCC), a consortium of providers, health plans, medical associations, pharmaceutical companies and other stakeholders, "The cultural change for providers is to start thinking of themselves as systems designed to deliver comprehensive, integrated, coordinated care that is structured to keep patients out of the hospital. The current system is structured to pay more for uncoordinated, episodic care. That's a big shift." (Birk, 2011)

# **Need to Share Costs and Benefits among Participants**

In supply chains, participants want to make improvements, not just in their individual companies, but throughout the supply chain. They continuously struggle with how to most equitably allocate costs and benefits. For example: The conversion from bar codes to RFID tags imposed costs on manufacturers, whereas much of the benefits occurred at the retail level, in the form of added data about product movement. These types of improvements are still a source of concern and debate among supply chain partners.

A similar question haunts integrated health care programs. The basic issue is how to move from a fee for service (FFS) paradigm to a managed care environment with its uncertainties of relative contribution from participants, including health care providers, equipment manufacturers, medication companies, and patients; as-yet unmeasured benefits of increased quality of life or relieve from chronic illnesses; or the conflicts between market-driven solutions and governmental mandates.

In their latest book on innovation, Clayton M. Christiansen, along with co-authors Jerome H. Grossman and Jason Hwang (2009) believe that disruptive business models will eventually prevail in health care to change the fee structure. These models include:

- Solution shops, which diagnose problems and recommend solutions, and must be compensated on a fee-for-service basis.
- Value-adding process businesses, performing procedures in which definitively diagnosed problems are repaired or created through a relatively standard sequence of steps, and paid for on a fee-for-outcome basis.
- Facilitated networks, in which professionals and patients exchange with and help each other, and whose coordinators typically need to be compensated on a fee-for-membership basis.

It appears the PCMH could encompass all of these approaches to health care.

In a roundtable of health care executives, Jerry Salkowe, MD, vice president of clinical quality improvement, MVP Healthcare reports: "The model that most programs seem to circle around is one that preserves perhaps 60% of the compensation as traditional fee-for-service reimbursement with the other

40% divided between process measures, care management activities and outcomes." (Miller, 2010) As long as this uncertainty exists, it will slow the progress of PCMH implementations.

#### **CONCLUSIONS**

There is little doubt that something must be done if health care coverage is to be provided across the U.S. population and, at the same time, costs are to be controlled and quality of care improved. Some of the most energetic and innovative ideas are coming from within the healthcare industry. The Cleveland Clinic has long been a shining example of progress (Colvin, 2010). In an interview with Susie Gharib, anchor of the Nightly Business Report, David Cordani, CEO of Cigna, fourth largest insurance company, repeatedly stressed the need to work within the guidelines of the Health Care Reform Act to reduce costs and improve quality of patient care. Cordani also stressed the need to move ahead with the complete health reform package and not allow politicians to pick it apart without regard to the consequences (Gharib, 2010).

There is another trend in healthcare that may be affected by the PPACA – that of businesses moving to self-insurance plans with a "stop-loss" feature when individual care exceeds some negotiated limit. Selfinsured plans provide employers with more information about their workers use health care and enable employers to focus preventive actions such as smoking-cessation or weight-loss programs.

Table 4 summarizes the results of a survey by Business Week. While the percentage of companies using self-insured plans is concentrated among larger firms, there is a tendency for smaller firms to move toward self-insured plans.

Table 4. Percentage of Firms Using Self-Insured Healthcare Plans as of 2010

Number of Employees in Firm	Percentage of Companies Using Self-Insured Plans, 2010
3 to 49	8%
50 to 199	20%
200 to 999	48%
Over 1,000	80%

Adapted from Tozzi, Business Week, 2012

If the trend continues, it could adversely affect the validity of state insurance exchanges expected to launch in 2014. Companies with young and healthy workers could adopt self-insured plans (they would have a lower risk) while the remaining companies would have a pool of higher-risk employees (Trozzi 2012).

What is the next step? The Federal government has provided a start with the Health Care Reform Act. However, there are differences of opinion about its eventual effect on costs. Some argue it will reduce health care costs; others are just as emphatic it will increase health care costs. The PPACA, when fully implemented, will expand insurance coverage to millions of uninsured citizens - these increased costs must be offset with spending reductions achieved through better efficiency of the total health care system. Changing the ways in which Americans consume health care services will make it possible to provide coverage to more citizens (Roggenkamp, 2010). It appears that industry must adapt to the legislation's requirements. However, this means that there must be an unprecedented level of collaboration among stakeholders – patients, care providers, insurance companies, and special-interest groups. There must be culture and paradigm changes. Patients must intelligently manage their own health through diet and exercise. Care providers must move from a "pay for service provided" to a holistic health care management program for their unique population (Harris, Grauman and Hemnani, 2010). Insurance companies must move from simply demanding lower costs to collaborating with primary care providers in figuring out how to reduce costs through process improvements.

In addition to the culture change, there is a need to use technology, especially to transform patient records into electronic format for easier access and use throughout a patient's life. The infrastructure must change to something like the ACO or PCMH ideas described earlier. Finally, there is a need to blend technology (electronic records) with infrastructure (patient-centered medical home) and culture (patients and other collaborative stakeholders). A survey by Managed Healthcare Executive (Miller, 2010) reported the following expectations for the future of PCMH, as a percentage of the total respondents.

- Adoption will be nearly nationwide (5%)
- Projects will spread into larger regional areas (25%)
- Projects will spread into a few small areas (40%)
- Current projects will continue but nothing more (18%)
- Projects will decrease (12%)

As can be seen, there is a lack of agreement about how well PCMHs will be expanded. While there are encouraging examples, there is not yet a widespread major initiative to implement PCMHs.

There is another potential challenge to the implementation of PCMHs. The recent hearing before the Supreme Court focused primarily on the mandate requiring health coverage for all U.S. citizens and did not address the PCMH. However, a potential ruling may strike down the entire PPACA, which would necessitate a rethinking of all of its provisions. (CNN 2012)

We have provided a limited perspective about the many similarities between supply chains and PCMHs. Progress is being made by individuals and isolated groups already working in health care. While there are no simple fixes, it appears that supply chain models can provide some guidance in the design and implementation of a PCMH.

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# The LMS Acquisition at Georgia Southern University

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## **ABSTRACT**

This paper describes the information technology system acquisition life cycle and examines an enterprise class information technology system acquisition, specifically Georgia Southern University's acquisition of a new learning management system. There are many activities that need to be addressed during the IT system acquisition life cycle to determine the appropriate IT system for an organization, such as planning, information search, evaluation of prospective systems, and vendor negotiations.

## INTRODUCTION

System acquisition is an important part of any organization's business strategy. An information technology (IT) system acquisition may be tailored to an individual or used as an enterprise-wide solution. Whether it is a purchase of a new desktop computer for a student or an enterprise resource planning system for a multi-national company, an acquisition process is followed.

This case study explores the acquisition of a learning management system for the University System of Georgia (USG) and more specifically for Georgia Southern University (GSU). Learning management systems have been adopted within higher education as a way to

enhance traditional on-campus courses with online content, and to market online distance education and hybrid courses. The USG task force was looking to replace the current learning management systems used by the majority of USG institutes with one common learning management system. As GSU is part of the 35 institutions that make up the University System of Georgia, GSU's Information Technology Advisory Council was allowed access to the information and resources utilized by the USG's Learning Management System Transition Task Force to determine which LMS would work for the University System of Georgia.

A large IT system can cost upwards of \$100 million and an incorrectly chosen IT system can cost an organization billions of dollars, however there is an absence of research that explores the acquisition process of an IT system. This paper will add to the body of knowledge about the IT system acquisition process and help IT managers and researchers to understand the complexities of an IT system acquisition and how to carry out a future IT system acquisition process.

# **BACKGROUND INFORMATION**

# **IT System Acquisition**

An information technology system (IT system) is comprised of hardware, software, a network, databases, and components. The hardware would include a computer, the different inputs and outputs, cables, and wires. The software could include the operating system, and any application on the computer. Components of an IT system may be acquired separately; however there may be a cost savings and improved performance if the pieces are bundled together.

Acquiring individual components may not make up a system, but a bunch of components of a system.

Traditionally, IT managers often have to decide the important question of "To buy or to build" a new IT system project. However, in recent years, a new form of acquisition, leasing, has come on the scene and is growing rapidly. IT managers now need to decide whether to buy, build, or lease an IT acquisition. As represented in Figure 1, IT managers have a variety of choices with how to acquire an IT system or the components within.

Many organizations will purchase commercial-off-the-shelf software and customize it.

Organizations may choose to customize the software in-house or through the use of outside software contractors. Customized commercial-off-the shelf software, like a content management system, can be customized with additional modules (or plug-ins) that allows a specific organization to increase functionality that was not available with the core system. Additionally, individuals can customize their software by changing the default font or margins in a software product such as Microsoft Word to fit their precise needs.

Custom software is one of the most expensive options a company can choose. This is due to the amount of source lines of code for the custom software. Custom software may have 100,000 source lines of code or more that need to be written to achieve the specific requirements for the software (Adams, et al. 2004).

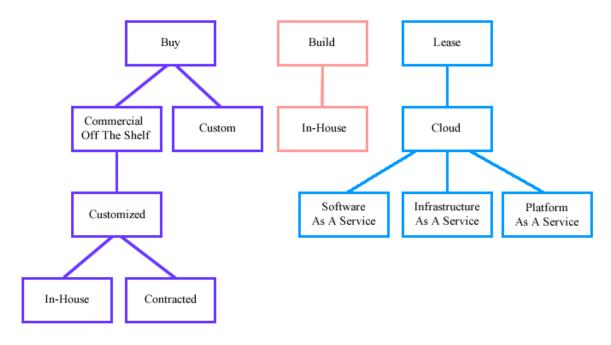
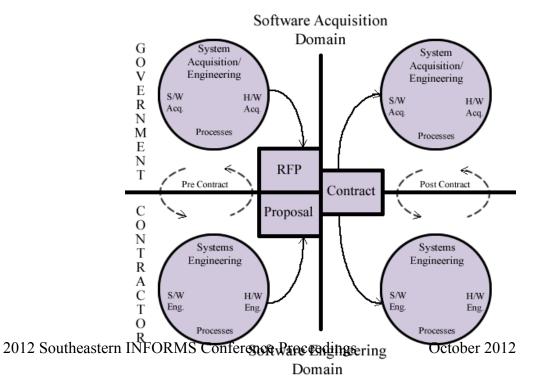


Figure 1: IT Acquisition Options

As software always exists within an IT system, all practices related to software acquisition must be consistent and integrated with the IT system acquisition practices (Adams, et al. 2004). Software is rarely purchased by itself. A new software acquisition usually requires an upgrade to be made to the IT system as well.

The United States government defines software acquisition as the set of processes that are



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used to acquire the software portion of a software-intensive system. The acquisition process covers the entire life cycle of the project, including all the related methods, tools, techniques, and procedures used to acquire the project to the end-of-life (Adams, et al. 2004). The United States government follows the process for software acquisition as illustrated in Figure 2.

Figure 2: Software Acquisition Domain

# **Acquisition Life Cycle**

The system development methodology is a standard process followed in an organization to conduct all the steps necessary to analyze, design, implement, and maintain IT systems (Hoffer, George and Valacich 2005). The systems development life cycle (SDLC) model, shown in Figure 3, is a traditional methodology that is used to develop, maintain, and replace IT systems. This life cycle allows for the repetition of phases to improve the quality of the new IT system.

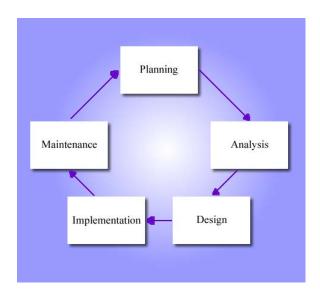


Figure 3: Systems Development Life Cycle

The planning phase is used to determine, at a managerial level, what the IT system will be expected to do and what the organizational need or reason for the new IT system is. The analysis phase starts to determine specific requirements that the IT system will need to do or have. The design phase takes the requirements from the analysis phase to create software or the components that make up the IT system. The implementation phase includes the finalization all the software or components of the IT system and integration of the IT system within the organization. The maintenance phase monitors, reports, and improves the IT system until the end-of-life for that particular IT system.

A traditional SDLC model deals with the building of a new IT system. When an organization has little to no information technology knowledge, building a new IT system is not feasible. These organizations will most likely need to acquire the entire IT system or portions thereof. The IT system acquisition life cycle model (SALC) is slightly different from a traditional SDLC due to the different focus.

The IT system acquisition life cycle model, shown in Figure 4, includes two high level phases: system selection and acquisition, and system implementation and integration (Reichgelt and Barjis n.d.). These two phases also include many activities to be completed before being able to advance to the next phase. For the system selection and acquisition phase, the following activities need to be fulfilled: planning; information search; selection; evaluation; negotiation; and choice. The system implementation and integration includes the following activities: assemble the implementation team; identify specific implementation and integration issues; determine how to address the issues; put the new system into practice; and cut over from the old system to the new system.

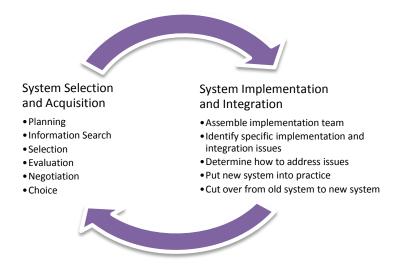


Figure 4: System Acquisition Life Cycle

## **Planning**

The first activity in the acquisition phase is planning. The planning activity can set the scene for remaining activities, so organizations need to utilize this activity wisely. An incorrectly used planning activity could lead to wasted time or an incorrect acquisition.

The planning activity often includes the following six objectives:

- form the acquisition team
- decide the acquisition strategy
- complete a requirements analysis and definition for the project
- determine the criteria used for selection and evaluation
- consider other acquisition related issues that may factor into the choice of IT system
- execute a market place analysis

Selecting an acquisition team is the first objective of the planning activity due to the complexity of IT systems and components a single individual would not have all the information needed to make a decision. Members of an acquisition team come from all parts of the organization including the end user groups, IT staff, and finance and purchasing staff. As an acquisition may affect many departments in an organization, end users representatives are included to explain existing business processes and how likely users are to accept a change in the process. The IT staff is involved to make sure the new acquisition will integrate with the existing IT system. Finance and purchasing staff are often found on acquisition teams due impact on the finances of an organization and legalities of an eventual contract.

After creating an acquisition team, the team should discuss the strategy for the acquisition. These discussions would include decisions on how communications with potential

vendors should be handled, if questions brought up by a vendor should be shared with other vendors, and how subjective judgments are handled.

The third objective is to complete the goals and requirements analysis of the IT acquisition project. Goals are a high-level want that a new system should be able to attain, whereas requirements are the new system needs to do to obtain a goal. Determining requirements is considered hard as there may be a lack of communication between IT specialists and end users, a difficulty in specifying exactly what an end user wants, or a requirements analysis that was rushed.

#### **Information Search**

The information search is done throughout the acquisition project. The granularity of the information search differs depending on the activity of the acquisition project.

The information search tends to follow a three step process. Step one, find relevant information. Step two, screen the information. Step three, determine whether to keep or discard the information (Reichgelt and Barjis n.d.).

If an acquisition team does not feel the team members have the required expertise about a system, external consultants may be brought in. However with external consultants come added costs and issues. Identifying appropriate consultants and how the consultants will be used are just two issues acquisition teams would have determined in the planning activity.

Vendor conferences and demonstrations may also be used by acquisition teams to gather information. Vendor conferences are held by the organization to give invited vendors a high-level overview of the solution that they would like to acquire. Vendors who do not attend or send low-level representatives may be removed from the selection list. Vendor conferences can bring vendors together to facilitate cooperation, but can also lead to collusion as vendors learn who

their competition is. Vendor demonstrations can give the acquisition team much valuable information depending on how it is set up. Vendor-driven demonstrations allow the vendor to present their product in the best light and highlight the top features, which may not be important to the organization. On the other hand, scenario-driven demonstrations have the vendors perform specific tasks requested by the organization. Developing the scenarios may be a time-consuming and expensive task, so acquisition teams may use a mix of vendor- and scenario-driven demonstrations. Keeping audio or video copies of the presentations will allow the acquisition team to go back over the presentation to clear up any misconceptions or discrepancies different members of the team may have.

#### **Selection and Evaluation**

During the planning phase, generalized selection and evaluation criteria should be defined. Having the criteria defined prior to looking at vendors will help to make sure there is not a bias towards a specific vendor.

Using the selection criteria will often narrow the amount of vendors found in a market search. An organization will use the selection criteria to make sure it does not spend the time and money to evaluate an IT system that does not meet all the requirements determined.

During the evaluation period, the acquisition team will be looking into the financial and strategic direction of the vendor, the functionality of IT system, the degree to which the IT system meets technical requirements, and the cost of the IT system. The acquisition team may look at the fiscal health, strategic direction, and response time of vendors being evaluated. The acquisition team will be looking at how well the IT system meets the needs of the organization and if the IT system meets the requirements. The IT system will also be evaluated on how it will mesh with the current IT infrastructure and skill level of IT staff. Not only is the actual cost of

the new IT system evaluated, but the cost of optional hardware or personnel, end-user training, data conversion, and disruption of business operations and opportunity costs. The evaluation phase will narrow the prospective IT system vendors farther than the selection phase.

## **Choice and Negotiation**

After the evaluation phase, the acquisition team needs to make a choice on what IT system the organization will be acquiring. Depending on the organization and the acquisition team, the final step in the acquisition process is to submit a report on choice of IT system and the reasoning behind why that IT system was chosen. Negotiations may be handled by a different team.

Once a team has selected an IT system to purchase they will have to negotiate a pricing model. This pricing model will include, initial cost of the software (lump sum or per user), maintenance fees, the amount of copies that can be made, and whether or not the buying organization can be a reference site for the vendor for a reduced price (Reichgelt and Barjis n.d.).

## **Learning Management System**

A learning management system (LMS) may go by many names, the most common being course management system (CMS). CMS companies have changed to LMS in order to eliminate confusion due to content management systems. A learning management system is a framework used to handle all aspects in a learning process; from delivery and management of content to course registration and administration.

Learning management systems are used to support online, hybrid courses (courses that mix a few face-to-face meetings, but spend the majority of the course online), and traditional courses. Instructors have utilized course management systems to place course materials online, track student performance, store student submissions, and facilitate communication between

students and instructors. A learning management system "provides an instructor with a set of tools and a framework that allows the relatively easy creation of online course content and the subsequent teaching and management of that course including various interactions with students taking the course" (EDUCAUSE Evolving Technologies Committee 2003). Learning management systems provide instructors a way to continue teaching and students to continue learning and interacting while not being confined to a physical classroom.

## **METHODOLOGY**

Research was done on the topic of Information Technology (IT) systems acquisitions to improve the examiner's understanding of the topic. The examiner had previously taken a course about system acquisition, implementation, and integration during her undergraduate education and was the graduate assistant for the course for two years.

After having researched how different IT systems were acquired, the examiner's advisor contacted key informants on IT system acquisitions to ask if they would participant in case study about IT system acquisitions. These key informants were the project leaders on their specific IT system acquisition.

The key informants were interviewed with an open and close-ended questionnaire in a session that lasted approximately one hour. Additional resources were given at the interviews relating to the choice of IT system. The IT system acquisition project discussed in this paper utilized the resources of an on-going higher-level acquisition process for the same type IT system, so access to the higher-level project documents was granted.

# A New Learning Management System

## **University System of Georgia**

The University System of Georgia created a Board of Regents in 1931 in order to have a unified governing and management authority over public higher education. The University System comprises of four research universities, two regional universities, thirteen comprehensive universities, fourteen state colleges, two two-year colleges, and the Public Library System with three-hundred eighty-nine facilities.

In the fall of 2010, the University System of Georgia (USG) was notified about the end-of-life for the current learning management system (Blackboard Learning System Vista 8) being used by the majority of colleges and universities. The operational support of Vista 8 would conclude in January 2013 and many issues between Vista 8 and Blackboard's newest product, Learn 9.1, existed. A few of these issues included the lack of multi-institutional functionality, integration with the Student Information System, learning context hierarchy, and lack of a clear migration path.

On August 18, 2010, the Executive Vice Chancellor and Chief Academic Officer for the University System of Georgia charged the Director of the Center for the Enhancement of Teaching and Learning at Georgia Institute of Technology to chair a task force to determine a new learning management system. The charge instructed the Director to create a task force that would work together to determine an appropriate learning management system for the 35 institutes that make up the University System of Georgia, although not all institutes are required to use the new system.

The task force was comprised of a total of 20 representatives. These representatives were from each of the major stakeholder groups, such as faculty, students, information technology and

other end-users and agencies. Representatives from the state's Department of Education and the Technical College System along with members of the central office and Information Technology Services (ITS) participated on the task force, however did not vote on the recommendation and the final decision was made by Academic Affairs.

The task force's charge stated the guiding principles that the task force would use to determine which learning management system (LMS) would be recommended. The guiding principles were the following:

- Recommend a product that meets 21st century needs of students and faculty supporting the improvement of retention and graduation rates.
- Recommend a product that will be used for multiple purposes (e.g. academic instruction/research/training/continuing education/economic development).
- Recommend a student focused minimum LMS suite to maintain affordability and increase efficiency.
- The task force will partner with IT to recommend an enterprise solution with an architecture that provides optimal performance/stability and supports increased enrollments of 100,000 additional students by 2020.
- The work of the task force will be an open and transparent process to include all stakeholders.

The timeframe of this recommendation process was eight months, from the charge in August 2010 to the final recommendation report in April 2011. The task force met every two weeks via online audio/video conferences (except during holiday periods) and had two face-to-face meetings.

At the first meeting, September 2, 2010, the task force discussed the goals that a new generation LMS must satisfy and created a list. This list, known as the Guiding Criteria, stated that the platform must:

- be well-established and stable operationally;
- be able to be integrated with a student information system;
- be committed to being fully compliant with accessibility laws and recommendations;
- and meet basic functionality requirements of the current system.

These conditions and others were used to whittle over seventy-seven LMS candidates down to approximately eight platforms.

An initial list of features were created and separated into the following three categories: non-negotiable (the things a LMS must satisfy), extremely important (the features that many users need), and nice-to-have (the functionalities that would make life easier). A few features from this list are in Table 1.

Table 1: Summary of the USG LMS Task Force Initial Features/Functionality List

Category	Feature/Functionality
Non-negotiable	<ul> <li>Security</li> <li>Scalability</li> <li>508 Compliance</li> <li>Integration with enterprise systems</li> </ul>
Extremely Important	<ul> <li>Mobile device compatibility</li> <li>Less reliant on Java</li> <li>Real-time integration with Banner</li> <li>Integrate with campus systems for single sign-on login to other systems</li> </ul>
Nice-To-Have	<ul> <li>Flexible graphical interface</li> <li>Video is easier to use &amp; upload</li> <li>Ability to import and integrate a calendar</li> <li>Allow group collaboration between different sections of the same course</li> </ul>

A reference check of two additional conditions (community/vendor responsiveness and successful large scale implementation history) limited the eight LMS candidates to five semi-finalists. The five semi-finalists were a mix of commercial and open-source platforms.

Blackboard Learn 9, Desire2Learn, and Pearson Learning Studio were the commercial options with Moodle and Sakai being the open-source learning management systems. Due to a miscommunication, Pearson Learning Studio did not have the ability of being hosted internally by the USG which was a technical requirement set forth by the ITS. As this was learned later in the process, Pearson Learning Studio was kept as a candidate under consideration.

Each finalist was asked to answer a few questions related to their functionality and future road map. Questions for the open-source finalists, Moodle and Sakai, were directed at appropriately selected Moodle and Sakai community members. Each finalist was invited to host a webinar to demonstrate the platform, go over answers from the posed questions, and answer additional follow-up questions. Commercial affiliates of Moodle and Sakai hosted the webinar and carried out the demonstration and included community members in the question and answer portions. In addition, ITS supplied each finalist with specific questions related to technical requirements.

A final report with a recommendation of a next generation learning management system was submitted to the University System of Georgia on April 30, 2011 by the task force chair. A primary recommendation and a secondary choice that takes into account budgetary constraints that a university may be facing were given. Each institute within the University System of Georgia was allowed to opt out of the recommended choice.

# **Georgia Southern University**

Georgia Southern University (GSU) is a Doctoral-Research Institution and classified as a regional university by the University System of Georgia (USG). The USG defines regional universities as meeting specific core characteristics, but may differ in purpose, history, traditions, and settings. Georgia Southern University works to improve the level of service and capabilities that are required of a Doctoral Research Institute while meeting the student-centered approach that is central to the university.

With the focus on students, over two-thirds of the faculty members utilize the current learning management system that is provided by the University System of Georgia, GeorgiaVIEW. Ninety-eight percent of Georgia Southern University students access the learning management system for at least one course in order to check grades, submit assignments, or have discussions with other class members.

GeorgiaVIEW is the rebranded name for the learning management system, which is used by the majority of institutes throughout the University System of Georgia. Each institution is given the choice of having GeorgiaVIEW hosted as a "shared service" centrally by the USG ITS department or individually by each institution. The Georgia Southern University utilized the shared services option for GeorgiaVIEW; sharing hardware, network, and support services with many other USG institutions. This caused a "lowest common denominator" effect which left many requests for enhancements to the system to go unfulfilled by USG ITS department. The "lowest common denominator" effect was caused by having only the basics features of the LMS available among a group of universities.

With the University System of Georgia looking to leverage economies of scale with a new centrally hosted learning management system, and the end of life looming for

GeorgiaVIEW, Georgia Southern University needed to determine if the recommendation from the USG would work or if a different learning management system would need to be acquired. "Economies of scales" is a term that means an organization that purchases in large quantities may receive a cost advantage that may not be available to organizations that only need one product, service, or system.

The Vice President of IT at Georgia Southern University tasked the twenty member Information Technology Advisory Council (ITAC) with determining "what is best for Georgia Southern" regarding a new LMS and hosting solution at the October 1, 2010 meeting. There were GSU representatives who were on the USG LMS task force that were able to continue providing support and information for the USG LMS task force while participating on the ITAC at GSU. The USG LMS continued to share access to the LMS information from the different institutes and included GSU to have on campus LMS vendor demonstrations.

The Vice President of IT at Georgia Southern University also created a white paper to discuss what the ITAC should be looking forward to the requirements that are wanted and needed with a new learning management system at Georgia Southern University. The ITAC needed to keep in mind the University's vision of a twenty-first century doctoral research university and the requirements relating to Title IV regulations, such as requests for scripts to be run against the LMS database to provide valuable metrics and the automation of attendance verification.

The January 28, 2011 ITAC meeting was able to narrow the viable learning management systems down to two platforms, Blackboard Learn 9 and Desire2Learn, while the USG LMS task force released the list of the top five semi-finalists. The ITAC continued to learn about these two platforms to determine which is "best for Georgia Southern University" while monitoring the on-

going USG processes. Blackboard Learn 9, Desire2Learn, and Moodle representatives held demonstrations on the GSU campus for consideration with the USG LMS transition task force.

From March 24 to April 15, 2011, the five USG semi-finalist platforms were evaluated in individual sandbox environments. ITAC utilized the sandbox environments to supplement their understanding of the platforms. ITAC also kept the campus stakeholders informed about the sandbox environments and received feedback on what was liked or disliked about each platform the stakeholders checked out.

### The Recommendation

The University System of Georgia Learning Management System task force announced Desire2Learn as the official recommended learning management system to be used on April 30, 2011. The Board of Regents accepted the recommendation of Desire2Learn on August 10, 2011 to replace the current system that is no longer being supported by Blackboard effective January 2013. The Vice Chancellor and Chief Information Officer of Information Technology Services met with other USG CIOs to discuss the general parameters associated with contracting and implementing Desire2Learn. A tentative implementation schedule was created to have all institutions off the current system by July 2013.

Georgia Southern University followed the official recommendation of Desire2Learn to replace GeorgiaVIEW, but will follow a different implementation process that focuses on local resources and Desire2Learn expert services. This change in implementation process allows GSU to avoid the risks associated with having over thirty institutions transitioning to Desire2Learn in a short time period. GSU faculty will begin to be migrated to Desire2Learn in phases over three semesters, having all faculty members using Desire2Learn by January 2013.

## **DISCUSSION**

The case relates to the Georgia Southern University's acquisition of a new learning management system (LMS). Georgia Southern University (GSU) is part of the coalition that makes up the University System of Georgia (USG). USG was going through the process to acquire a new centralized learning management system to be used by the institutions that make up the USG, but the institutions were not required to use the chosen learning management system. This allowed GSU to utilize USG's resources to choose the new system specific to GSU.

This case study follows the IT system acquisition process. Table 3 displays how the case study acquisition relates to the IT system acquisition life cycle. The project had a business reason that needed to be resolved. For the Georgia Southern University, a new learning management system needed to be acquired to replace the no-longer supported version.

During the planning phase, the project formed an acquisition team, and executed a market place analysis. The Georgia Southern University had two members on the USG's learning management system transition task force and was able to use those resources to help the twenty members of the Information Technology Advisory Council (ITAC) to revise the requirements and carry out a market place analysis for a learning management system specific to GSU.

The information search was repeated throughout the LMS acquisition project. The ITAC used on-campus vendor demonstrations and sandbox environments to learn about each LMS finalist. After a user had explored a LMS sandbox, the user was asked to respond to a survey to determine the likes and dislikes of the LMS. The survey responses from the LMS acquisition were used to evaluate the potential systems. This allowed for greater feedback from different user groups about the potential systems and increased buy-in from some end-user groups as they felt their voice was heard.

SALC	GSU LMS
Planning	
Form Acquisition Team	20 member team
Decide Acquisition Strategy	Yes
Complete Requirements Analysis and Definition	Yes
Determine Criteria for Selection and Evaluation	Yes
Consider Related Acquisition Issues	Yes
Do a Market Place Analysis	
	77 vendors evoked
Information Search	
Response to a Request for Proposal	No
Vendor Conference	No
Vendor Demonstration	Yes
External Consultants	No
Survey Responses	Yes
Selection	Yes, narrowed vendors to 2 semi-finalists
Evaluation	
Viability of Vendor	Yes
Functionality of Product	Yes
Extent of Technical Requirements	Yes
Cost of Product	Yes
Choice	Desire2Learn Learning
	Management System
Negotiation	Yes

Table 2: SALC activities followed by the case study

## **CONCLUSION**

The acquisition process for an IT system is not a trivial pursuit. There are many activities addressed during the acquisition phase of the IT system acquisition life cycle to determine the appropriate IT system for an organization. The planning activity is one of the most important as it determines how the rest of the acquisition phase goes and defines the project at a managerial level. The information search is an iterative process in order to gather the information to determine if a potential vendor or IT system is relevant. This information is used for the selection and evaluation activities which continue to narrow the field of prospective IT systems. After all the IT systems have been evaluated, the acquisition team will make a choice as to which prospective IT system meets the majority of the organization's requirements. The negotiation activity includes all the legal and business contract agreements, spending a large portion of time on the pricing model.

This case followed the IT system acquisition life cycle without formal knowledge of the system acquisition life cycle. A business reason determined the need for a new IT system, and the planning began. A task force was created for the acquisition project. Requirements for the IT system were created and used during the selection and evaluation phases. Information was gathered throughout the acquisition project along with feedback from end-user groups.

The LMS has currently begun the implementation process at Georgia Southern. It has undergone a rebranding and a few pilot courses have been taught over the Summer 2012 term using a beta version. There have been mixed results from the students on how well they like the new LMS. File names are being renamed when downloaded to be graded which causes problems with files that link to each other, especially with HTML courses. However, the Fall 2012 term will be using a different version of Desire2Learn.

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# EMOTIONAL INTELLIGENCE IN THE BUSINESS LITERATURE: CURRENT FINDINGS AND DIRECTIONS FOR FUTURE RESEARCH

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#### **ABSTRACT**

In recent years Emotional Intelligence (EI) has been introduced in mass-market books and articles and discussed in television programs. In addition, there has been a substantial amount of research on EI across a wide array of disciplines. Yet, this term has received little attention in the business literature.

A review of studies examining EI is presented in this paper, with special attention to its treatment in the business literature. Furthermore, the relationship between emotional intelligence and ethical judgment among practicing managers with respect to questions of ethical nature that can arise in their professional activity is discussed.

Research questions that await scholars interested in EI and business ethics and requiring empirical investigation are proposed. This paper shows that there is a wealth of opportunities for researchers to expand and refine our understanding. A thorough scholarly investigation of these topics would expand our knowledge of this important concept and suggest ways to improve business ethics.

#### INTRODUCTION

The October 2, 1995 cover of *Time* proclaimed that "emotional intelligence may be the best predictor of success in life, redefining what it means to be smart". When an article on EI was published in the *Harvard Business Review* in 1998, it gained a greater percentage of readers than any previously published article in that journal in the previous four decades (Cherniss 2000). An annual "International Conference on Emotional intelligence", featuring a wide variety of speakers and researchers, has been held since 2007 to share the results of various studies, guide future research on the subject, and discuss ways to applying EI in the workplace.

#### **EMOTIONAL INTELLIGENCE**

The construct EI was first identified by E. L. Thorndike in 1920 when discussing the possibility of a form of intelligence that he termed "social intelligence" as distinct from abstract or academic intelligence (Matthews et al. 2002). Subsequent research has revealed different forms of intelligence and grouped them mainly into three clusters: abstract intelligence - the ability to understand and manipulate with verbal and mathematic symbols, concrete intelligence - the ability to understand and manipulate with objects, and social intelligence - the ability to understand and relate to people (Ruisel 1992).

Salovey and Mayer (1990) were among the earliest to suggest the term *emotional intelligence* to refer to the ability of a person to deal with his or her emotions. They defined it as "a type of social intelligence that involves the ability to monitor one's own and others' emotions, to discriminate among them, and to use the information to guide one's thinking and actions" (Mayer and Salovey 1993, p. 433). Interestingly, they traced the intellectual origins of the construct to the ancient Greek Stoics who maintained that reason was superior to emotion (Mayer et al. 2004). However, the appeal and usefulness of EI is probably due to

Goleman's (1995, 1998) work in which he used the construct to describe certain abilities found in people who excel in the workplace. He asserted that "the most effective leaders are alike in one crucial way: they all have a high degree of what has come to be known as emotional intelligence... emotional intelligence is the *sine qua non* of leadership" (1998, p. 94).

EI has been defined as "the set of abilities that enable a person to generate, recognize, express, understand, and evaluate their own, and others, emotions in order to guide thinking and action that successfully cope with emotional demands and pressures" (Van Rooy and Viswesvaran 2004, p. 72). It is "related to the ability to accurately perceive, understand and manage both one's own and others' emotions" (Holian 2006, p. 1129). Thus EI is an individual difference variable involving one's ability to identify, perceive, understand, and manage emotions in oneself and in others (Ashkanasy and Daus 2005). Goleman (1998) contends that a lack of EI is an obstacle to self-confidence; maturity is a process of increasing one's awareness about one's emotions and relationships.

#### EMOTIONAL INTELLIGENCE AND ETHICS

In his pathbreaking work, Forsyth (1980) identified two distinct dimensions that play an important role in ethical evaluation and behavior – idealism and relativism. These two aspects explain a significant amount of the variance in what different individuals perceive as right and wrong. He defined the former as the degree to which "a person focuses on the inherent rightness or wrongness of an action and assumes ... that desirable consequences can, with the .right. action, always be obtained..." (p. 176). Relativism is defined as "the extent to which an individual rejects universal moral rules in making ethical judgments" (p. 175). In a later study, Forsyth (1992) wrote that idealists "feel that harming others is always avoidable, and they would rather not choose between the lesser of two evils which will lead to negative consequences for other people" (p. 462). On the other hand, relativists "generally feel that moral actions depend upon the nature of the situation and the individuals involved, and when judging others they weigh the circumstances more than the ethical principle that was violated" (p. 462). Idealism and relativism are two distinct concepts; an individual may be high or low on either dimension.

An Ethics Position Questionnaire (EPQ) was developed by Forsyth (1980) to measure am individual's ethical judgment. The EPQ consists of two scales, each containing six items; one scale is designed to measure idealism and the other to measure relativism. Different versions of these two scales have been widely used in ethics research (e.g. Singhapakdi et al. 1999. Marta et al. 2008, Zhao 2008). Forsyth states that "the two scales that make up the EPQ were found to have adequate internal consistency, were reliable over time, were not correlated with social desirability " (1980, p. 175). Others have subjected these scales to considerable empirical verification and were found to be both valid and reliable (see, e.g. Rawwas 1996, Lee and Sirgy 1999, Vitell et al. 2001). Examples of typical idealism items are: "The dignity and welfare of people should be the most important concern in any society" and "One should never psychologically or physically harm another person." Each respondent's score was computed by calculating the mean of the scores to ten items measuring idealism.

These two constructs have been extensively used in the business ethics literature. For example, they have been found to be quite useful in the study of consumer ethics in China (Zhao 2008), ethical decisions of small business managers (Marta et al. 2008), the moral ideology of African Americans (Swaidan et al. 2008), ethical sensitivity (Sparks and Hunt 1998), the ethical ideology and judgment of Portuguese accountants (Marques and Azevedo-Pereira 2008), and the ethical beliefs of Austrian consumers (Rawwas 1996).

Rather than classify individuals as either relativistic or idealistic, Forsyth (1992) recommends dichotomizing each dimension into "high" and "low" levels, and constructing a four-fold classification based upon one's preferred ethical ideology as shown in Table 1. In the first cell are "situationists" - individuals who are highly relativistic and highly idealistic. They believe that people should make every effort to produce positive consequences for all those who are involved, but that moral rules cannot be applied across all situations. They choose to closely scrutinize the situation before reaching an appropriate

moral evaluation. They might rely on deception if it yielded the best possible results.

The second cell contains "subjectivists" – those who are highly relativistic and possess a low level of idealism. They do not believe in universal moral principles or absolutes. They are not interested in achieving the best consequences for all involved, and evaluate each decision based on whether they stand to gain or lose. They describe their moral decisions as subjective judgments that cannot be reached based on more objective information, such as universal moral absolutes or the extent to which the action harms others. Next are "absolutists" – those who are low in relativism and, like situationists, are highly idealistic. They believe that actions should produce the best consequences for all involved. However, they are not relativistic. They feel that some ethical absolutes are so important that they must be strictly adhered to when making moral judgments. Finally, in the fourth cell are "exceptionists" – individuals who are low in both relativism and idealism. They adhere to universal moral rules to guide their behavior, but believe that deception and actions that yield some negative consequences cannot always be avoided. They are willing to make exceptions to their moral principles by harming some individuals in order to benefit others.

## TABLE 1: CLASSIFICATION OF ETHICAL IDEOLOGIES a

#### Idealism

RelativismHighLowHighSituationistsSubjectivistsLowAbsolutistsExceptionists

When this classification was used in a number of empirical studies, the results revealed a fairly consistent pattern. A study of business students by Barnett et al. (1994) reported significant differences in ethical judgment due to the students' ethical ideology in 14 of 26 scenarios. Absolutists were the least lenient in 10 of the 14 scenarios while subjectivists were the most lenient in 11. In another study involving marketing professionals, Barnett et al. (1998) found that absolutists were the strictest when judging actions involving ethical vignettes and subjectivists were the most indulgent. In addition, they reported significant differences between absolutists and subjectivists and between absolutists and exceptionists. Among finance professionals, Hartikainen and Torsila (2004) found absolutists to be the least lenient when judging ethical actions presented in four of five scenarios while subjectivists were the most lenient in all scenarios.

#### EMOTIONAL INTELLIGENCE IN THE BUSINESS LITERATURE

Although a wide range of diverse issues related to EI have been investigated, business researchers' interest in this concept can be attributed to studies showing it to be an important quality of effective leaders (Mandell and Pherwani 2003, Bradberry and Greaves 2005, Boyatzis and Saatcioglu 2008). There is increasing evidence that EI predicts a wide range of additional positive outcomes. EI rather than intellectual capabilities has been found to be the differentiating factor in job performance (Goleman 1995, Goleman et al. 2002, Dulewicz et al. 2005), sales performance (Wong et al. 2004), supervisor ratings of overall job performance (Law et al. 2004, Slaski and Cartwright 2002), and team performance (Druskat and Wolff 2001, Jordan and Troth 2004).

Furthermore, some writers have argued that EI can be usefully linked to job satisfaction (Sy et al. 2006),

<sup>&</sup>lt;sup>a</sup> Adapted from Forsyth, 1992.

organizational change (Huy 2002), workplace spirituality (Marques et al. 2008), global leadership (Alon and Higgins 2005), and effectiveness under high stress (Gohm 2003). For example, Muchinsky (2000) asserts that EI can be a valuable tool in personnel selection. He contends that it "may be the long-sought missing link ... which unites the classic `can do' ability determinants of job performance with the `will do' dispositional determinants" (p. 807) and argues that an assessment of a candidate's EI could become a primary tool in personnel selection. More recent studies have demonstrated that the competencies associated with EI are twice as important for career success as intelligence or technical abilities (Cote and Miners, 2006, Law et al. 2004).

For business students, Tucker et al. (2000) discuss the importance of EI in the development of graduates across several disciplines. For accountants, Akers and Porter (2003) state that "The AICPA and the Institute of Management Accountants recognize that emotional intelligence skills are critical for the success of the accounting profession" (p. 65). In health care, McQueen (2003) argues that EI can be of enormous help to nurses by mitigating the effects of job stress and burnout, while Freshman and Rubino (2002) contend that EI skills are a core competency for health care administrators. More broadly, Holt and Jones (2005) emphasize the economic value of EI "In the age of information and highly specialized work teams, EI is becoming a vital skill as people must accomplish their work by collaborating with each other, and their ability to communicate effectively becomes as critical, if not more critical, as technical skills and capabilities" (p. 15).

With a few exceptions, the literature only briefly alludes to the relationship between EI and certain aspects of ethics such as honesty and integrity (see Holian 2006, McPhail 2004, Bay and Greenberg 2001). In the popular press, writers have asserted that "without a moral compass to guide people in how to employ their gifts, emotional intelligence can be used for good or evil" (Gibbs and Birnbaum 1995, p. 67). In a recent non-empirical article, Maak and Pless (2006) argued that "responsible leaders need both emotional and ethical qualities to guide their action and behaviour in interaction" (p. 105). They maintained that, to be effective, leaders should possess a high level of "relational intelligence" - a blend of emotional intelligence and ethical intelligence. In a study of management decision making, Holian (2006) recommended that future studies investigate whether ethical decisions are influenced by skills associated with emotional intelligence. Similarly, Mulki et al. (2009) suggested that future research include an examination of the impact of emotional intelligence on an individual's ethical judgment. Overall, however, in a recent paper Bay and McKeage (2006) unequivocally state that "the link between emotional intelligence and ... ethics is not verified by the (so far) hypothesized link between these constructs and emotions" (p. 452). They encourage researchers to examine this possible relationship: "It may eventually be shown that emotional intelligence is one of the variables that may explain the current gap between ethical understanding and ethical behavior" (p. 441).

#### AGENDA FOR FUTURE RESEARCH

Ethical conduct is essential for the proper functioning of society in general and business in particular. The ethical standards of managers have been one of the perennial and most vexing issues confronting business and society for many years. Of particular interest to educators, practitioners, and regulators is the extent to which businesses are responsive to the claims of shareholders and society. While businesses have always been responsible for maximizing shareholders' long-term value, they are increasingly expected to recognize the importance of their responsibilities toward society and to faithfully adhere to certain ethical standards.

The recent proliferation and widespread media accounts of myriad illegal and fraudulent practices involving some of the largest corporations and financial institutions have shaken the public's confidence and diminished investors' trust in the soundness of corporate decisions and the integrity and competence of business managers. Events such as the current crisis confronting the financial system, the sub-prime mortgage scandal, and questionable CEO compensation packages have shocked and outraged the public and tarnished the reputation of business executives. As a result, numerous calls for reform and closer

scrutiny of business ethics are being made by many, including business practitioners and researchers. In addition, these problems and ethical lapses have prompted fresh concern over the societal impact of corporate activities and the extent to which managers are responsive to society's expectations. Thus perhaps today, more than ever, understanding the ethical perspective of managers and determining the possible link between their ethical attitudes and other variables are of critical importance.

#### **Corporate Training Programs**

For practitioners, it is vital for managers to pay more attention to emotional intelligence. Those with personal qualities that enable them to recognize and evaluate their own and others' emotions are more likely to make decisions whose consequences are favorable for all those involved. Would corporate training programs whose goal is to improve ethical sensitivity be more effective if they concentrated on developing or enhancing participants' EI?

Although much has been written about the efficacy of many ethics training programs, contradictory conclusions have been reported about their ability to sensitize employees to ethical matters and to shape their ethical perceptions. Some have stated that "it is encouraging to note that individuals are, in fact, positively affected by formal ethics training, even as adults" (Lopez, et al. 2005, p. 353). When members of the Columbia University Graduate School of Business classes of 1953-1987 were surveyed, they reported that their respective firms. ethics training programs had a positive impact (Delaney and Sockell 1992). The authors of that study concluded that "The existence of an ethics training program lowers the extent to which respondents perceived that they had to do unethical things to get ahead in their firm" (p. 723). However, only one-third of the respondents indicated that their firms provided such programs. On the other hand, others found that "current ethics training focuses on superficial ethical dilemmas for which most in the room can call out a simple and ready answer" (Jennings 2006, p. 46). Furthermore, Jennings (2006) has criticized such training because employees might not be willing to subscribe to the corporate values espoused by these programs. Training and development efforts that focus on emotional intelligence might offer a more effective way to improve managers' ethical behavior.

#### **Business Instruction**

For business educators, it is important to note that research confirms that ethical sensitivity is a highly valued trait in applicants for various business positions (see, e.g., Ahadiat and Smith 1994). In public accounting, for example, employers believe that "a commitment to ethical behavior is ... the foundation for all other standards of performance" (Turpen and Witmer 1997, p.65). They seek to hire accountants who will consider the ethical implications of their actions and expect them to respond appropriately when confronted with ethical dilemmas.

Unfortunately, an extensive literature has offered conflicting evidence and positions regarding the influence of ethics instruction on business students' ethical attitudes (Arlow 1991, Glenn 1992, Weber 1990). Some have argued that ethics cannot be taught since a student's character development has already occurred prior to their college education (Cragg 1997). Changing a person's values and standards in one or two college-level courses or by integrating ethics into the business curriculum is difficult if not impossible to achieve (Ritter 2006; McDonald, 2004). Business courses designed to persuade students to consider the ethical dimension when making decisions may not lead them to act in a more ethically sensitive way.

Advocates of ethics instruction contend that it must be given a high priority in the business curriculum (Henle 2006, Sims and Felton 2006). Improvements in ethical sensitivity, moral reasoning, and ethical behavior can be achieved in such courses (Loe and Weeks 2000, Weber and Glyptis 2000). For example, Carlson and Burke (1998) report that "education in ethics produces more enlightened consumers of ethics information who are able to make sound determinations about responsibility in ethical dilemmas" (p. 1179). Still others have proposed a variety of pedagogical approaches to enhance the effectiveness of

these business courses by promoting ethical decision making (Smith and Queller 2000, Ritter 2006, Pettifor et al. 2000, Weber 2007). Interestingly, a recent study found that while ethics education can impact ethical behavior, it "does not necessarily result in internalized ethics values" (Mayhew and Murphy 208, p. 297). Indeed, Richards has found that while integrating a limited amount of ethics training into a business course can have an immediate positive impact, "those results give false hope, because the effects of such training appear to be short-lived. Subjects' ethical standards declined significantly over a four-week period after exposure to an ethics module incorporated into a management course" (Richards 1999, p. 332). More dramatic results have been reported by Wolfe and Fritzsche (1998) who found that in some cases business students tend to be more unethical after graduation than before.

Overall, designing in-service ethics training programs and business ethics courses aimed at increasing emotional intelligence is an appealing undertaking. Unlike traditional programs and courses, those that enhance managers' and students' "soft" or "people" skills – the ability to identify with, understand, and empathize with others – might offer a superior approach to shaping managers, ethical judgment.

#### **Additional Research Avenues**

However, there are caveats regarding results showing a strong relationship between emotional intelligence and ethical ideology. It cannot be said that such investigations empirically resolve the causal relationship between the variables. Clearly, such studies are "correlational." They open a line of inquiry on whether a high level of emotional intelligence can improve ethical behavior. Conversely, does a high degree of concern of concern for ethics - focusing on the inherent rightness or wrongness of an action produce "the ability to monitor one's own and others' emotions, to discriminate among them, and to use the information to guide one's thinking and actions" (Mayer and Salovey 1993, p. 433).

Research with large national samples is necessary to confirm any findings. As Shaub (1994) points out, an individual's ethical perspective could be influenced by geographical and cultural location. Studies tend to be based largely on aggregate measures. However, they open a line of inquiry on whether their results are valid when only those operating in particular industries are surveyed. This would ensure a greater homogeneity within the group being studied. A related issue concerns the possible presence of covariates - e.g., age, gender, years of business experience - that could affect the relationship between the variables being investigated. For example, it would be useful to examine differences between future managers, younger managers, and managers with more extensive work experience. This type of analysis would yield insight into the relationship between these three generations' EI and their attitudes toward business ethics. Finally, another interesting research avenue would be a longitudinal study (with a control group) to determine whether a selection process that includes personality tests or assessment centers that measure or evaluate applicants' EI can have a positive impact on managers' ethical decisions.

This paper shows that there is a wealth of opportunities for management scholars and practitioners. The entry of scholars from disciplines such as marketing, finance, and organizational behavior into this field can enrich the quality of future research. This will expand and refine our understanding of EI and business ethics and, in turn, assist practicing managers to make better operational and strategic decisions.

In conclusion, this study provides helpful insights into an area of growing concern to society, all types of organizations, and educators. The numerous managerial ambiguities that are inherent in business decisions are further complicated by growing societal demands on corporations and increased awareness of the ethical dimension of decision making. This issue is likely to gain increased attention by educators and practitioners in the coming years.

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# UNEMPLOYMENT AND JOB CREATION PROGRAMS: IS THERE A SKILLS GAP?

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#### **ABSTRACT**

The current unemployment rate (August 2012) of 8.3 percent nationally has not dropped following the last recession as quickly as it has in the past following previous recessions. Over the years there has been much discussion on causes and solutions regarding recessions and unemployment. The Federal government spends over \$18 billion a year on 47 different training programs in nine agencies. However, many employers comment that they cannot find qualified workers (Easton, 2011). Over three million jobs are vacant and employers are looking for workers to fill the positions (Easton, 2011), while there are approximately 14 million jobless workers who cannot find jobs (Shierholz, 2011). This paper seeks to evaluate the government response to the high level of unemployment, to evaluate some of the job creation programs that are currently in existence, and to consider the possibility of a skills gap between job seekers and available jobs.

#### INTRODUCTION

The unemployment rate is one of the most prominent issues discussed today by politicians, news commentators, and economists. The rate was 8.3 percent nationally in August 2012, and it has been at 8% or higher each month since February 2009, a period of 42 months. This has been the longest period of unemployment above 8% since 1948. According to the National Bureau of Economic Research, the U.S. experienced a recession beginning in 2007 (Isidore, 2008). This recession has been a leading cause of unemployment, which has continued to rise. During the first ten months of 2008, employers reduced jobs by 1.2 million (Isidore, 2008).

In the past, the unemployment rate rose during recessions, continued to rise after the official end of the recession, but then declined substantially. According to the Bureau of Economic Research, a recession starts at the peak of a business cycle and ends at the bottom of a cycle (Business Cycle, 2012). Our most recent recessions have been the July 1981 – November 1982 period, the July 1990 – March 1991 period, the March 2001 through November 2001 period, and the December 2007 through June 2009 period.

The unemployment rate at the end of the July 1981 – November 1982 recession was 10.8%. It remained at 10.8 % in December 1982, and then declined during the 1980s, reaching a low of 5.0% in March 1989 (US Business Cycle, 2012; Unemployment Rates, 2012)

The unemployment rate at the end of the July 1990 – March 1991 recession was 6.8%. It then rose to a high of 7.8% in June 1992, and declined during the 1990s, reaching a low of 3.9% in September 2000. Our next recession was the period March 2001 through November 2001, which ended with an unemployment rate of 5.5%. The rate then rose to a high of 6.3% in June 2003, and declined, reaching a low of 4.4% in May 2007.

Our most recent recession was the period December 2007 through June 2009, which ended with an unemployment rate of 9.5%. The rate reached a high of 10.0% in October 2009, but has declined very slowly since that time (Databases, 2012).

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#### **CAUSES OF UNEMPLOYMENT**

The persistent high unemployment rate may be related to the different types of unemployment. There are several types of unemployment and each has a different cause. Economists have identified four types of unemployment: frictional, seasonal, structural, and cyclical (Bade, 552). Frictional unemployment arises from the unemployment of individuals who are changing jobs in response to temporary layoffs, workers quitting jobs to find new ones with better pay or job conditions, and persons entering or leaving the labor force.

Seasonal unemployment arises from the unemployment of persons who cannot work because of the changes in the seasons. Agricultural workers can work only during the planting and harvest season, construction workers and pavement graders can work only when weather conditions permit such work, and ski lift operators can work only when there is sufficient snow.

Cyclical unemployment arises from changes in the economy related to the business cycle: as the economy expands, companies produce more goods and hire more employees, and the unemployment rate declines. When the economy goes into a recession companies produce less and reduce the number of employees, and the unemployment rate rises.

Structural employment arises from a lack of skills needed to perform jobs that are available, or the destruction of jobs in some locations and the creation of jobs in other geographical locations, and the reluctance of persons to move to areas where the newly created jobs are located.

#### EFFORTS TO COMBAT UNEMPLOYMENT

#### **Frictional Unemployment**

What should be done to fight unemployment? Frictional unemployment can be reduced by improving the communication between job seekers and job providers. Readily accessible information on the existence of available jobs can reduce the time involved in making job changes. There are numerous job sites where one can search for specific jobs in specified geographical areas (Bergen, 2012). For example, the job site Indeed claims to be the top job site worldwide. It has several million job listings aggregated from thousands of company websites and job boards across all fields, and there are a billion job searches per month by more than 50 million unique individuals.

Another large job search engine is SimplyHired, which claims to be working on building the largest online database of jobs. It currently has listings of more than 5 million jobs pulled from job boards, company career sites, newspapers, non-profit organizations, government sites, and others. Users can browse by state, city, company, industry, or job category.

Some other job websites are LinkedIn, CareerBuilder, Monster, Craigslist, Glassdoor, Dice, Mediabistro, and TweetMyJobs.

These can be useful in letting potential job seekers know what is available; some offer advice on preparing a cover letter and resume, and how to prepare for an interview.

## **Seasonal Unemployment**

There is not much that can be done to decrease seasonal unemployment; when the weather changes, employees can return to jobs that are weather related, or agricultural workers can return to the appropriate

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fields for the harvest season. Seasonal unemployment is temporary and does not have a significant impact on the unemployment rate.

## **Cyclical Unemployment**

It is cyclical unemployment where governmental intervention may have its greatest impact on the unemployment rate. There are a number of approaches that have been advanced by economists: do nothing, use fiscal policy, use monetary policy, and pursue supply side economics. Some economists have argued that there is no need for any governmental intervention; they argue that high unemployment is a temporary phenomenon, and that the economy contains seeds within itself that will, in the long run, automatically bring down the unemployment rate. This approach has been largely discredited because there have been several periods of long duration of high unemployment in our history, and in the shortrun, there may be a need for some governmental activity.

Fiscal policy involves the use of taxation and government spending to expand the economy and attack the unemployment problem from the demand side. It is recognized that O = C + I + G + E: the total output of the economy is equal to the sum of consumption spending, business investment spending, government spending, and net exports (exports minus imports). An increase in either one of these would expand the A reduction in taxes would give consumers and businesses more money to spend, thus increasing demand; the additional spending would prompt companies to expand and hire more workers, thus reducing the unemployment rate. Increased government spending would also increase aggregate demand, causing firms to expand and hire more workers. Thus, to reduce the unemployment rate, fiscal policy calls for reducing taxes, increasing government spending, or both.

Monetary policy involves changes in the money supply and interest rates to expand the economy and fight unemployment, again from the demand side. An increase in the money supply leads to a decrease in interest rates. At lower interest rates businesses would increase their investment spending, since more projects become economically feasible; a firm will invest in a project if its internal rate of return is greater than the cost of rising funds. Also consumer spending is likely to rise as interest rates fall: the portion of current income that is spent will rise since saving is less profitable at lower rates, and consumers are more willing to borrow at lower interest rates. The decrease in interest rates would lead to more spending by consumers and businesses, thus increasing aggregate demand, causing firms to expand and hire more workers. Thus, to reduce the unemployment rate, monetary policy calls for increasing the money supply and reducing interest rates.

Fiscal policy and monetary policy attack the unemployment problem from the demand side; supply side economics attacks it from the supply side. Supply side economists argue that government policy should make changes to enhance business firms' ability to increase production and thus increase jobs. These changes include reducing tax rates on businesses, reducing or eliminating those regulations that increase business costs, and reducing spending and borrowing by the government (to make more room for private spending and borrowing).

Fiscal policy, monetary policy, and supply side economics have been used recently to attempt to expand the economy and bring down the unemployment rate. The American Recovery and Reinvestment Act was passed in 2009 to stimulate demand in the economy and reduce unemployment. Also known as the economic stimulus package, it consisted of \$787 billion in tax cuts and additional spending, designed to put more money in the hands of individuals and small businesses. Funds were provided for transportation, mass transit, and water projects; job training for disabled individuals; school districts and states to pay teacher salaries; Pell grant increases; investment in science research and technology; increase in alternative energy production; and expanded health care (Amadeo, 2011; Amadeo, 2012).

Tax cuts from the stimulus package were provided for individuals in the form of a reduction in withholdings, a tax credit to first time homebuyers, a college tuition tax credit, additional payments to social security recipients, extended unemployment benefits, and expanded earned-income tax credits. An additional tax cut was provided to individuals in 2011 and 2012 in the form of a reduction in the payroll tax.

Tax cuts were also provided to businesses in the form of a capital gains tax cut for small business investors, tax credits for small businesses that hire long-term unemployed veterans and students, increasing the deduction for machinery and equipment, and allowing a special depreciation deduction for 2008. An additional tax credit was provided to firms for all new hires in 2011.

On the monetary front, the Federal Reserve pushed interest rates to near zero in 2008 and has kept rates at a low level since that time.

The additional government spending, low interest rates, and tax reductions have expanded the economy, the stock market indices have increased, but the unemployment rate has remained uncomfortably high. What is happening here? Why have these policies not resulted in a substantial drop in the unemployment rate?

Some have argued that the stimulus package was not large enough to take us from the deep recession of December 2007 through June 2009; perhaps a second stimulus package was needed to create the jobs that were lost in the recession. The spending gap created during the recession from inadequate consumer spending, business investment, and exports has been estimated to be approximately \$2.9 trillion (Nobel Laureate, 2009); the stimulus package was less than one-third of the amount needed to close the spending gap. The size of the stimulus package was the result of an attempt to compromise between the Democratic and Republican parties in the House and Senate.

After much debate, a reduced amount of \$789 billion was approved with no Republican votes in the House and three votes in the Senate. The consensus among economists is that the stimulus package helped prevent a higher unemployment rate and provided a modest recovery (Economic Stimulus, 2012). A second stimulus package was not politically possible, given the make-up of the Congress following the 2010 mid-term elections.

It should be noted that the economic recovery that followed the July 1981 - November 1982 recession was fueled by tax cuts and increased government spending. Similarly, the expansion that followed the March 2001 – November 2001 recession was also fueled by tax cuts and increased spending.

It is clear that more jobs are needed in the economy if the unemployment rate is to be reduced appreciably. Another approach is to consider the impact of corporate taxes on job creation: many politicians and economists argue that a decrease in the corporate tax rates would spur economic growth and employment. Reduced taxes would give companies more money to spend; the companies could then expand their operations, create more jobs, and hire more employees.

For a variety of reasons, however, reduced taxes may not necessarily result in substantial job creation in this economic environment. First of all, many firms today already have excess cash, and are not using that excess cash to expand operations and hire additional workers. Giving them more cash

through tax reductions will not necessarily prod them to expand and hire more workers. A firm with excess cash has several options: hold the cash; increase dividends to stockholders; buy back its stock; buy another company; or use it to expand operations.

General Electric recently indicated that it expects to generate \$100 billion in excess cash from 2012 to 2016; these funds will be used for "dividends, stock buybacks, acquisitions, and other initiatives" (Linebaugh and Sechler, 2011). There was no mention of expansion and additional hiring.

Citigroup reported earnings of \$3.8 billion in the third quarter of 2011, a rise of 73% from the \$2.2 billion reported in the third quarter of 2011 (Kapner, Citi Shines, 2011). This large profit increase, however, has not increased Citigroup's hiring. Actually, Citigroup announced plans to cut 4,500 jobs over the next few quarters because of concerns about worldwide financial markets and new regulations (Kapner and Rieker, 2011).

Honeywell International also had outstanding third quarter results: its profits increased from \$596 million in the third quarter of 2011, a 45% increase. However, in an interview with the *Wall Street Journal*, Honeywell's CEO David Cote indicated that although the company is generating cash, he is cautious about bringing on additional employees in the prevailing economic atmosphere. (Linebaugh, 2011))

Pfizer, Inc., the large pharmaceutical firm, had about \$3.7 billion in cash and cash equivalents plus \$25.3 billion in short-term investments, which can readily be converted into cash, in October, 2011. It was recently announced that this excess cash would be used to finance a 10% dividend increase to stockholders and a stock repurchase plan of up to \$10 billion. This new repurchase program is in addition to the \$6.5 billion of shares repurchased in 2011 (Loftus, 2011). But Pfizer also announced plans to lay off 16,500 employees because of an expected drop in sales of its best-selling cholesterol product, Lipitor (Edwards, 2011) because the patent for Lipitor expired on November 30, 2011 (Countdown, 2011).

McGraw-Hill Companies, Inc. also announced that it will use some of its excess cash to implement a share buyback program, and it will cut jobs. About 550 positions, including both executive and lower level personnel, will be cut, and \$1.5 billion will be used to repurchase shares of the firm's outstanding common stock (McGraw-Hill, 2011). Campbell Soup Company and Best Buy Company, Inc. are two other well-known companies that have recently announced share repurchase programs (\$1 billion and \$5 billion, respectively) (Rougemont, 2011).

Using excess cash to repurchase outstanding shares, rather than expanding operations, has become a common practice for companies today. Companies in the S&P 500 Index spent a total of \$109.2 billion on stock buybacks during the second quarter of 2011 and \$118.4 billion during the third quarter; the expectation was that over \$120 would be spent during the fourth quarter (S&P Indices, 2011).

Thus a reduction in taxes would provide firms with additional cash, but that additional cash does not necessarily lead to substantial job creation.

Secondly, firms that decide to use their excess cash to expand operations may do so in another country. To take advantage of lower labor costs, companies have been shifting production to Mexico, China, and other low wage countries. Because of weak demand for its appliances, Whirlpool is cutting 5000 jobs and closing a plant in Arkansas, which manufactures refrigerators. Whirlpool is shifting the production of refrigerators to its plant in Mexico (Hagerty and Tita, 2011; Smith, 2011). In recent years, other companies, including Ford, General Motors, General Electric, Coca Cola, and RCA have opened plants in Mexico. General Electric employs 30,000 employees in its 35 Mexican plants. These moves, of course, create jobs, but they are not in America (Ensinger, 2011).

The Commerce Department reported that U.S. based multinational companies expanded their workforces at home by 0.1% in 2010 while expanding their overseas employment by 1.5%. Since 1999 these companies have actually reduced their domestic employment by 1 million employees and added 3.1 million workers overseas. In 2010, capital spending by these U.S. based firms increased by 3.3% at home and by 8.6% abroad (Wessel, 2012).

When our economy improves to the point where firms decide to expand and hire additional workers, many of those new jobs will most likely be located in foreign countries and will have minimal impact on our unemployment rate.

Thirdly, when companies decide to expand in this country, the expansion often takes place with few or no additional workers. The wireless industry has shown rapid growth over the past 5 years as more consumers use smartphones, wireless applications, and network technology. Revenue in the industry has grown 28% since 2006 when employment in the industry peaked at 207,000 employees, but productivity gains, consolidation, and outsourcing have led to a decline of 20% of workers in the industry over the past 5 years (Troianovski, 2011). Sprint Nextel Corporation has decreased its number of call centers from 74 in 2007 to 44 in 2010, with a corresponding drop in workers from 60,000 to 40,000. AT&T, Inc. and Verizon Communications, Inc, have kept their number of employees relatively constant over the past few years, but their revenues increased from \$100 billion in 2008 to \$122 billion in 2010. Some jobs have been created in other industries as a result of the wireless expansion, but those numbers do not match wireless job losses.

Exxon Mobil Corporation, the world's most profitable company, reported third quarter income of \$10.33 billion in 2011, an increase of 41% from 2010; revenue increased by 32%. (Ordonez, 2011). The firm has reported huge profits in other quarters as shown in Figure 1 (Why Tax Cuts, 2011):

Figure 1: Top 10 quarterly earnings of all time (prior to 2011)

- 1. Exxon Mobil Corp: 2008, 2Q \$11.68 billion
- 2. Exxon Mobil Corp: 2007, 4Q \$11.66 billion
- 3. Exxon Mobil Corp: 2008, 1Q \$10.89 billion
- 4. Exxon Mobil Corp: 2005, 4Q \$10.71 billion
- 5. Exxon Mobil Corp: 2006, 3Q \$10.49 billion

- 6. Exxon Mobil Corp: 2006, 2Q \$10.36 billion
- 7. Exxon Mobil Corp: 2007, 2Q \$10.26 billion
- 8. Exxon Mobil Corp: 2006, 4Q \$10.25 billion
- 9. Exxon Mobil Corp: 2005, 3Q \$9.92 billion
- 10. Exxon Mobil Corp: 2007, 3Q \$9.41 billion

However, job growth over the years has not accompanied these profits, as shown in Figure 2:

Figure 2: Number of Employees at Exxon Mobil

<u>Year</u>	Employees at Exxon Mobil		
1999	106,900		
2000	99,600		
2001	97,900		
2002	92,500		
2003	88,300		
2004	85,900		
2005	83,700		
2006	82,100		
2007	80,800		

Thus, Exxon has been able to expand with fewer workers. There are many other exceptions to the notion that increased sales and profits lead to increased hiring in this economy. In North Carolina there is a new toll road in the Raleigh-Durham-Research Triangle Park area. However, there are no toll booths on this road and thus no toll collectors and minimal job creation; tolls are collected electronically (Free Rides, 2011). Drivers can set up an account with the North Carolina Turnpike Authority and install on the car windshield a N.C. Quick Pass electronic transponder that has a customer ID number. Overhead frequency readers communicate with the transponders and deducts tolls from a prepaid account. Overhead cameras will take photos of the license plates of cars that do not have the transponders, and the owners will be sent a monthly bill (Toll Operations, 2011).

In a speech in Kansas, President Obama noted the disconnect between production and employment: "Steel mills that needed 1,000 employees are now able to do the same work with 100 employees, so layoffs too often became permanent, not just a temporary part of the business cycle." (Friedman, 2011). Economists refer to this situation as a jobless recovery: companies are able to expand without hiring additional workers (Knotek and Terry, 2011).

Finally, some firms have been expanding, but bringing foreign workers here to take advantage of a quirk in the immigration and social security laws. American employers can avoid paying social security, medicare, and unemployment taxes on certain classes of foreign workers. It has been estimated that there are over half a million of these employees in the country. Depending on the salaries paid to the employees, the savings to the employers can result in thousands of dollars per employee per year (North, 2012). Of course employing these workers does not decrease our unemployment rate. Actually, these 8

savings, plus the lower wages these foreigners are often willing to accept, encourage employers not to hire U.S. citizens to perform jobs that these foreigners can perform.

Thus, it is clear that granting firms more cash through tax reductions will not necessarily lead to substantial job creation and a decrease in our unemployment rate. Corporations' loyalty is to their stockholders, not to the national economy. Actions to increase profits are not always consistent with decreasing the unemployment rate.

## **Job Creation Programs**

It is evident that job creation continues to be a problem nationally as unemployed workers struggle to find jobs. Formal job creation programs help job seekers connect with employers as well as obtain skills, knowledge and training that will help them get a job. Job creation programs can come directly from private industry or from government-based job creation programs.

Government is taking aggressive steps to help reduce unemployment. One way of helping to generate jobs for unemployed workers is through Federal job creation programs. There are a multitude of different programs serving different needs and requirements that have been in existence for several years. There are also some state programs that are effectively creating jobs for unemployed workers. Discussed below are two examples of these state programs: the Georgia Works program and the Minnesota Emergency Employment Development (MEED) program.

# Georgia Works Program

After the recession, this program has been praised nationally as a jobs creation program that is working. Georgia Works was started in 2003 and is a program to help unemployed workers get work which involves first, matching workers with employers and then allowing the workers to work for the company for free. The company gets a chance to see the worker in action and the employee gets a chance to learn new skills and knowledge (Luhby, 2012). Since its inception, over 4,000 Georgians have found new careers as a result of participation in the program. Interviews with some of the program participants revealed that they gained some skills that enabled them to find employment. The Georgia labor commissioner reported that \$6 million was saved in the unemployment insurance trust fund by putting unemployed workers to work after their participation in the program (Jilani, 2011).

Some economists disagree with the success and say that there is not any support to show that workers get jobs faster. The program has suffered some setbacks in recent years with budget constraints, lack of promotion and other limitations which have restricted the program (Luhby, 2012).

Other states, including New Hampshire and Missouri, have job creation programs that are based upon the Georgia Works model. Georgia Works is a voluntary program, where workers get a chance to try out an open position as an unpaid employee. The unemployed can work a maximum of 24 hours per week. The unemployed worker will work for eight weeks and the employer then decides if he wants to keep the employee longer.

Since the beginning of the program in 2003, only 18 percent of the workers that completed the training have been taken on as hired employees by the employers that hired them. Some who oppose the program, like labor unions, suggest that this is free labor and that this is unfair. Some employers were using the

program as free labor for selfish gain, so policies were set in place to discourage this behavior by limiting the participation by employers after repeated use of unemployed workers without hiring any.

However, some say that this should not be the only indicator of success. For one thing workers are able to obtain new skills. Many workers report that they have learned a great deal in terms of new skills and knowledge. Georgia State University has had some success in using the program. Georgia State has hired 37 workers from the program out of 54 who started out as voluntary trainees.

## Minnesota's MEED program for unemployed workers

The MEED program in Minnesota, which has been around since the 1980s, is a little different from the Georgia Works program because it is a subsidized program for the unemployed. The MEED program gave employers \$10 per hour as a wage subsidy so that they could hire specific, disadvantaged workers for six months for full-time work. The focus was on unemployed workers who were not receiving unemployment benefits. The jobs that the workers worked on had to be newly created jobs and the pay was the same as a regular worker. The employers were supposed to make a commitment to keep the workers for one year after the 6 months subsidized job ended. If the employer did not honor the agreement, then he/she could be fined (Bartik, 2011).

# **Structural Unemployment**

The slow

decline in the unemployment rate may be due to structural unemployment; fiscal policy, monetary policy, and supply side economics do not address the issue of unemployment due to a lack of skills. Over 44% of the unemployed are actively seeking jobs (and thus are counted in the official unemployment rate), but many of these people may need new skills and training (Easton, 2011).

One approach to battling structural unemployment is to develop job training programs. Job training and job training programs have been existence for many years and have helped many workers in gaining employment. For example, during the Great Depression of the 1930s, the Federal-State unemployment Insurance program was started. During this same time the job training programs associated with the New Deal programs were started (O'Leary et al., 2004). Another job training initiative, called the Manpower Development and Training Act of 1962, was targeted toward low-income people and welfare recipients (O'Leary et al., 2004).

According to O'Leary et al., 2004, "Job training involves teaching someone the skills required to do a job competently. It is distinct from general education because of the exclusive focus on preparation for employment. Job training can range from remedial training, which teaches people the skills they need to learn other skills, to very sophisticated occupation specific training, which teaches people detailed procedures to perform at a high level in a specific occupation".

Job training focuses on closing the unemployment gap between available job openings and workers who are looking for jobs. There are many different types of job training that could take place in various places. Job training could be administered on the job or in a classroom at a private company, school (high school or college/university) or government-sponsored training facility.

The numerous training programs address the many and varied needs of a multitude of people with differing circumstances and needs. For example, there are training programs that specifically address youth, women, minorities, veterans, post prison-inmates, remedial needs, apprenticeships, and occupational skills. In the next section examples of some of the various training initiatives are discussed.

## **High School Training**

One job training program started in Oregon was initiated at six high schools. The program focuses on freshmen through seniors. Freshmen visit work places to see different workers, sophomores enroll in one of the six available career tracks, and the juniors and seniors are paired with jobs or internships associated with their vocational choices (Celis, 1994).

Another high school program in Seattle prepares high school students for obtaining jobs by offering a group of programs through the Seattle Public Schools Skills Center. Students have a choice of four different programs: Digital Animation and Game programming, Aerospace Science, Health Sciences, and the Cisco/Microsoft Information Technology Academy (Schiffler, 2012).

In Baltimore, Sollers Point Technical High School offers vocational programs where students earn certificates when they complete their course of study. In the culinary arts program students are prepared to go directly into the work world (Abramson, 2012).

## **University Training**

There are several training programs offered through universities to help students obtain jobs after college. The University of Texas at Austin offers students the opportunity to become software developers through an on-the-job training program (Software Developer, 2012).

Montclair State University offers a program to unemployed people. They are offered a fee-waiver and allowed to enroll in the university courses that will help them obtain job skills that will help them gain reemployment (NJ State, 2012).

Clark-Atlanta University has a job training program called Worker Education and Apprenticeship Job Training Programs which offers three different training programs: The Minority Worker Training Programs (MWTP); Brownfields Minority Worker Training Program (BMWTP) and the Youth Apprenticeships Job Training Program (YAP). The programs are designed to help trainees obtain skills to prepare them for work in the construction and environmental remediation business (Worker Education, 2012).

## **Government sponsored job training programs**

The U.S. government has been providing help in training and development of knowledge and skills through job training programs for a long period of time, including the New Deals programs during the depression era.

The Comprehensive Employment and Training Act (CETA) of 1973 focused on decentralization and more state/local control using local advisory boards to address job training and local employer needs. The CETA job program focused on disadvantaged youth and welfare recipients (O'Leary et al., 2004).

The Job Training Partnership Act (JTPA) of 1982 was put into place during the Reagan era and focused on employers' job needs and restricted the employee training to skills that local employers were requesting (O'Leary et al., 2004).

Many of these programs address many different types of people and different skill and development needs. One program that has been around since 1964 that has successfully helped youth obtain jobs is the Job Corps program. It is a free one year program for struggling and disadvantaged youth that provides assistance in obtaining jobs by offering job training, remedial instruction and other support.

The following is a list of some of the federal job training programs:

Employment Service/Wagner-Peyser Funded Activities

H-1B Job Training Grants

Homeless Veterans' Reintegration Project

Job Corps

Local Veterans' Employment Representative

Program National Farmworker Jobs Program

Native American Employment and Training

Registered Apprenticeship and Other Training

Reintegration of Ex-Offenders

Senior Community Service Employment Program

Trade Adjustment Assistance

Transition Assistance Program

Veterans' Workforce Investment Program

WIA Adult Program

WIA Youth Activities

**WIA Dislocated Workers** 

WIA National Emergency Grants

WANTO

Youth Build

Department of Agriculture

**SNAP** Employment and Training Program

Department of Justice

Second Chance Act Prisoner Reentry Initiative

Department of Education

American Indian Vocational Rehabilitation Services

Career and Technical Education – Basic Grants to States

Career and Technical Education – Indian Set-aside

Grants to States for Workplace and Community Transition Training for Incarcerated Individuals

Migrant and Seasonal Farmworkers Program

Native Hawaiian Career and Technical Education

Projects with Industry

Rehabilitation Services – Vocational Rehabilitation Grants to States

State-Supported Employment Services Program

Tech-Prep Education

Tribally Controlled Postsecondary Career and Technical Institutions

The Federal government spends billions of dollars a year on these training programs, but one out of three employers still comment that they do not have qualified workers that they can hire (Easton, 2011). Over three million jobs are vacant and employers are looking for workers to fill these positions (Easton, 2011), while there are approximately 14 million jobless workers who cannot find jobs (Shierholz, 2011). According to Nicholas Pinchuk, the CEO of Snap-On Inc, businesses are not doing enough in terms of training to help decrease the gap between skills possessed by unemployed workers and skills

needed for available jobs (Loughley, 2012). U.S. companies may face a severe skills shortage in the near future, but a more pressing issue is the lack of available jobs. Even if all of the vacant jobs were filled, there would still be over 10 million jobless workers.

Educational institutions that are also preparing individuals for jobs in the economy face a similar problem of job availability. Universities, community colleges, and high schools offer a variety of majors and vocational programs which provide their graduates with the skills needed for a wide range of positions in business, educational, and governmental agencies. Many graduates, however, have great difficulty in finding jobs. There is real concern that the jobs are just not available.

There must be a high level of job creation if the unemployment rate is to be reduced substantially. The economy lost more than 5 million jobs in 2009. In 2010, 940,000 jobs were created, and there were 1.6 million new jobs in 2011 (Wiseman and Rugaber, 2012). As noted above, figures from the Bureau of Labor Statistics at the end of 2011 indicated that there were approximately 14 million unemployed workers, but only 3.3 million job openings. Thus, the number of unemployed workers to job openings was greater that 4-to-1, indicating that there were no jobs available for more than three out of four unemployed workers. This ratio has remained over 4-to-1 for almost three years (Shierholz, 2011); before the recession it was only 1.5 (Wessel, 2011). It has been estimated that, considering the growth in the working age population, it will require adding 275,000 new jobs each month for 5 years to bring the unemployment rate down to where it was when the Great recession began (Shierholz, 2011). This level of job growth is probably not likely.

It has been often noted that major job growth in the economy comes from small firms and new business startups. According to the Small Business Administration, small businesses - firms with fewer than 500 employees - provide jobs for over half of the nation's workforce. They create more than 50% of the private, non-farm gross domestic product, and they create between 60% and 80% of the nation's net new jobs (Langley, 2012).

A study at the Federal Reserve Bank of Cleveland evaluated several measures of entrepreneurship over the past few years. It found that the number of businesses in the country reached a peak in early 2005 and then began to decline. After the recession began in December 2007, the decline was magnified. Some of the decline was due to business failures, but a larger portion of the decline was because of a decrease in business formations. It was noted that "68,490 more businesses closed in 2009 than in 2007, an closure rate. But by 2009, 115,795 fewer employer 11.6% increase in the business businesses were founded than in 2007, a 17.3% decline in firm formation" (Rampell, 2011).

A Kauffman Foundation-Census Bureau study on U.S. entrepreneurship, entitled, "Where Have All the Young Firms Gone?" also found that the number of American businesses is declining. The study highlighted the decreased number of startup businesses. The U.S. Census data indicated that new business growth dropped from 13 percent of U.S. employers in 1980 to 8 percent in 2010 (Haltiwanger, 2012).

Since most new businesses are small, and since small business drives job formation, one can conclude that hiring will remain depressed until the rate of new business formation improves.

## Conclusion

In conclusion, the United States has a high unemployment rate that has declined very slowly since the end of the last recession. The country has a serious shortage of jobs that are needed to provide opportunities for individuals who want to work. There are a number of job creation programs that are creating a small number of jobs, but this number is miniscule compared with what is needed to significantly improve the unemployment rate. The traditional governmental policies of fiscal policy, monetary policy, and supply side economics appear to be inadequate in solving the problem. There is a skills gap which programs such as the Georgia Works program help to close, but much more is needed.

Additional research will address several issues:

- 1. To reduce the unemployment rate further, are there additional measures, beyond increasing spending, reducing taxes, and decreasing interest rates, that should be considered by the government? Are there additional policy initiatives that can be employed?
- 2. Is there a new type of unemployment that is an additional component of the total unemployment picture? If there is a new type, its recognition may help us understand why the unemployment rate has not decreased appreciably.
- 3. Although new job training programs and improvements to existing programs are being initiated, there is a need to evaluate the programs to better understand how serious the gap is between what employers are seeking from potential employees and the training and skills that they are acquiring in the various programs. This knowledge can help to improve the quality of the training and close the skills gap. Specifically, we wish to determine whether there are significant numbers of jobs that are available, but the current skills of unemployed workers do not match the needs of the employers.

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# What are the Characteristics of Customer Satisfaction Among Chilean Consumers?

An Exploratory Study

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#### Abstract

In the environment where many organizations are providing similar product offerings, with very close price range and channels of communications facing constant clutter it seems that delivering high level of customer satisfaction can be an important component of company's distinctiveness over competitors. It is well established that satisfied customers are the key to long-term business success. There are number of discussions in marketing literature devoted to the effects of customer satisfaction on business performance. Some studies have proven that customer satisfaction has strong positive impact on customer loyalty and behavioral patterns (Bolton 1998, Fornell 1992). Loyal customers tend to consume or buy more (Bolton, Kannan, and Bramlett 2000); make recommendations to others (Anderson, Fornell and Mazvancheryl 2004) therefore secure future revenue (Rust, Moorman, and Dickson 2002, Rust and Zahorik 1993, Rust and Keiningham 1994). Sui – Hua (2007) documented direct link between. This paper focuses on the physical and service attributes that affect consumer satisfaction in Chilean retail stores. The findings indicate that there is a mixed response to these issues and that many people do not care about the customer satisfaction issues. Others believe that a business that does not provide superior quality should not be in business.

#### Introduction

It is well established that satisfied customers are the key to long-term business success. Organizations having superior service quality have been found to be market leaders in terms of sales and long-term customer loyalty (Gilbert & Veloutson, 2006). Customer satisfaction is regarded as a primary determining factor of repeat shopping and purchasing behavior. The greater the degree to which a consumer experiences satisfaction with a retailer, the greater the probability the consumer will revisit the retailers (Wong & Sohal, 2003; Burns & Neisner, 2006). The role of affect in the evaluation of retail stores has long been recognized. Store image recognized as a key ingredient in consumer choice of shopping location and thus a key factor in a retailer's long-term success (Samli, 1999; Sirgy & Samli, 1985; burns & Neisner, 2006). Hook (1989, p.3) states that there are two generally accepted facets of store image

- a. One image is combination of functional and psychological factors;
- b. Another image is based on consumer's perception not reality.
- c. The image which a consumer forms f a retail store, therefore, is based on the affective perception of cues internal or external to the store in addition to the actual physical quality of the store (Mazursky & Jacoby, 1986).

In the environment where many organizations are providing similar product offerings, with very close price range and channels of communications facing constant clutter it seems that delivering high level of customer satisfaction can be an important component of company's distinctiveness over competitors. It is well established that satisfied customers are the key to long-term business success. There are number of discussions in marketing literature devoted to the effects of customer satisfaction on business performance (). Some studies have proven that customer satisfaction has strong positive impact on customer loyalty and behavioral patterns (Bolton 1998,

Fornell 1992). Loyal customers tend to consume or buy more (Bolton, Kannan, and Bramlett 2000); make recommendations to others (Anderson, Fornell and Mazvancheryl 2004) therefore secure future revenue (Rust, Moorman, and Dickson 2002, Rust and Zahorik 1993, Rust and Keiningham 1994). Sui – Hua (2007) documented direct link between consumer satisfaction and consumer profitability. Providing high customer satisfaction has a negative impact on customer complaints (Bolton 1998, Fornell 1992) so, it can reduce costs associated with handling problems with field services, defective products and warranties (Fornell 1992). Higher levels o customer satisfaction can also enhance company's reputation (Fornell 1992, Andreson and Sullivan 1993, Wangnheim and Bayon 2004) and brand image (Lawson, Glowa 2000d), which can leads to creation of instant awareness and ease of acceptance of new product and lower costs of attracting new customers (Robertson and Gatignon 1986). Anderson (1996) suggests that higher customer satisfaction can decrease price elasticity and lover possibility of consumer switching behavior (Anderson and Sullivan 1993; Mithas, John and Mitchell 2004). Recent studies suggest that customer satisfaction has a strong relationship with shareholder return (Anderson, Fornell and Mazvancheryl 2004), and stock prices (II Fornell, Mithas, Morgeson and Krishnan 2006), which may be important from the investor's point of view. More complex approach presented by Naumann and Hoisington (2001 II) linked positive relationship between customer satisfaction and employee satisfaction, market share and productivity indicators at IBM Rochester.

#### BACKGROUND AND PREVIOUS RESEARCH

#### **Customer Satisfaction Definitions**

There are number of approaches to define what customer satisfaction is. Zeithaml and Bitner (2000) describe it as "the customer's evaluation of product or service in terms of whether that product or service has met their needs and expectations". This definition is rooted in Oliver's (1980) disconfirmation paradigm, which states that satisfaction is believed to occur through a matching of expectations and perceived performance. Schneider (2000) defines satisfaction by analyzing how it is formed. It is the result of the psychological process in which customer is making comparison of the perceived level of organization performance to his/her specific standards, known as expectations.

Woodruff and Gardial (1996) provided one of the most complete definitions that summarize many aspects of customer satisfaction. They define customer satisfaction as a customer's positive or negative reaction to perceived value of specific product offering in the specific buying situation. This feeling can be described as an immediate reaction after purchase situation or accumulation of overall experiences with product, service or organization.

Different approach to describe customer satisfaction is presented by Kano (1984). He indicated that not all attributes of product or service equally contribute to the overall customer satisfaction. He identified three different groups of attributes that have different impact on the process of satisfaction formation.

- 1. Expected performance variables (the must be, basic), which are basic attributes necessary to provide functional benefits of product or service. They are obvious to the customer and they don't identify them specifically. As long as they are present customer don't notice them, but without them product/service will be unacceptable and customers will be dissatisfied.
- 2. One-dimensional performance variables (performance or quality oriented), which present linear relationship among manifestation of these attributes and level of satisfaction. The greater level of attribute delivery (i.e.: quality) the greater level of customer satisfaction. If product/service doesn't deliver this attribute customer will not be satisfied or dissatisfied.
- 3. Attractor performance variables (delighter, excitement). Customers are often unaware of their existence because they don't expect them. If these attributes are present they will generate considerable satisfaction, and delightful experience. If they are not present there are no negative consequences. However, they offer significant opportunities for differentiation that can provide foundations for building a long-term relationship and loyalty.

Model presented by dr. Noriaki Kano provides some guidelines to identifications of critical components that greatly improve customer satisfaction. However, this model doesn't explain consumer motivations and reasons why some of these variables are more important than others.

## Satisfaction and store loyalty

Early studies conducted by Hummel and Savitt (1988) indicated that there is a little empirical evidence to support the explicit relationship between store satisfaction and store loyalty. Many studies devoted to investigate this problem looked at the relationship between customer satisfaction and store loyalty as related to products and services (Burmann, 1991, Bloemer and Lemmink, 1992; Bloemer and Kasper, 1995). Some believes that for the retailers loyalty is important aspects of customer satisfaction because it has been often regarded as an antecedent of store loyalty (Bitner, 1990).

Mazursky and Jacoby (1986) provide some evidence that store loyalty may be (positively) related to store image. However, they didn't examine particular relationship between satisfaction, image and loyalty in a retail environment. The study conducted by Bloemer and de Ruyter (1998) tried to investigate whether there is a direct relationship between store image and store loyalty or whether there is an indirect relationship via store satisfaction. Their study shows that relationship between store satisfaction and store loyalty depends on the specific type of satisfaction. They distinguished two types of store satisfaction: manifest satisfaction and latent satisfaction as antecedents to store loyalty. The manifest satisfaction is a result of the evaluation of the outcomes that consumer is likely to be aware of which results from explicit comparison between expectations and performance. The latent satisfaction is a result of implicit evaluation because of lack of motivation and/or ability of the consumer to evaluate the store; therefore the consumer is not likely to be fully aware of his/her satisfaction. This study shows that positive impact of manifest satisfaction on store loyalty.

Another important aspect that can influence customer loyalty in the retail environment is customer's perception of value that will be offered by particular store or shopping outlet, because this is what in a first place brings customer into a store and precedes satisfaction. Without delivering value, there is no possibility to satisfy customer needs. In a study recently conducted by Smith and Colgate (2007) 4 types of customer value were analyzed in a model framework.

This was done in order to provide the researchers with a tool for companies to use in order to possibly describe a potential marketing strategy, enhance a particular product, identify potential value creation opportunities, and develop measures of customer value. The four types of value that were studied included functional/instrumental value, experiential/hedonic value, symbolic/expressive value and cost/sacrifice value. Functional/instrumental value is when a customer obtains the perceived benefits within a desired characteristic or desired function that the consumer was seeking to get from the product or service. Experiential/hedonic value deals with a product or service that is able to create customer certain feelings or emotions. Symbolic/expressive value is placing a psychological meaning to a product or service in order to justify purchase. Cost/sacrifice value deals with what the customer feels they are giving up, price for example, versus the perceived benefit of the product or service (Smith & Colgate, 2007).

#### EMERGING CHILEAN MARKET

Geographically, Chile is located in the southern cone of South America bordering the South Atlantic Ocean and the South Pacific Ocean between Argentina and Peru. It has 2,500 miles of coastline with world-class costal facilities readily available for overseas commerce activity (Sharma, 2002). Chile's population of 15 million people with a literacy rate approaching 95% has given it the human capital to develop a strong growing business environment. During the period of 1988-1997, Chile's economy grew at a rate of over 8% annually. This continuous growth was primarily due to an export expansion in such items as processed natural resources, fresh fruits and forestry products (Sharma, 2002).

Chile no longer is considered a fledging republic with an unstable political economy and failed economic development policy that typically characterizes Latin American countries. In fact, Chile has become Latin America's showcase to the world. It has surmounted great economic, political and social obstacles causing it to be recognized as a global center and a first choice for investors seeking to expand in Latin America. Chile's decision in 1990 to become a

democracy has provided the political infrastructure for installing a free market economy. The free open economy has put Chile on the path to world competition among the major globally oriented countries. It is one of the world's most competitive countries with regard to the cost of doing business. Moreover, the appealing business environment in Chile is a consequence of a policy driven strategy that focuses on maintaining sound macro economic fundamentals and strong incentives that encourages competition and international integration (www.gobiernodechile).

Chile has been instrumental in promoting effective economic fundamentals with the implementation of clear transparent rules, a dynamic and innovative private sector, and a productive labor force along with an independent and accountable judiciary. These comparative advantages have meant lower tariffs, increasing levels of foreign trade and rapid integration into the world markets (<a href="www.gobiernodechile">www.gobiernodechile</a>). Additionally, the key success factors of its ultra modern telecommunication systems, internationally competitive banking sector, improved infrastructure and high quality services, allows Chile to participate with almost any world competitor (<a href="www.gobiernodechile">www.gobiernodechile</a>).

Probably Chile's greatest achievement is its policy continuity strategy for creating a vigorous business environment. Pressing forward consistently and deliberately has allowed Chile to create its impressive competitiveness and enduring economic stability (O'Brien, 2002). The result of this persistence produced Chilean businesses, which are predominately privately owned and controlled (Sharma, 2002). As such, Chile offers good markets for U.S. telecommunication, computers, construction, mining and financial services. Because of the strong economic foundation, enterprises that seek to compete in Chile will encounter intense competition from domestic, European and Asian business entities (Sharma, 2002).

Macro economic management will remain sound into the foreseeable future with a tightening of monetary policy in 2003 and the steady decreasing of fiscal deficits. GDP expansion is expected to reverse in 2003-04 mostly driven by exports along with a strengthening global economy, a weaker peso and an improved access to the EU (www.economist.com). The Chilean business environment is solid, stable and offers great opportunities for investors who want to conduct business in Latin America.

#### Chile's Retail Sector

Chile's strong economy, its low unemployment and higher wages, have provided the fertile business environment for a relatively mature retail sector (Kholer, 1996). Presently, the Chilean retail landscape is very active and highly competitive. A small number of traditional family-owned chain stores are more and more competing with big foreign enterprises to win the confidence of the emergent middle class. One of the main reasons for this expansion in retailing relates to the simultaneous growth in Chilean consumer's ability to acquire credit. This has substantially increased the number of people shopping at the malls and markets. As a result, Chile's retail sector averaged 8.8% GDP during the 1990's and thus there has been a boom in malls and a substantial growth in the super market sector. As this growth has continued, the retail sector has become the second highest employer providing jobs for 18% of the work force (www. businesschile)

Many different super markets designs have emerged ranging from hypermarkets and mega big volume malls to the traditional neighborhood super markets and convenience stores. Seventy percent the super markets are located in the provinces, while the remainder is in Santiago and neighboring communities.

Chile is an appealing market for retailers even though it is obviously limited by its small size and scarcity of major urban centers. Chileans are good customers, which creates exceptional opportunities for high performance low cost operators (Kholer, 1996).

## Research

In this study we took approach to analyze customer satisfaction on a transaction level, sometimes defined as a service encounter. We utilized SERVQUAL index, which is based on the confirmation/disconfirmation model and we were asking customers to compare their perception of service they encountered with their pre-consumption standards or expectations. SERVQUAL contains six indicators to monitor customer service. The indicators include responsiveness, reliability, competence, accuracy, courtesy, and completeness.

## **Customer Satisfaction Definitions**

There are number of approaches to define what customer satisfaction is. Zeithaml and Bitner (2000) describe it as "the customer's evaluation of product or service in terms of whether that product or service has met their needs and expectations". This definition is rooted in Oliver's (1980) disconfirmation paradigm, which states that satisfaction is believed to occur through a matching of expectations and perceived performance. Schneider (2000) define satisfaction by analizing how it is formed. It is the result of the psychological process in which customer is making comparison of the perceived level of organization performance to his/her specific standards, known as expectations. This definition leads us to pose the research question.

Research Question and Hypotheses:

Are physical aspects, reliability, personal interaction, problem solving and policy important factors affecting customer satisfaction?

Based on the research question, our review of the literature and the data we collected the following hypotheses are important to understanding the customer satisfaction issues among Chilean consumers. Thus we posit that:

H1 Do consumer had a significant different response/reaction between physical aspects, reliability, personal interaction, problem solving and policy.

H2 there is a significant difference among attributes of customer satisfaction and gender?

H3 there is a significant difference among attributes of customer satisfaction according to marital status?

H<sub>4</sub> there is a significant difference among attributes of customer satisfaction according those respondents having some college and being a college graduate status?

H5 there is a significant difference among attributes of customer satisfaction according and age groups?

# THE STUDY

Methodology and Data Collection

As an exploratory study, data for this project was collected among retail establishments in the city of Talca, Chile. Customers of the retail stores were randomly selected using the mall intercept method. A cross sectional approach was taken were different retail stores completed the survey.

The survey consisted of five major constructs or customer satisfaction attributes such as physical aspects, reliability, personal interaction, problem solving, and policy. All of these constructs had

a series of questions associated with them. The final results of administering this survey collected 201 respondents. The questionnaire consisted of 5 sections with a varied number of questions per construct. A 1-5 Liker scale was used to measure the respondents with 1 being strongly agreed and 5 strongly disagree.

Analysis and Findings

The first step in analyzing the data for this research paper was to develop the descriptive statistics that described the respondents' demographics and their beliefs about the five major customer satisfaction constructs. Table 1 summarizes the means and standard deviations of all categories associated with the main constructs.

--Insert Table 1 about here --

The second step in the analysis of the data was to regroup the data into three major categories: Low customer satisfaction (Low), medium customer satisfaction (Med) and high customer satisfaction (High). This provided a more realistic method of analyzing the data and shed lighter on the areas that are important in customer satisfaction. When presented with the scale, respondents shopping in the Talca, Chile retailing sector, had little difficulty relating to them and the reliability coefficient for the overall scale was (Cranach Alpha = .890), which was considered very good based on criterion used in the literature (Nunnaly, 1967).

Analysis and Findings

Using descriptive and inferential statistics we completed several analyses of the data. The descriptive statistics presented in Table 2 indicates the mean scores and standard deviations among all the questions posed to the respondents. Clearly there is a great deal of

The following presents the preliminary and initial results of our study.

#### Discussion

The results seem to indicate that there is support for the analyzing customer satisfaction in retail environments. We did find differences among marital status and customer satisfaction. There was also a significant difference regarding college educated people and customer satisfaction. There is also significant differences found between gender and personal interaction between the customer and the retail store personnel. Hence, all but one hypotheses was confirmed

## Conclusions

The research has demonstrated that the overall SERVQUAL scale is both valid and reliable as a measure of market orientation in an emerging nation such as Chile. As an exploratory study this paper examined the perceptions of Chilean customers' perceptions to assess their views related to the over all satisfaction of various retail service areas.

Based on the results of cluster analysis, we believe that a large proportion of the executives who participated in the study had higher levels of market orientation. These findings are encouraging since there is a large body of the literature which supports that argument that higher levels of market orientation would lead to a better organizational performance. In other word, small businesses in Guatemala, which have higher market orientation, will place more importance on determining and satisfying customer needs. Small business owners in Guatemala should emphasize customer understanding and satisfaction as well as competitor orientation since this will enhance the level of market orientation, which in turn expected to lead to improved performance. Some of these small businesses are already involved in market orientation activities. Many of them do not label these activities as "marketing," but as we discovered in this study, small business owners in Guatemala are very much concerned

about service delivery, target markets and information dissemination as their counterparts did in developed countries. Interviews with small business managers confirmed that they were very familiar with that market orientated philosophy.

- Customer satisfaction is an important dimension in the retail sector of Talca, Chile retail stores.
- The methodology and survey scale used in this research is suitable and has great potential for use in other geographic locations

Most people believe that the customer satisfaction is Medium Customer satisfaction

- Medium Satisfaction means that there is room for improvement.
- Stores could add dimensions to help in the enhancement of these five store attributes
- Stores need to find new strategies to meet customer needs.

## **Managerial Implications**

Marketers who sell goods in Chile need to understand the dynamics of consumer interactions when selling goods to this population. The strategies that are used can determine how many resources will be allocated to the process of selling goods to Chileans. The sensitivity of the Chilean consumer is important for the relationship between the consumer and the retail store or channel of distribution. When a manager does not know the needs of the consumer and how he or she sees their relationship it will become an inefficient and ineffective relationship. When consumer relationships are poorly developed it is bad for the seller and the buyer. So paying attention to the customer satisfaction dynamics and characteristics can assist the seller in reaching sales goals and customer base expansion. While personal selling in retail stores is sometime thought of as a historical artifact, customers really like to be waited on. This has an important impact on the customer's impression. As such, when a manager knows the characteristics of the customer and what they want, he/she can modify, or adapt responses to the

customers' desires. Knowing the customer satisfaction characteristics is critical to successful selling of any product or service, especially in foreign cultures like Chile.

## Limitations

There are some limitations of the study and therefore the findings must be viewed as tentative. The first limitation is that due to the cross-sectional approach adopted, our conclusions are restricted to those of associations rather than causation. Second, this study was exploratory in nature and specifically focused on market orientation. Third, due to the multi-organizational nature of the sample used in this study, differences among the small businesses were not accounted for. In this context, a worthy area of investigation may be to test for differences performance between the market oriented and non-market oriented small business in Guatemala. Finally, while the dataset used in this study was sizable, it was a convenience sample and a larger and more representative sample is needed for more conclusive results.

- It was an exploratory study completed only in Talca, Chile
- Need to develop a larger sample
- Need to do a cross sectional study of more retail stores

Need to complete the study in other countries to see if there is a comparison.

Table 1
Service Quality of Retail Stores

	Physical Aspects	Mean Score	Standard Deviation
1	This store has modern-looking equipment and fixtures.	3.81	.913
2	The physical facilities at this store are visually appealing.	3.63	1.00
3	Materials associated with this store's service (such as shopping bags, catalogs, or	3.68	1.00

	statements) are visually appealing.		
4	This store has clean, attractive, and convenient public areas (restrooms, fitting rooms).	3.19	.978
5	The store layout at this store makes it easy for customers to find what they need.	3.61	.922
6	The store layout at this store makes it easy for customers to move around in the store.	3.45	1.04
	Total for the six items in this category	3.56	.63
	Reliability		
1	When this store promises to do something by a certain time, it will do so.	3.54	.95
2	This store provides its services at that time it promises to do so.	3.58	1.00
3	This store performs the service right the first time.	3.54	.985
4	This store has merchandise available when the customers want it.	3.68	.958
5	This store insists on error-free sales transactions and records.	3.68	.937
	Total for the four items in this category	3.60	.71
	Personal Interaction		
1	Employees in this store have the knowledge to answer customers' questions.	3.45	.984
2	The behavior of employees in this store instills confidence in customers.	3.62	.973
3	Customers feel safe in their transactions with this store.	3.94	.95
4	Employees in this store give prompt service to customers.	3.29	1.06
5	Employees in this store tell customers exactly when services will be performed.	3.48	.884
6	Employees in this store are never too busy to respond to customers' request.	3.14	1.03
7	This store gives customers' individual attention.	3.39	1.02
9	Employees in this store are consistently courteous with customers.	3.45	1.05
10	Employees in this store treat customers courteously on the telephone.	3.30	.950
	Total for the ten items in this group	3.45	.67
	Problem Solving		
1	This store willingly handles returns and exchanges.	3.38	1.10
2	When a customer has a problem, this store shows a sincere interest in solving it.	3.31	1.01
	1	1	I

	immediately.		
	Total for three items in this group	3.27	.84
	Policy		
1	This store offers high quality merchandise	3.82	1.04
2	This store provides plenty of convenient parking for customers.	2.80	1.33
3	This store has operating hours convenient to all of their customers.	3.90	1.02
4	This store accepts most major credit cards.	3.39	1.13
5	This store offers its own credit card.	4.23	1.18
	Total for the five items in this category	3.63	.67

# Table 2

Gender	Number
Male	88
Female	113
Total	201

# Table 3

Age	Number
Less than 20	17
20 – 30	109
31-40	26
41-50	35
51-60	10
Over 60	6
Total	201

# Table 4

Occupation	Number

Professional Manager	26
Technical, sales admin. Support	8
Service	16
Farming	8
Precision products, craft and repair	7
Operator or laborer	11
Full time student	92
Not working	21
Other	12
Total	201

Table 5 Gender and Reliability

Level of Satisfaction	Male	Female	Per Cent
Low	16	32	23.9%
Medium	45	40	42.3%
High	27	41	33.8%
	88	113	100%

Pearson's Chi Square 5.485 p > .005 - Significance .064, Likelihood Ratio .063

Table 6 Gender and Personal Interaction

Level of Satisfaction	Male	Female	Per Cent
Low	13	32	22.4%
Medium	62	56	58.7%
High	13	28	18.9%
	88	113	100%

Pearsons Chi Square 9.149, p < .05, Significance .010, Likelihood Ratio .009

Table 7 Marital Status and Physical Aspects of Retail Store

Level of Satisfaction	Married	Single	Other	Per Cent
Low	30	13	4	23.4%
Medium	70	19	3	45.8%
High	33	27	2	30.8%
	133	59	9	100%

Pearsons Chi Square 11.880, p < .05, Significance .018, Likelihood Ratio .023

Table 8 Policy and College Educated consumers

Level of Satisfaction	Some College	College Graduate	Per Cent
Low	12	23	22.7
Medium	20	54	48.1
High	5	50	29.2
	37	127	

Pearson Chi-Square 6.495 p< .05, Significance .039, Liklihood Ratio .029.

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### Simple Heuristics for the Generalized Quadratic Assignment Problem

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#### **ABSTRACT**

The generalized quadratic assignment problem (GQAP) can be stated as the problem of assigning M machines to N locations, where M > N and one or more machines can be assigned to each location without exceeding the capacities of the locations. Although the QAP is a well-researched problem, there are very few papers in the literature which focuses on the GQAP. In this paper, a construction algorithm and a local search heuristic are developed for the GQAP. Also, a mathematical model is presented for the problem, and a problem instance will be used to illustrate the solution techniques.

Keywords: Facility layout problem, Generalized quadratic assignment problem, Heuristics

#### INTRODUCTION

The problem of assigning M machines to N locations on the plant floor of a manufacturing facility such that the sum of material handling and installation costs is minimized is known as the machine layout problem. For this problem, the plant floor is represented as an array of N equal size grid units, each having enough capacity to store any of the M machines. Therefore, this problem can be modeled as a quadratic assignment problem (QAP). The QAP was introduced by **Koopmans and Beckmann (1957)**, and was proven to be NP Hard by **Sahni and Gonzales (1972)**. See **Burkard et al. (1998)** and **Loiola et al. (2007)** for an extensive review of the solution techniques for the QAP.

A generalization of the machine layout problem defined above is to assign one or more machines to each location on the plant floor such that the plant floor may be represented as an array of unequal-area grids. More specifically, M machines, which may have different space (area) requirements, are assigned to N locations of varying sizes (M > N) such that the capacities of the locations are not exceeded. This extended machine layout problem can be modeled as a generalized quadratic assignment problem (GQAP), which was introduced by **Lee and Ma (2004)**. Other applications of the GQAP are to assign sets of equipment to manufacturing sites as described in **Lee and Ma (2004)** and to assign sets of containers to storage locations in container yards as described in **Cordeau et al. (2006)**. In this paper, the GQAP is defined as the problem of assigning M machines to N locations (M > N) such that the capacity of the locations are not exceeded and the sum of material handling and installation costs is minimized.

The formulation of the GQAP is given below and is an adaptation of the model presented by **Lee and Ma** (2004).

Minimize 
$$z = \sum_{i=1}^{M} \sum_{k=1}^{N} a_{ik} x_{ik} + \sum_{i=1}^{M} \sum_{j=1}^{M} \sum_{k=1}^{N} \sum_{l=1}^{N} c_{ijkl} f_{ij} d_{kl} x_{ik} x_{jl}$$
 (1)

s.t. 
$$\sum_{k=1}^{N} x_{ik} = 1$$
,  $i = 1, ..., M$  (2)

$$\sum_{i=1}^{M} r_i x_{ik} \le C_k, \ k = 1, ..., N$$
 (3)

$$x_{ik} = \{0, 1\}, \qquad i = 1, ..., M, k = 1, ..., N$$
 (4)

where M is the number of machines, N is the number of locations,  $a_{ik}$  is the cost of assigning (installing) machine i to (at) location k,  $f_{ii}$  is the flow of materials from machine i to machine j,  $d_{kl}$  is the distance from location k to location l,  $c_{ijkl}$  is the unit cost per distance unit of moving materials from machine i (at location k) to machine j (at location l),  $r_i$  is the space requirement of machine i, and  $C_k$  is the amount of space available (capacity) at location k. The decision variables are defined as

$$x_{ik} = \begin{cases} 1, & \text{if machine i is assigned to location } k, \\ 0, & \text{otherwise.} \end{cases}$$

Objective function (1) minimizes the sum of the installation and material handling costs. Constraints (2) ensure that each machine is assigned to only one location. Constraints (3) ensure that the space capacity of each location is not exceeded, and the restrictions on the decision variables are given in (4).

The term in objective function (1) used to obtain material handling cost has a quadratic term (i.e., product of two variables). As a result, the mathematical formulation (1) - (4) is nonlinear and is called a binary integer nonlinear programming model. The model is linearized by substituting  $w_{iikl}$  for  $x_{ik}x_{il}$ . Then, replace objective function (1) with

Minimize 
$$z = \sum_{i=1}^{M} \sum_{k=1}^{N} a_{ik} x_{ik} + \sum_{i=1}^{M} \sum_{j=1}^{M} \sum_{k=1}^{N} \sum_{l=1}^{N} c_{ijkl} f_{ij} d_{kl} w_{ijkl}$$
 (1')

and add the following constraints

$$x_{ik} + x_{jl} - 1 \le w_{ijkl}$$
 for  $i, j = 1, ..., M, k, l = 1, ..., N$  where  $j \ne i$  and  $l \ne k$  (5)  
 $w_{ijkl} = 0$  or 1 for  $i, j = 1, ..., M, k, l = 1, ..., N$  where  $j \ne i$  and  $l \ne k$  (6)

$$w_{ijkl} = 0 \text{ or } 1$$
 for  $i, j = 1, ..., M, k, l = 1, ..., N$  where  $j \neq i$  and  $l \neq k$  (6)

As a result, the linearized model (i.e., a binary integer linear programming model) for the GQAP consists of objective function (1') subject to constraints (2) – (6). This model will be used in the next section to solve a small GQAP instance.

The GQAP literature is very limited. Lee and Ma (2004) presented the first formulation for the GQAP. Also, the authors presented three methods for the linearization of the formulation, and a branch and bound algorithm to optimally solve the GQAP. Hahn et al. (2008) presented a new algorithm based on a reformulation linearization technique (RLT) dual ascent procedure to optimally solve the GQAP. Similarly, **Pessoa et al.** (2008) presented two exact algorithms for the GOAP which combine a previously proposed branch and bound scheme with a new Lagrangean relaxation procedure over a known RLT formulation. It is important to note that the exact algorithms presented above are unable to solve largesize problems in reasonable time. However, the following heuristics (or approximation algorithms) are able to obtain "good" solutions for large-size problems in reasonable time. Cordeau et al. (2006) presented a linearization of the GQAP formulation as well as a memetic heuristic for the GQAP, which combines genetic algorithms (Holland, 1975) and tabu search (Glover, 1986). Mateus et al. (2011) proposed several GRASP (greedy randomized adaptive search procedure) with path-relinking heuristics for the GQAP using different construction, local search, and path-relinking procedures.

In this paper, a construction algorithm and a local search heuristic are developed for solving large-size GQAP instances. The paper is organized as follows. Next, an illustrative example is presented and solved using the mathematical formulation presented above. Afterwards, construction algorithms and a local search technique are presented for the GQAP. Then concluding remarks are given.

#### ILLUSTRATIVE EXAMPLE

Consider a GQAP where 6 machines are assigned to 4 locations on the plant floor. First, the space requirements of each machine is determined by obtaining the footprints, personnel space needed, and material storage requirements for each machine. The space calculations are summarized in Table 1 below. Notice machine 2 requires 120 ft<sup>2</sup> of space.

		Area (square feet)							
					Total				
Machine	Footprint	Equipment	Personnel	Material	$(r_i)$				
1	5 ft x 10 ft	50	20	20	90				
2	6 ft x 10 ft	60	20	40	120				
3	5 ft x 6 ft	30	20	50	100				
4	5 ft x 8 ft	40	20	50	110				
5	5 ft x 10 ft	50	20	40	110				
6	5 ft x 6 ft	30	20	20	70				
·			Total area required						

Table 1. Calculations of space requirement  $(r_i)$  for each machine i.

Next, the plant floor configuration is given in Figure 1. The dimensions, area capacities, and centers of the locations (centroids) for the four locations (sites) are given in Table 2. For instance, location 2 is 20 feet long by 10 feet wide, and the centroid is at (25, 15). Therefore, location 2 has 200 square feet of capacity. Once the centroids are obtained, the distances between locations are calculated using the rectilinear distance measure. If  $(a_k, b_k)$  and  $(a_b, b_l)$  are the centroids for locations k and l, respectively, then the distance between the locations is  $|a_k - a_l| + |b_k - b_l|$ . See matrix  $d_{kl}$  for distances between locations.



Figure 1. Plant floor configuration for Production area.

				_					
Location	Dimension	Area $(C_k)$	Centroid	_		1	2	3	
1	15 ft x 20 ft	300 sq ft	(7.5, 10)	_	1	0	22.5	17.:	5
2	20 ft x 10 ft	200 sq ft	(25, 15)	$d_{kl} =$	2	22.5	0	15	
3	10 ft x 10 ft	100 sq ft	(20, 5)	_	3	17.5	15	0	
4	10 ft x 10 ft	100 sq ft	(30, 5)	_	4	27.5	15	10	
Production Area	35 ft x 20 ft	700 sq ft							

Table 2. Calculations of capacity  $(C_k)$  of each location k, and distances  $(d_{kl})$  between pairs of sites k and l.

The amount of materials  $(f_{ij})$  flowing between machines i and j per month are obtained from route sheets and are given in Table 3. Also, the total cost of installing each machine i to each location k is calculated, and then the monthly equivalent cost  $(a_{ik})$  is obtained and given in Table 3. Assume  $c_{ijkl} = 1$  for all i, j, k, and l. Recall,  $c_{ijkl}$  is the unit cost per distance unit of moving materials from machine i (at location k) to machine j (at location l).

		1	2	3	4	5	6		_	1	2	3	4
	1	0	33	41	9	16	56		1	700	1,600	1,900	1,400
	2	0	0	49	91	78	23		2	1,300	1,800	1,700	800
$f_{ij} =$	3	0	0	0	41	38	44	$a_{ik} =$	3	800	1,400	3,000	1,100
	4	0	0	0	0	6	17		4	3,000	800	700	1,500
	5	0	0	0	0	0	68		5	1,200	1,500	1,300	1,800
	6	0	0	0	0	0	0		6	1,700	800	1,200	1,100

Table 3. Material flow and installation cost data.

Using the linearized mathematical formulation for the GQAP presented above which consist of objective function (1') subject to constraints (2) – (6), the optimal solution is obtained for the illustrative example using MPL modeling language (commercial software) and CPLEX 11.0 solver. Since the variables  $w_{ijkl}$  are used only to linearize the objective function, the values of these variables do not give any useful information and is not given here. However,  $x_{13} = x_{21} = x_{34} = x_{42} = x_{51} = x_{61} = 1$ , and all other decision variables are zero. The total cost of the solution ( $z^*$ ) is \$17,165 which is the sum of \$8000 (total installation cost) and \$9165 (total material handling cost). More specifically, machines 2, 5, and 6 are assigned to location 1. Machine 4, 1, and 3 is assigned to location 2, 3, and 4, respectively. See optimal layout (assignment) in Figure 2. Since each machine is assigned to a location, and the capacity of the location is not exceeded, the optimal solution obtained is feasible. See Table 4. For instance, machines 2, 5, and 6 require 120, 110, and 70 square feet of area, respectively. Thus, a total of 300 square feet of area is required for location 1, which has 300 square feet of area. Therefore, the remaining capacity (unused area remaining) is zero.

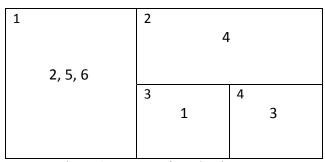


Figure 2. Layout of Production area.

Location	Area (ft²)	Machine	Area (ft <sup>2</sup> ) Required	Remaining Capacity (ft <sup>2</sup> )
1	300	2, 5, 6	300	0
2	200	4	110	90
3	100	1	90	10
4	100	3	100	0

Table 4. Details of optimal solution.

## **SOLUTION TECHNIQUES**

Since the mathematical model can only be used to solve small-size problems in reasonable time, heuristics are developed for the GQAP. As a result, additional notation is used to give another formulation of the GQAP. The solution is represented as

$$S = (s(1), s(2), ..., s(M))$$

where s(i) = k, which is equivalent to saying location k is assigned to machine i. The solution is feasible if the following constraints hold,

$$\sum_{\forall i \text{ s.t. } s(i)=k} r_i \le C_k \text{ for } k=1, ..., N$$
(7)

The total cost of the solution is obtained using the following equation.

$$TC(S) = \sum_{i=1}^{M} a_{is(i)} + \sum_{i=1}^{M} \sum_{\substack{j=1\\j \neq i}}^{M} c_{ijs(i)s(j)} f_{ij} d_{s(i)s(j)}$$
(8)

For example, consider the solution S = (3, 1, 4, 2, 1, 1) for the illustrative example given above (see Tables 1-3). That is, s(1) = 3, s(2) = 1, s(3) = 4, s(4) = 2, s(5) = 1, and s(6) = 1. More specifically, machines 2, 5, and 6 are assigned to location 1, machine 4 to location 2, machine 1 to location 3, and machine 3 to location 4. Notice, this is the same optimal solution obtained above using the mathematical formulation. For location 1 (i.e., k = 1), consider equation (7).

$$\sum_{\forall i \text{ s.t. } s(i)=1} r_i \leq C_I \text{ or } \sum_{i=2,5,6} r_i \leq C_I.$$

Recall, 
$$r_2 = 120$$
,  $r_5 = 110$ ,  $r_6 = 70$ , and  $C_I = 300$ . Therefore,  

$$\sum_{i=2,5,6} r_i = 120 + 110 + 70 = 300 \le C_I = 300.$$

Thus, the capacity constraint for location 1 holds. It is easy to validate that the constraints for locations 2 and 3 also hold. As a result, the solution S = (3, 1, 4, 2, 1, 1) is feasible. Now the total cost of the solution is obtained using equation (8), which is \$17,165 which is the sum of \$8000 (total installation cost) and \$9165 (total material handling cost).

This formulation which minimizes objective function (8) subject to constraint (7) is called the combinatorial optimization problem (COP) formulation. It has fewer variables (s(i)), constraints, and solutions compared to the mathematical formulation given earlier. See comparison of models in Table 5 where M = 6 and N = 4 as in the illustrative example. Notice the number of constraints in the mathematical model is based on the number of constraints for constraints (2), (3), and (5) where the restrictions on the variables are not considered. Also, the number of solutions for both models considers all possible sets of values for each variable, whether the solutions are feasible or infeasible. More importantly, the solution space is much less for the COP model, only 4096 solutions compared to 16,777,216. Therefore, it is much more efficient using the COP formulation. Next, a construction algorithm for the GQAP is presented.

M = 6, N = 4	Math Model	COP Model
Number of Variables	M(N) = 24	M=6
Number of Constraints	M + N + M(M-1)(N)(N-1) = 370	N=4
Number of Solutions	$2^{M(N)} = 16,777,216$	$N^{M} = 4096$

Table 5. Comparison of the models.

The following construction algorithm is used to generate a solution for the GQAP.

```
Step 1: Initialize capacity of locations (i.e., C(k) = \{C(1), C(2), ..., C(N)\}).

Initialize space requirement of machines (i.e., r(i) = \{r(1), r(2), ..., r(M)\}).

Step 2: Sort machines in descending order with respect to r(i) in the eligible machine set (EMS) and break ties by selecting machine with lower machine number.

Step 3a: Set k = 1;

Step 3b: If k > N, then go to step 5b. Else go to position 1 of the EMS (i.e., set u = 1).

Step 4: Set i = the machine in the uth position in EMS.

Step 5a: If r(i) \le C(k)

Assign machine i to location k (i.e., set s(i) = k), and set C(k) = C(k) - r(i);

Remove machine i from EMS. If EMS is empty, then go to step 5b;

If C(k) < r(i) for Last(i) in EMS, then set k = k + 1 and go to step 3b;

Else Go to step 4.

Else Set u = u + 1 and go to step 4.
```

Step 5b: Terminate algorithm. If EMS is empty, then display feasible solution S. Else display "No feasible solution!"

To illustrate the construction algorithm, consider illustrative example presented earlier (see Tables 1-3).

```
<u>Iteration 1</u>: In step 1, let C(k) = \{300, 200, 100, 100\} and r(i) = \{90, 120, 100, 110, 110, 70\}. In step 2,
obtain EMS = \{2, 4, 5, 3, 1, 6\}, and set k = 1 (start with location 1) in step 3a. In step 3b, since k = 1 < 4
= N, set u = 1 (start at position 1 in EMS). Since machine 2 is in position 1, set i = 2 in step 4. In step 5a,
since r(2) = 120 < 300 = C(1), set s(2) = 1 (assign machine 2 to location 1), obtain C(1) = C(1) - r(2) = 1
300 - 120 = 180, and remove machine 2 from EMS. Thus, EMS = {4, 5, 3, 1, 6}. Since C(1) = 180 > 70
= r(6), go to step 4.
<u>Iteration 2</u>: In step 4, set i = 4. In step 5a, since r(4) = 110 < 180 = C(1), set s(4) = 1, obtain C(1) = C(1) - 180 = 1
r(4) = 180 - 110 = 70, and obtain EMS = \{5, 3, 1, 6\}; Since C(1) = 70 = r(6), go to step 4.
<u>Iteration 3</u>: In step 4, set i = 5. In step 5a, since r(5) = 110 > 70 = C(1), set u = 1 + 1 = 2, and go to step 4.
<u>Iteration 4</u>: In step 4, set i = 3. In step 5a, since r(3) = 100 > 70 = C(1), set u = 2 + 1 = 3, and go to step 4.
<u>Iteration 5</u>: In step 4, set i = 1. In step 5a, since r(1) = 90 > 70 = C(1), set u = 3 + 1 = 4, and go to step 4.
Iteration 6: In step 4, set i = 6. In step 5a, since r(6) = 70 = C(1), set s(6) = 1, obtain C(1) = C(1) - r(6) = 1
70 - 70 = 0, and obtain EMS = \{5, 3, 1\}. Since C(1) = 0 < 90 = r(1), set k = k + 1 = 2, and go to step 3b.
Iteration 7: In step 3b, since k = 2 < 4 = N, set u = 1, and set i = 5 in step 4. In step 5a, since r(5) = 110 < 10
200 = C(2), set s(5) = 2, obtain C(2) = C(2) - r(5) = 200 - 110 = 90, and obtain EMS = \{3, 1\}. Since C(2)
= 90 = r(1), go to step 4.
Iteration 8: In step 4, set i = 3. In step 5a, since r(3) = 100 > 90 = C(2), set u = 1 + 1 = 2, and go to step 4.
Iteration 9: In step 4, set i = 1. In step 5a, since r(1) = 90 = C(2), set s(1) = 2, obtain C(2) = C(2) - r(1) = 1
90 - 90 = 0, and obtain EMS = {3}. Since C(2) = 0 < 100 = r(3), set k = 2 + 1 = 3, and go to step 3b.
Iteration 10: In step 3b, since k = 3 < 4 = N, set u = 1, and set i = 3 in step 4. In step 5a, since r(3) = 100 =
C(3), set s(3) = 3, obtain C(3) = C(3) - r(3) = 100 - 100 = 0, and obtain EMS = \{\}. Since EMS is empty,
go to step 5b. In step 5b, the algorithm is terminated, and the solution S = \{2, 1, 3, 1, 2, 1\} is displayed. In
other words, machines 2, 4, and 6 are assigned to location 1, machines 1 and 5 are in location 2, machine
3 is in location 3, and location 4 is not assigned a machine.
```

The algorithm presented above either yields a feasible solution or no solution. A solution is not obtained when the difference between the total machine requirements (total area required by machines) and total capacity of locations (total area available) is relatively small, and when machines are assigned to locations such that some of the unused capacities of the locations are relatively large. If this is the case, the above algorithm can be modified such that in step 2 the machines can be ordered in ascending order, instead of descending order. Also, instead of starting at the first location, the algorithm can start at the last location (k = 4), and reduce k until all machines are assigned to locations. The different combinations of these modifications result in four different algorithms, which can be used such that a solution can always be generated. Next, an algorithm used to improve the constructed solution is presented next.

The following improvement algorithm, called the steepest descent local search heuristic, is used to improve the solution obtained from the construction algorithm presented above.

- Step 1: Construct a solution,  $S_0 = (s(1), s(2), ..., s(M))$ , using the above construction algorithm, and obtain its cost,  $TC(S_0)$  using objective function (8).
- Step 2: Evaluate all feasible solutions obtained from all possible drop/add operations on  $S_0$  and all possible pairwise exchange operations on  $S_0$ .
- Step 3: Pick best solution, S, with respect to cost, TC(S). If  $TC(S) < TC(S_0)$ , set  $S_0 = S$ ,  $TC(S_0) = TC(S)$ , and go to step 2. Else, terminate heuristic and display solution  $S_0$ .

The drop/add operation (u, v; v') represents exchanging location v assigned to machine u with location v' (drop v and add v'). For example, if  $S_0 = \{2, 1, 3, 1, 2, 1\}$ , then the drop/add operation (1, 2; 4) produces the solution  $\{4, 1, 3, 1, 2, 1\}$ . In other words, machine 1 assigned to location 2 is reassigned to location 4. Constraint (7) where k = 4 can be used to check for feasibility of solution. Since solution is feasible, the objective function value (OFV) of the solution is obtained using (8). All possible drop/add operations for each machine is considered. Since there are N = 4 locations, and each machine is already assigned to one location, there are N = 1 = 3 possible operations for each machine. Since there are M = 6 machines, there are M(N-1) = 6(3) possible drop/add operations.

The pairwise exchange operation (u, v; u', v') represents exchanging location v assigned to machine u with location v assigned to machine u. For example, if  $S_0 = \{2, 1, 3, 1, 2, 1\}$ , then the pairwise exchange operation (1, 2; 3, 3) produces the solution  $\{3, 1, 2, 1, 2, 1\}$ . In other words, machine 1 assigned to location 2 exchanges locations with machine 3 assigned to location 3. Constraints (7) where k = 2 and 3 can be used to check for feasibility of solution. Since solution is infeasible for k = 2, the objective function value (OFV) of the solution is not calculated using (8). All possible pairwise exchange operations are considered. Since two machines are swapping locations and there are M = 6 machines, there are a combination of M = 6 pick two (M(M - 1)/2 = 15) possible pairwise exchange operations. However, if u' = v', the solution does not change and is not considered. For instance, if  $S_0 = \{2, 1, 3, 1, 2, 1\}$ , then the operation (1, 2; 5, 2) produces the same solution  $\{2, 1, 3, 1, 2, 1\}$ ; therefore there are always less than M(M - 1)/2 pairwise exchange operations when a location has more than one machine assigned to it.

To illustrate the steepest descent local search heuristic, consider illustrative example presented earlier (see Tables 1 – 3). In iteration 1, the solution  $S_{\theta} = \{2, 1, 3, 1, 2, 1\}$  is obtained using the proposed construction algorithm in step 1. Also, the total cost (OFV) of the solution  $S_0$  (i.e.,  $TC(S_0) = \$21,255$ ) is obtained using (8). In step 2, all possible solutions are obtained for  $S_0$ . See Tables 6 and 7. Notice most of the solutions are infeasible, since the problem is tightly constraint (i.e., difference between the total machine requirements (total area required by machines = 600 ft<sup>2</sup>) and total capacity of locations (total area available =  $700 \text{ ft}^2$ ) is relatively small ( $100 \text{ ft}^2$ )). Nevertheless, operation (4, 1; 5, 2) produces the solution  $S = \{2, 1, 3, 2, 1, 1\}$ , which has the lowest cost (i.e., TC(S) = \$18,050) in step 3. Since TC(S) = \$18,050 < 1 $$21,255 = TC(S_0)$ , set  $S_0 = S = \{2, 1, 3, 2, 1, 1\}$ ,  $TC(S_0) = $18,050$ , and go to step 2. In step 3 of iteration 2, operation (3, 3; 4) produces the solution  $S = \{2, 1, 4, 2, 1, 1\}$ , which has the lowest cost (i.e., TC(S) =\$17,460). Since  $TC(S) = \$17,460 < \$18,050 = TC(S_0)$ , set  $S_0 = S = \{2, 1, 4, 2, 1, 1\}$ ,  $TC(S_0) = \$17,460$ , and go to step 2. In step 3 of iteration 3, operation (1, 2, 3) produces the solution  $S = \{3, 1, 4, 2, 1, 1\}$ , which has the lowest cost (i.e., TC(S) = \$17,165). Since  $TC(S) = \$17,165 < \$17,460 = TC(S_0)$ , set  $S_0 = S$  $= \{3, 1, 4, 2, 1, 1\}, TC(S_0) = \$17,165,$ and go to step 2. In step 3 of iteration 4, operation (6, 1; 2)produces the solution  $S = \{3, 1, 4, 2, 1, 2\}$ , which has the lowest cost (i.e., TC(S) = \$17,240). Since TC(S)=  $\$17,240 > \$17,165 = TC(S_0)$ , terminate heuristic and display solution  $S_0 = S = \{3, 1, 4, 2, 1, 1\}$ ,  $TC(S_0)$ = \$17,165. This solution is called a local optimum; however, since the solution is equivalent to the solution obtained using the mathematical model, it is also a global optimum.

#	Operation	Solution	OFV
1	(1, 2; 1)	{1, 1, 3, 1, 2, 1}	
2	(1, 2; 3)	{3, 1, 3, 1, 2, 1}	
3	(1, 2; 4)	{4, 1, 3, 1, 2, 1}	\$21,580
4	(2, 1; 2)	{2, 2, 3, 1, 2, 1}	
5	(2, 1; 3)	{2, 3, 3, 1, 2, 1}	
6	(2, 1; 4)	{2, 4, 3, 1, 2, 1}	
7	(3, 3; 1)	{2, 1, 1, 1, 2, 1}	
8	(3, 3; 2)	{2, 1, 2, 1, 2, 1}	
9	(3, 3; 4)	{2, 1, 4, 1, 2, 1}	\$20,695

	#	Operation	Solution	OFV
	10	(4, 1; 2)	{2, 1, 3, 2, 2, 1}	
-	11	(4, 1; 3)	{2, 1, 3, 3, 2, 1}	
-	12	(4, 1; 4)	{2, 1, 3, 4, 2, 1}	
	13	(5, 2; 1)	{2, 1, 3, 1, 1, 1}	
	14	(5, 2; 3)	{2, 1, 3, 1, 3, 1}	
	15	(5, 2; 4)	{2, 1, 3, 1, 4, 1}	
	16	(6, 1; 2)	{2, 1, 3, 1, 2, 2}	
	17	(6, 1; 3)	{2, 1, 3, 1, 2, 3}	
	18	(6, 1; 4)	{2, 1, 3, 1, 2, 4}	\$20,495

Table 6. Solutions obtained from add/drop operation.

#	Operation	Solution	OFV
_ 1	(1, 2; 2, 1)	{1, 2, 3, 1, 2, 1}	
2	(1, 2; 3, 3)	{3, 1, 2, 1, 2, 1}	
3	(1, 2; 4, 1)	{1, 1, 3, 2, 2, 1}	
4	(1, 2; 5, 2)	Same as $S_0$	
5	(1, 2; 6, 1)	{1, 1, 3, 1, 2, 2}	
6	(2, 1; 3, 3)	{2, 3, 1, 1, 2, 1}	
7	(2, 1; 4, 1)	Same as $S_0$	
8	(2. 1: 5. 2)	{2, 2, 3, 1, 1, 1}	

#	Operation	Solution	OFV
9	(2, 1; 6, 1)	Same as $S_{ heta}$	
10	(3, 3; 4, 1)	{2, 1, 1, 3, 2, 1}	
11	(3, 3; 5, 2)	{2, 1, 2, 1, 3, 1}	
12	(3, 3; 6, 1)	{2, 1, 1, 1, 2, 3}	
13	(4, 1; 5, 2)	{2, 1, 3, 2, 1, 1}	\$18,050
14	(4, 1; 6, 1)	Same as $S_0$	
15	(5, 2; 6, 1)	{2, 1, 3, 1, 1, 2}	

Table 7. Solutions obtained from pairwise exchange operation.

## CONCLUSION

The proposed construction algorithm and steepest descent local search heuristic were coded using the Visual Basic programming language, and the illustrative example was solved on a Pentium IV 1.5GHz PC. It required only 0.17 seconds of run time. Although the optimal solution was obtained for the illustrative example using the proposed heuristics, they may not always produce the optimal solution, especially for large-size problems. Therefore, for future research, a more powerful heuristic, such as tabu search heuristic, which obtains many local optima in search of the global optimum, will be developed for the GQAP.

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# A COMPLEMENTARY INVENTORY-CAPACITY TAXONOMY

## FOR THEORY OF CONSTRAINTS

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#### **ABSTRACT**

Theory of Constraints (TOC) literature typically addresses three categories of inventory: (1) productive inventory, protective inventory, and excess inventory. TOC also recognizes three corresponding categories of resource capacity: productive capacity, protective capacity, and excess capacity. These inventory and capacity terms are intended to correspond with three levels of resource action: (1) production by the constraint, or production by non-constraint resources matching the constraint resource's needs, (2) subordinate production by non-constraint resources to protect the constraint from interruptions, and (3) no production. Defects are common in manufacturing but such yield loss is rarely addressed in TOC literature, and not at all in the inventory and capacity terms used. This article extends inventory and capacity terms to address yield loss, and in so doing, demonstrates the complementary relationship of inventory and capacity.

## **INTRODUCTION**

Betterton and Cox [5] called for systematic efforts to move the research community toward consensus on conceptual and operational definitions of the TOC framework, including adherence to appropriate operational and conceptual definitions of terms. Distinctions between terms used in the TOC literature are not always clear, and that literature neglects entirely definitions of capacity and inventory related to waste caused by yield loss.

In TOC literature the use of inventory and capacity terminology has centered on the need to support production at the system constraint resource and to protect that critical resource from any form of interruption. The usual characterization of the sources of potential interruption is reference to "statistical fluctuations" and "dependent resources" seen most often as variation in process times, failure occurrences, and repairs that may cause starvation, blockage, or downtime of the constraint [7]. If a machine breaks down it is abundantly clear that it is not producing. If that machine is upstream of the constraint, some amount of buffer stock is needed to avoid starving the constraint during the downtime period. This implies that the upstream machine needs some additional or reserve capacity if it is to build or replenish buffer inventory. If the machine is downstream of the constraint, no buffer inventory is needed but it may need a similar additional capacity to process jobs quickly to avoid blocking the constraint after any breakdown.

But if a machine produces a defective item, it has still "produced," albeit what may be retrospectively called wasted inventory by using wasted capacity. If the defective item reaches the constraint undetected, and is processed by the constraint, throughput potential is lost forever. Constraint capacity is wasted, but there is no commonly accepted term that treats this situation in the TOC literature. If the defective item is detected and removed before it reaches the constraint, this may increase the likelihood of constraint starvation. The unwanted upstream production of defective items means that additional nonconstraint capacity must be exercised to replenish lost (defective) units. The unwanted downstream production of defective items means that throughput has been destroyed.

Scrap and rework are fundamentally different than other "statistical fluctuations" because they not only threaten, but destroy throughput directly or indirectly. No surge or sprint capacity can make up for the fact that the constraint, or a resource downstream, has just produced a defective item. Wasted capacity, and its corresponding wasted inventory, are things to be avoided. To better do so, we need to give them a name and focus on them. We need to understand wasted inventory and wasted capacity in the context of more familiar TOC capacity terminology.

## THE IMPACT OF DEFECTIVE WORK

Spoilage, defects, and rework are common occurrences in manufacturing. An Industry Week survey of 884 responding manufacturing plants found that scrap and rework costs were estimated as two percent of sales [11]. In some industries this internal failure cost is much greater. For example, it is estimated that defective work costs aerospace/defense companies an average of six percent of their total sales [12].

While spoilage, defects, and rework are often encountered, the impact of this poor quality on the production system is not well understood [1]. Producing defective items results in lower yield. Adding more inspection or testing to find defectives adds time and money to the process. Rework reduces line yield losses but increases cycle time and process costs.

Much of this impact is manifested by increases in variability. Hopp and Spearman [8, p. 390] claimed that quality problems are one of the largest and most common causes of variability and warned that such problems can have extreme consequences on operations. They described some of the direct and indirect effects of rework and scrap using a simple serial asynchronous four-stage constant work-in-progress (CONWIP) line with deterministic processing times. Using simulation, they showed that poor quality lowers throughput (yield) and increases cycle time for any given level of work-in-progress (WIP) inventory, because rework causes increases in both variability of process times and average utilization of affected workstations. Impact of poor quality on the overall line differs depending on the workstation where the defective item is produced. High WIP levels tend to amplify financial losses due to poor quality because of the larger time between processing the defective item and detecting the defect.

Scrap, which can be seen as the most extreme form of rework, is often treated as a deterministic quantity (e.g., 10%) when in almost all real situations the scrap rate for a given process is a random quantity [8]. For example, the *mean* scrap rate may be 10% but scrap may actually vary from 0% to 20% in different parts of the production cycle or at different workstations within the line. Most manufacturing systems use some form of job size inflation to compensate for average or expected yield losses and to protect customer due dates. The consequences for a specific order for a specific customer may be felt as increased lead time, waiting to fill out a lot due to low yield, or increased finished goods inventory resulting from excess goods caused by high yield. The more variable the yields, the greater the cost and disruption.

#### THE CORRESPONDENCE OF CAPACITY AND INVENTORY

Betterton [4] proposed a taxonomy of capacity types for TOC, and since every type of capacity has a corresponding type of inventory, that taxonomy can be extended to include inventory types for TOC.

Little's Law [10] says that the average number of items in a queuing system, denoted L, equals the average arrival rate of items to the system,  $\lambda$ , multiplied by the average waiting time of an item in the system, W. Thus,  $L = \lambda W$ .

For a system in which no losses occur the arrival rate must equal the departure rate, which is the throughput rate. The waiting time corresponds to the time period from entry to departure, so is equivalent to flow time. The number of items in the system corresponds to the system inventory. Thus by Little's Law in general is Mean Throughput Rate equals Mean Inventory divided by Mean Flow Time.

Since throughput is a rate it can be expressed as production units per time period. Likewise the right side of the equation is inventory units per time period. Thus there is a one-to-one relation between production capacity and resulting inventory; every use or type of capacity has a corresponding result or type of inventory.

Consistent with the above, Anupindi et al. [2] define theoretical capacity of a resource as the maximum sustainable flow rate if the resource was fully utilized. They discuss flow time and break it into two parts: theoretical flow time and waiting time. The theoretical flow time is the combined time of all operations on the critical path of the process, and for a serial line is just the total of all operations making up the process. Thus, for theoretical flow time there is no waiting (no variability), and accordingly, no buffer inventory. Theoretical flow time corresponds to theoretical inventory and theoretical capacity.

Inventory discussed by Anupindi et al. [2] is referred to as buffer input, buffer output, and station inprocess inventory. These inventory categories can be simplified to in-station inventory and in-transit inventory (inventory waiting or moving between stations). According to Anupindi et al [2] the minimum amount of inventory necessary to maintain a resource's full throughput rate can be called theoretical inventory and expressed as:

Theoretical inventory = (Max throughput rate) (Theoretical flow time)

This corresponds to the Hopp and Spearman [8] definition of Critical WIP as the WIP level at which a line, with no variability in process times, achieves maximum throughput with minimum cycle time. That is:

Critical WIP = (Bottleneck rate) (Raw process time)

where Raw process time equals total flow time with no variability.

Thus while different terms are used from author to author, the literature is consistent in recognizing the relationship of capacity and inventory at the global level. It is at the disaggregated level where a lack of clarity creeps in. As an example, Blackstone and Cox [7] define productive inventory as

...the amount of WIP inventory (measured in time units of the constraint work station) needed to support the constraint work station until material can get from the gating or first operation to the constraint work station ... In a deterministic world, this WIP level would maintain throughput until a unit can get from the gating operation to the constraint work station. The example line is

provided again in figure 4a. In figure 4b, 22 minutes are required for WIP to be processed through stations A (five units per hour represents 12 minutes per unit) and B (six units per hour represents 10 minutes per unit) therefore the **protective inventory** should equal this amount of constraint work station time. If 2 units of WIP are in the line at the constraint work station X (which processes parts at the rate of 15 minutes per unit), then this WIP equals 30 minutes of processing on the constraint work station. This material is the productive WIP required to support the constraint work station until another unit released from raw material could reach the constraint station X ... This productive WIP may be located anywhere between the material release point and the constraint work station; the closer to the constraint work station the better. (p. 419, emphasis added).

This statement defines productive inventory as an amount or quantity of inventory rather than a kind or type of inventory. Worse for this reader, the definition sounds like protective inventory when it says "productive WIP is that necessary to maintain uninterrupted production at the constraint until material can get from the gating or first operation to the constraint work station." This statement implies an interruption of production at stations preceding the constraint - which would require protective inventory. Notice that within the same cited paragraph the article actually refers to the two units of inventory as "protective inventory" (see bold), but later switches back to calling it productive WIP. The statement that productive WIP may be located anywhere between the material release point and the constraint work station can be correct only if one presumes that protective WIP is also on hand. For example, say the constraint just finished processing a unit. If the two productive WIP units mentioned as being "anywhere" were located upstream of the constraint and the constraint had no units in its feeding buffer then the constraint would starve.

If we define *productive inventory* simply as that inventory created by a resource using its productive capacity then there is a direct correspondence between productive capacity and productive inventory. With this definition, there is no confusing productive WIP with protective WIP. With this definition the statement is true that productive WIP may be located anywhere between the gate and the constraint, including at a station being processed. This definition holds in a deterministic or stochastic world. With this definition one can still quantify productive WIP in time units of constraint production. With this definition, the idea of imperfect quality translates perfectly - we get "Wasted Inventory" (scrap) corresponding to "Wasted Capacity." All in all, there is a one-to-one correspondence between the capacity relationships and the inventory relationships, as it should be according to Little's Law. The remainder of this paper illustrates that correspondence and defines the related terms.

#### **THROUGHPUT**

*Throughput* is system output converted to sales (or other goal units). Throughput is *productive inventory* in its final form, and is created by utilizing a portion of the system's installed or theoretical capacity. The portion of theoretical capacity so utilized is *productive capacity*.

#### SYSTEM CAPACITY AND INVENTORY

System capacity is equal to the productive capacity of the system's busiest (most highly used) resource over the time horizon of interest. Such a resource is a constraint, and the constraint's productive capacity is equal to its available capacity less its wasted capacity. Good output of the constraint is productive inventory; defective output is wasted inventory. Thus the capacity of a constraint is utilized as productive capacity or it is lost as wasted productive capacity. Once a resource becomes a constraint, it has no

protective capacity and no excess capacity, and it can produce no protective inventory and no (potentially) excess inventory.

#### THEORETICAL CAPACITY AND THEORETICAL INVENTORY

Theoretical capacity refers to the upper limit of output (quantity per time period) that an individual resource or system is capable of producing under normal conditions on a sustained basis. Theoretical capacity is equivalent to design capacity and is the practical or full capacity ordinarily achievable. Theoretical capacity may be less than surge capacity achievable for short durations or under operational conditions that shorten the life of the resource, or which are not sustainable over the long run. We define theoretical capacity as the normal full capacity of a resource (worker or machine), having no failure or other downtime (unavailability), and producing perfect results. For a production line this would be the constraint capacity. Since all inventory must be produced with some form of capacity, theoretical inventory is the counterpart of theoretical capacity. Theoretical inventory is the category or amount of inventory that would be produced with theoretical capacity.

In reality, of course, all resources have some downtime and suffer from some imperfections. So theoretical capacity may be seen as being composed of two components, available capacity and unavailable capacity. Likewise, theoretical inventory may be seen as being composed of two corresponding components, available inventory and unavailable inventory.

Theoretical Capacity = Available Capacity + Unavailable Capacity 
$$(1)$$

"Inventory from unavailable capacity" may seem like a contradiction in terms, but what it refers to is inventory that could be obtained if (for example) breakdowns could be reduced/eliminated.

#### AVAILABLE CAPACITY AND INVENTORY FROM AVAILABLE CAPACITY

Available capacity consists of effective capacity, wasted capacity, and excess capacity. Available capacity excludes periods when the resource is not operating, such as maintenance, repair, setup, or other downtime. We can use the widely accepted reliability definition for "availability" as:

$$Availability = MTBF / (MTBF + MTTR)$$
(3)

where, MTBF is mean time between failures, and MTTR is mean time to repair. Or more broadly, the definition given in the APICS Dictionary [6] can be used, according to which, availability is the portion of time that a resource is capable of working:

$$Availability = (S-B)/S \tag{4}$$

where, S is scheduled time, and B is downtime. Making use of (1) and (3) above, we define available capacity as the capacity remaining in a resource beyond any downtime, or:

Available Capacity = Availability x Theoretical Capacity = 
$$(MTBF / (MTBF + MTTR))$$
 x Theoretical Capacity =  $((S-B) / S)$  x Theoretical Capacity

The available capacity of a resource can be directed toward productive ends (utilized), expended toward unproductive ends (activated), wasted, or remain idle and unused. Inventory potential from Available Capacity will be in the categories of Inventory from Effective Capacity, Inventory from Wasted Capacity, and Inventory from Excess Capacity.

By *utilized* is meant capacity used in support of the constraint and by *activated* is meant capacity used that is not needed to support the constraint, for example by making excess inventory. In the theory of constraints, *utilization* is the ratio of utilized capacity to available capacity, however, more commonly, *utilization* is the ratio of used capacity to theoretical (full) capacity [9], or the percentage of time a resource is busy [3]. Capacity that is wasted represents a special form of activation, in which productive ends are intended but defective work (wasted inventory) is produced. By *idle* is meant that a nonconstraint resource is in standby mode until it is needed.

# EFFECTIVE CAPACITY AND INVENTORY - PRODUCTIVE AND PROTECTIVE

Effective capacity is composed of productive capacity and protective capacity. Inventory from Effective Capacity is composed of Inventory from Productive Capacity and Inventory from Protective Capacity. By *productive* is meant that the resource is creating throughput (good results), or is subordinating to the constraint in support of throughput production. The capacity used when a resource is engaged in throughput production, or in support of the constraint for throughput production, is termed *productive capacity*. Inventory created by a resource using its productive capacity is *productive inventory*.

A nonconstraint resource in idle or standby mode may be needed to protect constraint operation, for example, by "speeding up" for a period after it has experienced downtime, to replenish buffer inventory feeding the constraint, or to avoid blockage of the constraint by removing completed items from the constraint's downstream space buffer. The capacity used when the normally idle capacity of a nonconstraint resource is exercised effectively in a protective manner is termed *protective capacity*, and any inventory produced thereby is *protective inventory*. While protective capacity may remain idle for a while, eventually it is called upon to support throughput. Excess capacity by its nature is always idle and so never produces any inventory.

#### WASTED CAPACITY AND WASTED INVENTORY

It is possible that defective units can be produced by human error or by a machine that drifts out of control, or even through random chance in a capable process under statistical control. Defective units are not throughput, and they are not intended. The available capacity used to produce defective units is *wasted inventory*, and is accordingly termed *wasted capacity*.

Both productive and protective capacity may be wasted. A nonconstraint resource with less that 100 percent yield may invoke unused capacity in an attempt to compensate for some system fluctuation, i.e., to protect the constraint. To the extent that this resource produces good output (throughput) in support of the constraint, the capacity so exercised is protective capacity. To the extent that this resource produces defective output, even though intended to support the constraint, the capacity employed is wasted capacity and the inventory produced is *wasted inventory*.

In a serially linked set (chain) of resources with yield loss, additional wasted capacity and wasted inventory are produced when a downstream workstation converts good units created by an upstream workstation into defective units. This secondary conversion of the upstream resource's productive

capacity into wasted capacity may be thought of as a "system effect," and is more pronounced with longer resource chains.

## EXCESS CAPACITY AND EXCESS INVENTORY

Excess capacity is that portion of available capacity not needed, or so rarely needed that its benefits are outweighed by the costs of keeping it. By definition, excess capacity never exercised will produce no inventory; the idea of excess inventory corresponds to the inventory that would be produced if the excess capacity were used. Deciding what capacity is excess means deciding how much protective capacity is sufficient. This is no trivial decision. As Cox and Blackstone [7] have pointed out, there is currently no mathematical approach for defining protective capacity.

By the nature and definition of a constraint, it has no excess capacity and no protective capacity. (It does not protect itself.) Excess and protective capacity appear only at nonconstraints. A constraint resource will experience some downtime in the form of failure, maintenance, setup, etc. This aggregate downtime is the constraint's unavailable capacity, and is subtracted from the constraint's theoretical capacity to arrive at its available capacity.

Since the constraint has no excess or protective capacity, all of its available capacity would ideally be viewed as productive capacity and scheduled to support throughput by producing productive inventory. However, this is not possible if there are yield losses at the constraint. The effective (productive) capacity of the constraint will be degraded to the extent that yield loss is present. Productive capacity for a nonconstraint resource is equal to that of the constraint; the same quantity of productive inventory must flow through both constraint and nonconstraint resources. Any additional capacity exercised beyond this level by a non-constraint, in order to maintain uninterrupted production at the constraint, is protective capacity and is engaged in producing protective inventory.

## CAPACITY AND INVENTORY - TWO SIDES OF THE SAME COIN

Capacity exists before inventory – inventory is the manifestation of capacity. When inventory is created capacity is consumed. Capacity is potential inventory; inventory is actualized capacity. Capacity can be consumed with either positive or negative results; intended good output can be created or defective output can result. Scrap, rework, and other forms of non-optimum production are fundamentally different than other "statistical fluctuations" in the TOC world because they destroy throughput directly or indirectly.

Some threshold amount of protective inventory is needed to transmit protective capacity and vice versa. The presence or absence of strategically located work-in-progress (WIP) inventory serves to protect the constraint from being idled. Located upstream of the constraint, such WIP constitutes a buffer that helps prevent starvation of that critical resource. (A space buffer downstream from the constraint helps avoid blockage of the constraint.) Like capacity, WIP can be classified and defined based on its characteristics and use - productive, protective, wasted, and excess. When a resource produces a defective item, that resource is actually removing from the flow stream a (wasted) WIP unit that must then be replaced by a good one. Capacity and WIP are related in that it takes inventory to transmit capacity from resource to resource. Producing wasted WIP converts potentially productive capacity to wasted capacity.

This inventory-capacity taxonomy attempts to clarify the relationship of inventory and capacity within the TOC framework, and to address the problem that there is no commonly accepted term in the TOC literature that deals with the reality of yield loss and the resulting wasted capacity and wasted inventory. The Appendix provides a summary of the inventory and capacity relationships discussed.

# **APPENDIX - SUMMARY OF TOC INVENTORY AND CAPACITY RELATIONSHIPS**

## Part 1 - Summary of TOC Capacity Relationships

The capacity relationships defined and discussed above are summarized below:

Total System Capacity Potential = Theoretical Capacity

Theoretical Capacity = Available Capacity + Unavailable Capacity

Available Capacity = Effective Capacity + Wasted Capacity + Excess Capacity

Effective Capacity = Productive Capacity + Protective Capacity

Theoretical Capacity = Productive Capacity + Protective Capacity + Excess Capacity + Wasted Capacity + Unavailable Capacity

Idle Capacity = Protective Capacity + Excess Capacity

Theoretical Capacity = Productive Capacity + Idle Capacity + Wasted Capacity + Unavailable Capacity

## Part 2 - Summary of TOC Complementary Inventory Relationships

The inventory relationships defined and discussed above are summarized below:

Total System Inventory Potential = Inventory from Theoretical Capacity

Inventory from Theoretical Capacity = Inventory from Available Capacity + Inventory from Unavailable Capacity

Inventory from Available Capacity = Inventory from Effective Capacity + Inventory from Wasted Capacity + Inventory from Excess Capacity

Inventory from Effective Capacity = Inventory from Productive Capacity + Inventory from Protective Capacity

Inventory from Theoretical Capacity = Inventory from Productive Capacity + Inventory from Protective Capacity + Inventory from Excess Capacity + Inventory from Wasted Capacity + Inventory from Unavailable Capacity

Inventory from Idle Capacity = Inventory from Protective Capacity + Inventory from Excess Capacity

Inventory from Theoretical Capacity = Inventory from Productive Capacity + Inventory from Idle Capacity + Inventory from Wasted Capacity + Inventory from Unavailable Capacity

#### Notes:

- 1. "Inventory from unavailable capacity" may seem like a contradiction in terms, but what it refers to is inventory that could be obtained if (for example) breakdowns could be reduced/eliminated.
- 2. "Inventory from Idle Capacity" corresponds with the APICS definition of idle inventory The inventory generally not needed in a system of linked resources. Idle inventory generally consists of protective inventory and excess inventory.

# Part 3 - Summary of TOC Physical Inventory Relationships

Total System Inventory = Throughput (Finished Goods, good product) + Scrap (defective product) + Total WIP

Total WIP = Effective WIP + Excess WIP

Effective WIP = Productive WIP (line WIP) + Protective WIP (buffer WIP)

Effective Production = Throughput Production (Finished Goods without defects) + Effective WIP

Note 1: "Line WIP" refers to the productive WIP between the gate and the constraint, and "buffer WIP" refers to WIP that buffers the constraint against interruption.

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# The Structural Benefits of Co-opetitive Supply Chain Networks: A Simulation Study using "Beer Game" Mechanics

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#### **ABSTRACT**

Supply chain management research has noted supply chains where competitors selling the same product at the same level of the supply chain may work together to achieve optimal profits, using the term "coopetition" to describe the phenomenon. Theory suggests that suppliers may compete and collaborate simultaneously under certain structural conditions – goal congruence and deep interdependence - to achieve better collective supply chain performance. This study develops a simulation using Beer Game mechanics to model the effects of parallel and hub-based coopetitive supply chain structures on inventory management cost performance. Specifically, we examine the tradeoffs with respect to product substitution, supply chain membership, demand volatility, and lead times in such systems in our model which is derived from actual co-opetitive structures. This research will move the discussion from understanding the required environments for co-opetitive supply chains towards both an understanding of 1) the benefits to be expected from such networks and 2) under what conditions such networks achieve optimal inventory management and distribution cost performance.

Keywords: Co-opetition, Supply Chain Risk, Information Sharing, Experimental Analysis

## TEACHING AGGREGATE PLANNING IN AN OPERATIONS MANAGEMENT COURSE

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#### **ABSTRACT**

This paper discusses the challenges in teaching the topic of aggregate production planning in operations management. Among these challenges include the need of applying trial-and-error approaches to test various aggregate plans. These approaches involve performing repetitive calculations, which could hinder the possible insights gained from analyzing aggregate planning problems. In our operations management course, we require students to do an aggregate planning team project, which also includes an individual component. The project involves the use of spreadsheet, such as Microsoft Excel, to solve aggregate planning problems with various input datasets, taking factors such as demand pattern and various cost coefficients into consideration. The project also requires each team to write a report discussing how the team derives its final plan and the insights it acquires from the assignment.

#### INTRODUCTION

The Aggregate Production Planning (or Aggregate Planning) topic appears in virtually every operations management textbook. It is arguably a must-cover topic in an operations management course, particularly for a higher level undergraduate or a graduate course in operations. Aggregate Planning is about finding the quantity and timing of production for the intermediate future, often from 3 to 18 months ahead depending on the size of the company. As the term aggregate implies, an aggregate plan means combining various resources into general, or overall, terms. That is, the aggregate plan looks at production in the aggregate, not as a model-by-model breakdown.

Aggregate planning is part of the hierarchy of production planning decisions (Nahmias 2009) and may be stated below: Given demand forecast, facility capacity, inventory levels, workforce sizes, and related inputs, the planner has to select the rate of output for a facility over the next 3 to 18 months. Generally, the goal of aggregate planning is to meet forecasted demand while minimizing cost over the planning period. However, other strategic issues may be more important than low cost. These strategies may be to smooth employment levels, drive down inventory levels, and/or meet a high level of service.

Operations managers try to determine the best way to meet forecasted demand by adjusting production rates, labor levels, inventory levels, overtime work, subcontracting rates, and other controllable variables. When generating an aggregate plan, the operations manager must answer several questions (Heizer and Render, 2011):

- 1. Should inventories be used to absorb changes in demand during the planning period?
- 2. Should changes be accommodated by varying the size of the workforce?
- 3. Should part-timers be used, should overtime and idle time absorb fluctuations?
- 4. Should subcontractors be used on fluctuating orders so a stable workforce can be maintained?
- 5. Should prices or other factors be changed to influence demand?

Aggregate planning is important for several reasons. First of all, aggregate planning helps stay ahead of the curve as it takes time to carry out options, such as hiring and training new employees. Second, aggregate planning is necessary because it is hard to predict the demand levels of individual models with a high degree of accuracy. Therefore, an aggregate plan serves as an important bridge between long term and short term plans. Finally, aggregate planning is necessary for budgeting process and is important to keep the supply chain synchronized (Stevenson 2012).

There are four popular solution approaches that textbooks frequently cover in aggregate planning. These approaches are:

- 1. Linear Programming;
- 2. The Transportation Method of Linear Programming;
- 3. Trial and Error Approaches Graphing.
- 4. Linear Decision Rule.

Linear Programming (LP) is an optimization technique and can be used to solve aggregate planning problems. Depending on the rigor of the treatment, most introductory operations textbook introduce linear programming as an optimization approach for aggregate planning problems but do not give the details of formulating an aggregate planning problem into a linear programming model. A more rigorous treatment involves the formulation of a basic model, frequently along with solution obtained using software. A rigorous treatment for this topic would include various LP models to account for different types of aggregate planning problems. This treatment would only be reserved for the graduate level. The primary disadvantage of the linear programming approach is that students frequently find it difficult to master mathematical formulation, particularly written in abstract notation. Even if the basic model is mastered, most students find it challenging to go beyond the basic model.

The special case of the transportation method is generally more restrictive, this is because hiring and layoff options are not available. While subcontract capacity may vary from period to period, regular time and overtime capacity are usually fixed. Backordering is possible but frequently is assumed to be unavailable for simplicity. Moreover, most textbooks do not show how to optimally solve the special case, especially when backordering is allowed. Finally, there is no guarantee that a solution which satisfies the forecast demand over the entire planning horizon exists.

Trial-and-error approaches have generally received the most coverage in operations management textbooks, whereas linear programming has the most coverage in advanced operations management texts. Trial-and-error approaches are composed of developing tables and graphs that enable managers to visually compare forecasted demand requirements with current capacity. Graphs are frequently used to guide the development of alternatives. Once alternative plans are identified, they are evaluated in terms of their overall costs. These approaches are common because they are flexible, easy to understand and use. Also, they provide a visual portrayal of a plan. The major disadvantage of the trial-and-error approaches is that they do not necessarily result in the optimal aggregate plan.

Other solution techniques include the management coefficients model and linear decision rule; nevertheless, most textbooks only briefly mention these methods. The linear decision rule approach to solving aggregate planning problem has been proposed by Holt et al. (1960). It applies quadratic approximations for all the relevant costs and obtains linear equations for the optimal policies. One of the important limitations of the linear decision rule is that the model can produce solutions that are infeasible, i.e., negative.

In this paper, we propose a project that instructors can use as a means that supports processes of learning and teaching of aggregate production planning. The next section describes our aggregate planning project. It is followed by a project example. Finally, we give a summary and share our aggregate planning project experience in the conclusion section.

## AGGREGATE PLANNING PROJECT

Our aggregate planning project consists of two parts – the first part is individual, whereas the second part involves teamwork. In Part 1, every student is required to analyze an aggregate planning problem, and determine a level capacity plan and a chase demand plan for the problem. A level strategy maintains a constant output rate or workforce level over the planning horizon, whereas a chase strategy typically attempts to achieve output rates for each period that match the demand forecast for that period. Furthermore, we ask the students to implement their plans with Microsoft Excel. The purpose of this part is to ensure that every student fully understands the relationship of various terms, such as cumulative production used in aggregate planning, in addition to the level capacity and chase demand strategies. Part 1 is also aimed to prepare every student to be an effective contributing team member in Part 2.

An example of an aggregate planning problem data is given in Table 1. The aggregate planning problem has an 18-month planning horizon and is quite general in that the firm may vary workforce (via hiring and layoff) and inventory level (including backordering) to satisfy demand. The firm may also use overtime production to meet demand; however, overtime production in a period is restricted to no more than 20% of regular production in that period. Although subcontracting is not considered, this option still can be easily added. It should be noted that a feasible plan requires the firm to assume a non-negative inventory level by the end of the planning horizon.

In Part 2, students are assigned into teams of three or four and they are presented with the same aggregate planning problem as in Part 1, plus a number of additional problem scenarios. These scenarios differ from Part 1 by demand requirements and/or cost coefficients such as hiring and layoff costs. Table 2 illustrates two of these scenarios. Scenario 1 differs from Part 1 by demand requirements only, whereas Scenario 2 only differs by cost coefficients.

Each team will discuss and analyze each of the problem scenarios, including the base scenario of Part 1. After the discussion and analysis of a problem scenario, each team proposes an initial feasible plan (Plan 1) for the scenario and implements the plan with Excel. As stated previously, a feasible plan requires that the total net demand must be satisfied by the end of planning horizon. At the initial plan, the project is primarily looking for the quality of rationales behind the plan, not so much of the solution quality in terms of total cost.

By analyzing various resulting cost components, such as total hiring, total layoff, total holding, total backordering, and total overtime cost, the team prepares for the next plan. This iterative process continues until the team is satisfied with its final plan. For the final plan, say Plan 5 (P5), the team may fine-tune it further in search of the lowest overall total cost solution and label these resulting "secondary" plans as P5.1, P5.2, P5.3, etc.

Finally, the team is required to write a report documenting the rationales it applied to select each of its primary plans, say Plan 1, Plan 2, ..., Final Plan. It is particularly important that the team explains how it decided to move from one plan to the next. For example, a team comes up with five major plans for a problem scenario, the team is required to explain how it moves from Plan 1 to Plan 2, then to Plans 3, 4, and 5. The quality of the final solution is significant, as well as the logic and insight employed in deriving each of the primary plans. In the report, the team should include a table which summarizes the solution of its major and secondary plans (see Table 3 for an example). Finally, the report should include Excel worksheets showing each the major plans, as well as the fine-tuned secondary plans.

TABLE 1: AGGREGATE PLANNING PROBLEM DATA

Gross Demand	Working Days							
2,500	19							
2,600	20							
2,800	19							
2,700	25							
5 2,000 22								
6 2,000 20								
7 1,900 18								
8 1,700 25								
9 2,000 23								
2,000	24							
2,300	23							
2,500	19							
2,300	20							
2,300	22							
2,500	20							
2,400	21							
2,100	22							
2,100	20							
40,700	382							
y = 300  units								
200 units								
e = 200 workers								
000/worker								
80/unit/month								
g = 120/unit/month								
ne cost = \$130/unit								
$n \le 20\%$ of regular ting	me production							
working days, with t	he workforce level							
	2,500 2,600 2,800 2,800 2,700 2,000 2,000 1,900 1,700 2,000 2,000 2,300 2,300 2,300 2,300 2,300 2,300 2,300 2,100 2,100 2,100 40,700 y = 300 units 200 units the = 200 workers 000/worker 000/worker 80/unit/month the cost = \$130/unit n \leq 20% of regular times							

constant at 200 workers, the firms produced 2,120 units.

TABLE 2: AN EXAMPLE OF AGGREGATE PLANNING PROBLEM

Scena	ario 1	Scenario 2
Month	Gross Demand	Cost of hiring = \$1,500/worker
1	2,100	Cost of firing = \$3,000/worker
2	2,400	Cost of holding = \$60/unit/month
3	2,100	Cost of backordering = \$100/unit/month
4	2,700	Incremental overtime cost = \$150/unit
5 – 10	2,000	
11	2,300	
12	2,500	
13	2,300	
14	2,300	
15	2,500	
16	2,800	
17	2,500	
18	2,600	
Total:	41,100	

**TABLE 3: SUMMARY TABLE** 

Plan	1	1	2	2			5		5.1		5.2	
Period	$WF^1$	$OT^2$										
1	231	0										
2	231	0										
3	231	0	•••	•••					•••		•••	
4	231	0										•••
5	231	0	•••	•••					•••		•••	
6	231	0										
7	231	0			•••					•••	•••	
8	231	0									•••	
9	231	0			•••					•••	•••	
10	231	0			•••	•••	•••	•••		•••		
11	231	0			•••	•••	•••	•••		•••		
12	231	0			•••	•••	•••	•••		•••		
13	231	0			•••	•••	•••	•••		•••		
14	231	0										•••
15	231	0										•••
16	231	0										•••
17	231	0	•••	•••					•••		•••	
18	231	0										•••
Tot. Cost	\$1,27	3,520	•									
Hiring	\$62,	,000	•						•			
Firing	\$	0	•.						•			
Holding	\$392	2,849										
Backorder	\$818	3,671	•									
Overtime	\$	0	•			••				••		

<sup>&</sup>lt;sup>1</sup> Workforce level <sup>2</sup> Overtime production

#### AN EXAMPLE

We will present several feasible plans based on the example data given in Table 1. The first plan employs a level strategy; while the second one uses a chase strategy (achieved by hiring and/or laying off). These plans together represent two extremes. Table 4 summarizes the solutions of level capacity (Plan 1) and chase plans (Plan 2). Plan 1 has 285 workers throughout the planning horizon, implying a hiring of 85 workers in period 1. The total cost for the plan consists of two cost components – hiring and holding. The total hiring cost is \$170,000, whereas the total holding cost is approximately \$7 million. In Plan 2, the workforce level varies between 148 and 320. The overall total cost for the plan is around \$1.7 million, consisting of approximately \$0.7 million hiring cost, \$1 million firing cost, and \$22,315 holding cost (due to rounding of the workforce).

In addition to these two "extreme plans", there are many avenues that students may take to create an initial plan. Since backordering is allowed, students can propose a constant workforce plan using the average number of workers required to satisfy total net demand over the entire planning horizon (called Plan 3), and thereby resulting in backordering in some periods. Sometimes the demand data may suggest that it is advantageous to break the planning horizon into the two, use a constant workforce for the first half and another constant workforce for the second half (called Plan 4). Furthermore, when the cost of hiring and/or firing to the cost of holding and/or backordering is relatively low, along with changing demand pattern, it could be particularly beneficial to break the planning horizon into more, say four, segments, and apply a constant work force in each segment (called Plan 5).

Plan 6 is created with a close inspection of demand and cost data and an aid of various graphical tools. Among these are various graphical tools, students can create a line graph of cumulative demand and cumulative production output of an existing plan. When the cumulative demand lies above the cumulative output, excess inventory is built up, and vice versa. This graph provides students insight as to when to increase workforce/overtime or reduce workforce. Another simple graphical tool is the plotting of a bar chart showing inventory level at the end of each period. Table 5 gives a summary of the four plans described above as follows.

- Plan 3: Constant workforce over the entire planning horizon.
- Plan 4: Break the planning horizon into two segments, use constant workforce in each.
- Plan 5: Break the planning horizon into four segments, use constant workforce in each.
- Plan 6: Analyzing demand and cost data and using graphical tools.

Table 5 shows all four plans outperform Plans 1 and 2 significantly. Plan 5 (4 segments) yields the lowest total cost of \$887,244, it is followed by Plan 6 (examining demand and cost data with graphical tools) with a total cost of \$978,365, Plan 3 (1 segment) with a total cost of \$1,273,520, and Plan 4 (2 segments) with a total cost of \$1,346,106.

It is important that each team gives rationales to justify all its proposed plans, whichever ones are selected. When a team is satisfied with its final plan, it may further improve the final plan by fine-tuning. Suppose that Plan 3 is concluded as the final plan. By making minor changes to Plan 3 (i.e., constant 231 workers in each period), Plan 3.1 is created. Plan 3.1 utilizes 230 workers from periods 1-17 and 242 in period 18 and its total cost decreases from \$1,273,520 (Plan 3) to \$1,270,449. If it is undesirable to make a large workforce change in any period, a constraint can be introduced to enforce this requirement. Now suppose that Plan 6 is chosen as the final plan. Again by modifying Plan 6 slightly, Plan 6.1 is created. Plan 6.1 is identical to Plan 6 except for periods 12-14 with 226 (instead of 225) workers and periods 15-18 with 249 (instead of 250) workers. As shown in Table 6, Plan 6.1 yields a total cost of \$967,277 compared with \$978,365 of Plan 6.

TABLE 4: PLAN 1 (LEVEL CAPACITY) AND PLAN 2 (CHASE DEMAND)

Period	Plan 1	Plan 2
1	285	252
2	285	282
3	285	320
4	285	234
5	285	197
6	285	217
7	285	229
8	285	148
9	285	189
10	285	180
11	285	217
12	285	286
13	285	249
14	285	227
15	285	272
16	285	247
17	285	208
18	285	249
Overtime:	\$0	\$0
Hiring:	\$170,000	\$770,000
Firing:	\$0	\$1,008,000
Holding:	\$7,054,330	\$22,315
Backorder:	\$0	\$9
Total Cost:	\$7,224,330	\$1,800,325

**TABLE 5: PLANS 3-6** 

Period	Plan 3	Plan 4	Plan 5	Plan 6
1 – 5	231	227	255	250
6	231	227	192	240
7	231	227	192	225
8	231	227	192	200
9	231	227	192	200
10	231	236	230	200
11	231	236	230	200
12	231	236	230	225
13	231	236	230	225
14	231	236	240	225
15 – 18	231	236	240	250
Overtime:	\$0	\$0	\$0	\$0
Hiring:	\$62,000	\$72,000	\$206,000	\$200,000
Firing:	\$0	\$0	\$189,000	\$150,000
Holding:	\$392,849	\$290,683	\$193,559	\$302,383
Backorder:	\$818,671	\$983,423	\$298,685	\$325,983
Total Cost:	\$1,273,520	\$1,346,106	\$887,244	\$978,365

TABLE 6: PLANS 7 AND 8

	Plan 7		Plan 8	
Period	# of Workers	Overtime Units	# of Workers	Overtime Units
1	225	230	240	0
2	225	526	240	400
3	225	232	240	400
4	225	0	240	300
5	225	0	200	0
6	225	0	200	148
7	225	0	200	0
8	225	0	180	0
9	225	0	180	0
10	225	0	180	0
11	225	0	215	0
12	225	0	240	200
13	225	0	240	200
14	225	0	240	0
15	225	0	240	0
16	225	0	240	0
17	225	0	240	0
18	225	0	240	62
Overtime:	\$128	3,440	\$222	2,300
Hiring:	\$50	,000		0,000
Firing:	\$0		\$180,000	
Holding:	\$586,637		\$40,758	
Backorder:	\$295,283		\$195,610	
Total Cost:	\$1,060,360		\$838,669	

Now let's consider the use of overtime production to help reduce overall total cost. Table 6 shows two possible plans – Plans 7 and 8. Plan 7 uses a constant workforce level of 225, which is cut by six workers compared with Plan 3. Overtime production is used in periods 1, 2, and 3 to compensate for the output loss. Plan 7 yields an overall total cost of \$1,060,360 compared with \$1,273,520 of Plan 3. Finally, Plan 8 generally employs fewer workforce in most periods compared with Plan 5 and again makes up the difference via overtime production. It yields an overall total cost of \$838,669 compared with \$887,244 of Plan 5. Appendix A illustrates Plan 8 in great detail.

#### **CONCLUSIONS**

This paper discusses the challenges in teaching the aggregate production planning topic in operations management. Among these challenges includes the need to apply trial-and-error approaches to test various aggregate plans. These approaches involve performing repetitive calculations, which could hinder the possible insights acquired from analyzing aggregate planning problems. In this paper, we propose a project that instructors can use as a means that supports processes of learning and teaching of aggregate production planning. In our aggregate planning project, we require students to do a team aggregate planning team project, which also has an individual component. The project involves the use of a spreadsheet, such as Microsoft Excel, to solve aggregate planning problems with various input datasets, taking factors such as demand pattern and various cost coefficients into consideration. The project also

requires each team to write a report discussing how the team derives its final plan and the insights it acquires from the assignment.

The feedback we have received from our students is very positive. Most students said that the aggregate planning project allows them to learn the topic more effectively than those end-of-chapter problems in the textbook. Among the reasons given are: (1) the project is motivational; (2) it helps fully understand the details of aggregate planning; (3) it allows one to focus on analysis of the problem scenario rather than the repetitive computations; and (4) the Excel spreadsheet and project report are great for my college portfolio. We have found that the project is useful because our students must think critically in order to deliver rationales to each of their plans.

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# OBSTACLES TO THE INTEGRATION OF SAP TRAINING IN **ACADEMIC PROGRAMS**

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#### **Extended Abstract**

In order to prepare students for challenging careers where they are expected to produce results with little initial training and to compete against others for the best jobs, they need to be exposed to the latest technologies used within industry. One of these technologies is Enterprise Resource Planning (ERP) software. Implementing ERP software in academic programs of study provides many benefits to academic institutions, students, and employers. Academic institutions benefit by demonstrating they are providing cutting edge technology training to their students and are preparing them for challenging careers that employ this latest technology that has become a necessity in many sectors of industry.

Furthermore, students benefit from ERP software integration in academic programs by being exposed to this software. This exposure enables them to be much more prepared to work with software they are likely to use in their upcoming careers. If academic programs are able to successfully integrate ERP software throughout their curriculum, where students are engaged in the processing of actual transactions involving live ERP software that enable the implementation of business decisions, then students are more likely to benefit than those that are not exposed to such environments.

Employers also benefit by the implementation of ERP in academic programs for various reasons. First of all, employees that have already been exposed to current software require less initial training. Furthermore, they are more likely to become acclimated to their new environment much quicker than those that were not exposed to this software. Most of all, new employees that are already trained are more productive from the start and less expensive since they don't need a substantial amount of initial training to produce results for the company. Therefore companies, as well as students, benefit from the implementation of SAP within academic programs of study.

Although there are limited choices of ERP software packages that are widespread in industry, their implementation and understanding is complex and requires extensive training and exposure in order to establish a good knowledge base. Therefore, ERP exposure that begins early in an academic program of study and progresses throughout a degree program is more likely to provide the exposure and knowledge students need to be successful after graduation.

One of these leading ERP software packages used throughout industry is SAP ERP. It has been implemented in various sizes and sectors of industry. Its widespread use makes it an ideal software package to implement in degree programs of study. Many academic institutions have already implemented SAP within their degree programs through the SAP University Alliance (SAP UA) program. Some of these implementations have been very successful, while some have resulted in failed attempts. Research in this area is needed to gain a better understanding of the causes of these failures, if academic institutions are to be successful with their attempts to implement SAP within their programs.

To gain a better understanding of the implementation of SAP within academic programs through the SAP UA program, a study of SAP UA faculty was conducted. This study surveyed SAP UA faculty perceptions of their SAP ERP implementations utilizing an online survey instrument that consisted of demographic, open ended, and Likert-scale questions. Out of the 175 potential participants who were invited to participate in the study, 55 completed the survey, resulting in a 31% response rate. Email

addressed of potential survey respondents were located by searching web sites of academic institutions with SAP UAs and through a search of the SAP UA portal. The survey was developed and administered online using Qualtrics, a web-based survey development and management tool. The respondents with at least one year of experience within the SAP UA were asked to complete the survey.

One of the research questions for this study attempted to determine the areas that need the most attention within the SAP UA program. Respondents were give six options to choose from. They were allowed to choose one or more of these options. In addition, they were provided a method for entering text, if none of the options applied to them. Another research question attempted to determine the weaknesses of the SAP UA program. This was an open-ended question that was meant to capture all of the possible weaknesses of the respondent's SAP UA.

There are some limitations of this study that are worth noting. One of these limitations is the limited number of potential participants that were invited to participate in this study. After attempts to obtain faculty email addresses from regional SAP UA centers were not successful due to SAP's privacy concerns, email addresses for SAP UA faculty were obtained through web searches of SAP UA programs and through the SAP UA portal. This approach made locating SAP UA faculty emails difficult and likely resulted in a much smaller pool of potential participants than actually exist. Furthermore, since locating potential respondents was difficult, searches were limited to SAP UA within the United States. Therefore, the results of this study may not apply to the entire population of SAP UA faculty, since the study population was limited in scope.

Another limitation of this study is that it only uses the survey methodology to collect data from potential respondents. Other forms of data collection such as interviews of potential respondents would have produced more accurate results. Furthermore, only 31% of the potential respondents completed the survey. A higher response rate would have produced more accurate results. Also, no method was available to determine the level of experience among the respondents prior to invitations being distributed. In the invitation and in the opening screen to the online survey, respondents were asked to complete the survey if they met the one year of experience requirement.

Despite these limitations, an initial review of the data indicates that there are several obstacles to the implementation of SAP within academic programs that should be of concern for faculty and administrators that are contemplating the implementation of SAP within their programs of study. This paper will present the results of this study by categorizing and summarizing the responses obtained during this study. The authors believe this new knowledge will aid in decision making within academic programs, especially those in business schools, since the majority of responses were obtained from faculty within business schools located throughout the United States.

#### Keywords

SAP ERP, SAP University Alliance, Academic Programs

## **Abstract**

In order to ensure academic programs of study prepare students for rewarding careers in industry, they need to expose students to the latest technologies they are likely to use. One of these software tools is Enterprise Resource Planning (ERP). A leading ERP solution used throughout industry is SAP ERP. SAP has partnered with universities through the SAP University Alliance (SAP UA) program by providing universities access to software free of charge. Implementing SAP ERP within these programs of study has been met with some obstacles for faculty and universities. A study of SAP UA faculty within the United States was conducted to identify these obstacles to SAP ERP integration within academic programs and to identify possible solutions to these obstacles. This paper will present the results of this study.

# TOP PERFORMING SUPPLY CHAINS: AN INNOVATIVE APPROACH FOR TEACHING SUPPLY CHAIN MANAGEMENT

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#### **ABSTRACT**

Supply chain management is critically important for organizational success in today's global business environment. Organizations formulate various strategies to enhance supply chain performance and are continually seeking ways to gain a competitive advantage. This paper highlights one specific strategy: the Demand-Driven supply network (DDSN). (formerly AMR Research) has published the Top 25 Supply Chains for several years with DDSN being a main feature of companies on that list. This paper will discuss how the Top 25 can be used in various ways to teach supply chain management and to do research about top performing supply chains. We will also discuss lessons learned while using the Top 25 in the classroom.

#### Introduction

Today's global supply chains are extremely complex and achieving a competitive advantage very often depends on managing the supply chain effectively. The number of exchanges that occur in the overall process of planning, sourcing, making and delivering products, services and the related supply chain information translate to a large number of relationships which must be managed. As these exchanges occur and the material moves through a series of providers and ultimately reaches consumers, the efforts of several parties need to be aligned – this is referred to as the supply chain [18].

The following definition for "supply chain management" also highlights the need for integration and coordination:

"Supply chain management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders" [10].

This description emphasizes the need to coordinate across the entire network of companies in the Supply chain effectiveness depends on the management of each critical supply chain. relationship at each link of the supply chain.

For the above reasons, supply chain management continues to be a topic of great interest to teachers, students and practitioners. Because of the continued strong interest in supply chain management, looking at companies that are very successful with their supply chain initiatives may hold many worthwhile lessons for use in the classroom and in research. Research has assisted our efforts tremendously by evaluating and publishing the Top 25 Supply Chains for the past seven years. This list recognizes those companies that have achieved a high level of success in their supply chain performance. Gartner also provides some fundamental performance metrics and descriptions of company performance along with the Top 25 list.

Lee offers the following list of characteristics or "six rules of thumb" for designing agility into the supply chain:

- "Provide data on changes in supply and demand to partners continuously so they can respond quickly. ... Ensuring that there are no information delays is the first step in creating an agile supply chain.
- Develop collaborative relationships with suppliers and customers so that companies work together to design or redesign processes, components, and products as well as to prepare backup plans.
- Design products so that they share common parts and processes initially and differ substantially only by the end of the production process. I call this strategy "postponement." ... This is often the best way to respond quickly to demand fluctuations because it allows firms to finish products only when they have accurate information on consumer preferences.
- Keep a small inventory of inexpensive, non-bulky components that are often the cause of bottlenecks.
- Build a dependable logistics system that can enable your company to regroup quickly in response to unexpected needs. (this can be accomplished through an alliance with a third-party logistics provider).
- Put together a team that knows how to invoke backup plans" [11].

Many of these elements have been utilized successfully by such companies as Hewlett Packard [4][12][13][14][15] and Dell Computer [16]. Both of these companies also appear in the Gartner/AMR Research Top 25 list on a consistent basis [5][6][7].

#### **Demand Driven**

Gartner/AMR Research has publicized the term "demand-driven supply network" in the course of their published research about the leading supply chains known as the Top 25 Supply Chains [3]. The term "demand-driven supply network" is a prominent factor within the discussion of the Top 25 Supply Chains in the annual publications that accompany the release of the list [1].

A demand-driven supply network (DDSN) "is a system of technologies and business processes that sense and respond to real-time demand across a network of customers, suppliers and employees" [3]. "DDSN leaders are 'demand sensing,' have more efforts for 'demand shaping,' and focus on a profitable 'demand response' [3].

Gartner/AMR is the leading promoter of the "demand driven" concept. According to Gartner/AMR: "The report identifies the top 25 manufacturers and retailers that exhibit superior supply chain capabilities and performance. Supply chain leaders are able to shape demand, instantly respond to market changes, and crush their competitors. According to AMR Research benchmarking data, leaders carry 15% less inventory, are 60% faster-to-market, and complete 17% more perfect orders. These advantages separate predators from prey" [1].

The criteria for selection to the Top 25 list are as follows: "The first component of the ranking is publicly available financial data and is weighted at 60% of the total score, with return on assets and inventory turns each accounting for 25%, and trailing 12 months growth accounting for 10%. The second component of the ranking is AMR Research's opinion, which is weighted at 40% of the total score. The opinion component is based on a structured voting methodology across AMR Research's team of analysts" [1].

Over the years the selection criteria for the Top 25 has been modified. The most recent criteria are: 25 percent for Peer Opinion, 25 percent for Gartner Opinion, 25 percent for 3-Year Weighted Return-on-Assets, 15 percent for Inventory Turns and 10 percent for 3-Year Weighted Revenue Growth. Each evaluation category is then combined into a final Composite Score [5].

Companies in the Gartner Top 25 for three recent years are listed in Table 1:

**Table 1. Top 25 Supply Chains from Gartner** 

Rank	2011 Companies	2010 Companies	2009 Companies
1	Apple	Apple	Apple
2	Dell	Procter & Gamble	Dell
3	Procter & Gamble	Cisco Systems	Procter & Gamble
4	Research in Motion	Wal-Mart Stores	IBM
5	Amazon.com	Dell	Cisco Systems
6	Cisco Systems	PepsiCo	Nokia
7	Wal-Mart Stores	Samsung Electronics	Wal-Mart Stores
8	McDonald's	IBM	Samsung Electronics
9	PepsiCo	Research in Motion	PepsiCo
10	Samsung Electronics	Amazon.com	Toyota Motor
11	The Coca-Cola Company	McDonald's	Schlumberger
12	Microsoft	Microsoft	Johnson & Johnson
13	Colgate-Palmolive	The Coca-Cola Company	The Coca-Cola Company
14	IBM	Johnson & Johnson	Nike
15	Unilever	Hewlett-Packard	Tesco
16	Intel	Nike	Walt Disney
17	Hewlett-Packard	Colgate-Palmolive	Hewlett-Packard
18	Nestle	Intel	Texas Instruments
19	Inditex	Nokia	Lockheed Martin
20	Nike	Tesco	Colgate-Palmolive
21	Johnson & Johnson	Unilever	Best Buy
22	Starbucks	Lockheed Martin	Unilever
23	Tesco	Inditex	Publix Super Markets
24	3M	Best Buy	Sony Ericsson
25	Kraft Foods	Schlumberger	Intel

Source: [5][6][7]

# **Teaching Demand-Driven Concepts**

The Gartner/AMR Top 25 Supply Chains provides a widely recognized list of outstanding performers who leverage their supply chains to full advantage. These companies are excellent examples to use in classroom discussion or to assign for student research projects. The author has used the Top 25 list in several ways for student assignments for the past six years at two different universities. The following section offers a few examples of class assignments related to the Top 25.

#### **Example Class Assignments**

There are many ways to utilize the Top 25 Supply Chains and many of the examples have been classroom tested by the author. In this section we describe several examples of class assignments that have been utilized with the undergraduate supply chain class.

## Assignment Example #1

Compare ONE company from the Gartner Top 25 Supply Chains with ONE company that is not in the Gartner Top 25 (or even the Top 100). Discuss strengths or special characteristics; discuss the differences between the two companies; provide some recent performance numbers to compare the two companies (do more than just one quarter). The Research Paper should be 5 to 8 pages in length. Follow the APA format guidelines. List your References and cite your References appropriately in your paper.

STUDENTS - DO NOT use the following companies: Wal-Mart, Dell, UPS and FedEx

#### Assignment Example #2

This assignment was used for Term Papers during Spring 2007, Spring 2008, Fall 2008, Spring 2009, Fall 2009, Fall 2010, Spring 2011, Fall 2011 and Spring 2012. The following list was provided as suggestions for students to consider:

- What can we learn from AMR's Top 25 Supply Chains?
- How do suppliers contribute to the Top 25 Supply Chains? (give specific examples)
- Supply Chain Integration and the Top 25 Supply Chains
- In depth analysis of 2 or 3 companies listed in the Top 25 Supply Chains
- Detailed description of the Demand Driven Supply Network (DDSN)

You can find some of the basic information by doing a Google search for "Gartner Top 25 Supply Chains" or "AMR Top 25 Supply Chains".

These example assignments are suggested uses for the Top 25 Supply Chains. We would not recommend utilizing all approaches in a single class. These assignments have been used in classes with excellent results.

#### **Some Classroom Results**

Overall, the use of the Top 25 has been a great addition to the Supply Chain and Production and Operations Management (POM) classes. The students are able to research widely known companies such as Proctor and Gamble, Toyota, Nokia, Apple and Coca-Cola.

These assignments have been used for a Supply Chain Logistics course in a Distribution and Logistics undergraduate program and the assignments have also been adapted for the POM course in the College of Business. Some of the statistics for the most recent semesters are shown in Table 2 on the following page.

Some version from the five example assignments have been used for the most recent academic years from 2009 through 2012. A majority of the students have continued to elect the Top 25 Supply Chain companies as part of their assignment during those years.

The most popular topics for the few students who did not select a Top 25 topic included: Green Supply Chain, Reverse Logistics, and Supply Chain Relationships. These topics were among the options available in specific classes or they were approved by the instructor.

**Table 2. Student Frequency for Top 25 Assignments** 

Semester	Number Electing Top 25 Topic	Total Students in Course Section
Spring 2007	30	36
Spring 2008	25	35
Fall 2008	36	40
Fall 2010	12	22
Spring 2011	14	24
Spring 2012	15	21

Other highlights of these assignments are as follows:

- Questions from students about the best way to find more information about the Top 25 Supply Chain companies
- More discussion/questions from students about specific companies
- In depth research is required
- Higher interest level for this assignment compared to the typical textbook assignment

In general, these can be summarized as the students are more engaged in the topics related to this assignment.

One caveat should be mentioned. Dell and Wal-Mart have received more publicity in general and have a huge amount of published information available. If an instructor chooses to adopt one of these assignments, he/she may want to exclude Dell and/or Wal-Mart. This will force students to conduct research on the companies that have not received a tremendous amount of attention already. Federal Express and UPS are also prohibited for other assignment options.

## What We Can Learn

Students, teachers and practitioners can learn many lessons from the Top 25 Supply Chain companies. Examples of 'best practices' and 'lessons learned' are the topics of interest for practitioners and they are also the topics that students will likely report as a result of their research. Dell and Wal-Mart are the most prominent examples that are widely recognized and widely used in textbooks, case studies and other publications to demonstrate specific leading supply chain concepts. There are many reasons for this as they are usually the ones to demand and execute new and innovative approaches in supply chain management. The following examples will demonstrate the potential lessons to be learned from companies in the Top 25 supply chains.

<u>Nokia</u> – Nokia was #1 for 2007 and #2 for 2008. The company excels at speed-to-market for new product introductions. To deliver their new products they utilize rapid-response manufacturing and quick ship logistics. Nokia has instituted many "agile" capabilities in their supply chain [11]. In each instance, information technology plays a key role. "As a pioneer in value chain strategy, Nokia has led in supplier development, S&OP, and collaborative product development" [19].

<u>Cisco Systems</u> – Cisco's efforts are viewed as an outstanding example of "business transformation ... using Internet technology to integrate its core processes and culture." These

are some of the results that indicate Cisco's leadership in supply chain management and their ability to leverage the Internet:

- "90 percent of orders [are] taken online.
- Monthly online sales exceed \$1 billion.
- 82 percent of support calls [are] now resolved over the Internet.
- Customer satisfaction has increased significantly" [17].

Information sharing and the associated information systems appear to be a key element for this achievement and recognition. From this we can learn how a company has been able to utilize the Internet in a very successful manner and we can point to Cisco as a benchmark for other companies to emulate.

Another indicator of the focus on improvement of supply chain performance is the fact that "an average of four new names [appear] each year" in the Top 25 Supply Chain list [5]. Other companies like Colgate-Palmolive show steady improvement as they climb to higher rankings within the Top 25. Colgate-Palmolive reached the No. 13 position for 2011 after showing steady improvement from past years after ranking No. 17 in 2010 and No. 20 in 2009 [5]. Unilever is another example which appeared in the Top 25 "for the first time in 2009 and saw the biggest jump among our group this year, rising six spots to No. 15" [5]. The newcomers to the list each year are likely to be companies who have made significant supply chain improvements in the very recent timeframe.

#### **Research Opportunities**

There is very limited research that has utilized the Gartner/AMR Research Top 25 Supply Chains. Most of the information has been published in trade journals or the popular press. The "Demand Driven" strategy has not been thoroughly researched and is limited primarily to the publications from Gartner/AMR Research. Companies utilizing the Demand Driven approach need to be explored in greater depth to create a better understanding of the successful approaches. More in-depth empirical research about performance for the Top 25 Supply Chains would also be a fruitful research avenue.

One opportunity that presents itself is to use the Top 25 Supply Chains as a sample of companies to investigate empirical evidence to verify the relationship between supply chain performance and organizational performance. Hendricks and Singhal [8] [9] provide empirical evidence about the negative impact on shareholder value when supply chain glitches occur. The implication from their research is that successful supply chain management does contribute to favorable financial results and increases shareholder value. The work by Hendricks and Singhal [8][9] serves as a starting point for potential research topics utilizing the Top 25.

Based on these limited examples we suggest that there is a definite shortage of research that relates financial results to supply chain performance explicitly. There is a major gap in the research which needs to be addressed by looking at the positive impact of supply chain management on organizational financial performance. Comparing Top 25 companies with "not Top 25" companies could be a first step to address this gap.

#### Summary

Research for this paper seems to indicate that Demand-Driven needs to be explored further to see how it differs from both Lean and Agile. When we add the Gartner viewpoint, Demand Driven does appear to become more distinct due to the intense information technology applications that are utilized by many of the companies with successful DDSNs.

Utilizing the Gartner Top 25 Supply Chains for class assignments allows students and faculty to explore DDSN in more detail. This also provides an opportunity to learn more about different supply chain initiatives being employed by the companies on the Top 25 list. More

research to better understand the superior supply chain performance of these companies has the potential to be a major contribution to the body of knowledge in the supply chain research stream.

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# MODELING THE EFFECTIVENESS OF SELECTED TUBERCULOSIS INTERVENTIONS IN RESOURCE-CONSTRAINED COUNTRIES USING CFD

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#### INTRODUCTION

Tuberculosis (TB) is an airborne bacterial disease that primarily affects the lungs. TB germs are passed through the air when someone who is sick with TB disease coughs, speaks, laughs, sings, or sneezes [1]. People in close proximity to the infected person can breathe TB germs into their lungs and become infected as well. This is especially likely in confined spaces, including waiting rooms of healthcare facilities. Hospitals and clinics are also of great concern because they are likely to contain individuals especially susceptible to infection due to other underlying conditions. Significant progress has been made toward the elimination of TB in the United States, but it continues to be a grave concern in resource-constrained countries. In 2010, 8.8 million people around the world became sick with TB and there were approximately 1.5 million TB-related deaths. 82% of these infections occur in 22 countries [2]. Of growing concern globally is the increasing resistance to first and second line drugs, known as multi-drug resistant (MDR) and extensively drug resistant (XDR) TB.

This research is the first use of computational fluid dynamics (CFD) with practical application for clinic design in resource-constrained countries. The World Health Organization has best practices for clinic design [3] - including high air circulation rates and the use of isolation rooms - that are followed when feasible. But without resources to fully adhere to those recommendations decision makers for clinics in places such as Africa are often at a loss for which design and administrative decisions to make to reduce disease transmission in their clinic. We are working closely with the Centers for Disease Control (CDC) to ensure that the assumptions used in the research are practical and the results are transferrable.

#### LITERATURE REVIEW

There are many papers, primarily in the medical literature, studying the nosocomial (hospital or clinic-based) spread of infectious disease. One of the most widely used infection models for TB is the Wells-Riley model [4,5], which has been applied to numerous studies that look at TB transmission risk, including Escombe et al. [6], Cooper-Arnold et al. [7] and modified versions of the model in Gammaitoni and Nucci [8] and Beggs et al. [9]. Griffin et al. [10] use stochastic modeling in combination with the Wells-Riley model to study the probability of infection in a resource-constrained clinic waiting area, based on two specific infection control issues. All of the papers rely on the limiting assumption that air is instantaneously and completely mixed in the room once the infected person coughs. Noakes and Sleigh

[11] have shown significant differences in even aggregate results when considering zonal air mixing, rather than the complete air-mixing assumption of the Wells-Riley model. It is for this reason that we are exploring the use of CFD, in combination with stochastic modeling, to relax that assumption.

CFD is a flow modeling technique that solves Navier-Stokes equations to determine the motion of fluid substances. In CFD analysis, equations for the conservation of mass, energy, and momentum are solved simultaneously. These equations form a set of coupled, non-linear partial differential equations. Analytical solutions for these fluid flow models do not exist for most engineering problems. However it is possible to obtain approximate computer based solutions for the governing equations. There are several CFD packages available that could be used to solve this problem numerically. ANSYS Fluent is used in this study. After a numerical solution has been obtained, the results are post-processed for infection concentration visualization. The dispersion of TB droplets submerged in air is modeled using convection mass transfer.

CFD is useful for this problem because it allows tracking of the infectious droplets throughout the room. We are able to precisely estimate risk of disease transmission for patients located at various positions in the room, based on several characteristics of the room and infectious patient. This allows us to consider administrative controls, such as locating potential infectious TB patients in different areas of the room, using screens to block air flow, and segregating high-risk populations.

There is a significant amount of literature related to modeling the spread of infectious droplets similar to TB using CFD. However, the majority of the work comes from enclosed room ventilation researchers and studies particle concentration or movement as a result of very specific room set-ups. Balloco and Lio, Chen et al., and Mazumdar et al. have modeled particle transport and distribution in ventilated rooms and have used CFD to simulate the airflow and predict the particle concentration [12-14]. Our work takes this a step further with an objective of modeling the expected number of new infections based on more general instances of people in a clinic waiting area. Niu and Gao [15] also use infection probability (i.e. Wells-Riley model). However, they focus on changes in infection risk between floors of a building based on natural ventilation. The most similar analytical work is from Qian et al. [16] who also consider a stochastic version of the Wells-Riley model, but applied to SARS.

#### **METHODS**

For this study, we model a medium-resource, high-volume outpatient clinic waiting area in Africa, based on input from a researcher at the Centers for Disease Control. All modeling was done using Computer Aided Design (CAD) software called Solid Works and run in ANSYS Fluent version 13. The data used in the CAD and CFD models are listed in table 1.

Table 1: Data used in CFD model

Room Features		
	Room dimensions	30m X 18m X 4m
	Inlet Vent Radius	0.25 m
	Number of inlet vents	15
	Outlet vent dimension	3m X 0.25m
	Number of outlet vents	6
Flow		
Characteristics		
	Cough material	Liquid water droplets
	Relative velocity of cough	10 m/s
	Particle size	0.31 microns [SOURCE]
	Flow rate	1 kg/s
	Air changes per hour	6

It is imperative to validate CFD models with real data. For our model, we relied on the data from Murakami et al. [17], also used in Zhang and Chen [18]. Full details of our model validation can be found in Khalid and Scherrer [19].

To take the most advantage of relaxing the assumption of equal air mixing, this paper focuses on the impact of the location of the infectious source as well as on using room dividers (screens) to prevent the spread of TB. Based on an actual clinic in Africa, we model a single large (360 m²) waiting area with three seating areas with a total of 192 chairs. The room has mechanical ventilation at 6 air changes per hour (ACH). Air enters through 15 circular vents of 0.25m radius in the ceiling. Air is evenly distributed throughout the room and departs through 6 vents at floor level on the north and south walls of the room. (See figure 1.) We assume no other air enters or leaves the room. We also assume that there is exactly one infectious person in the waiting area and study the impact of placing two 6m long floor-to-ceiling screens in the room, separating the three blocks of chairs in the waiting area. We first model the infectious person located approximately in the middle of the room (patient 1) and then model the person seated toward the corner of the seating area (patient 2). The infected person is assumed to be sitting in the chair when the infectious particles are introduced in the room.

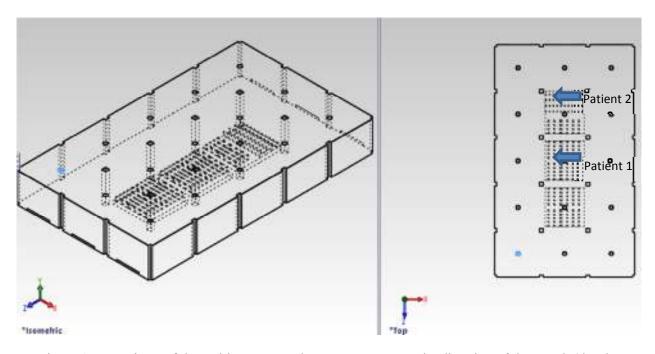


Figure 1: Two views of the waiting room. The arrows represent the direction of the cough (droplet introduction).

#### **RESULTS**

The output from fluent is very sophisticated and allows for multiple views of the room. For the purposes of this paper, we have presented the contour maps of TB particle concentration at both the seated height (assumed to be 1.5 meters) and standing height (assumed to be 2 meters). Figure 2 shows the results for the infectious patient in the center of the room. The top two contours are at seated height and the bottom two at standing height. The left two contour maps are without partition screens and the right two are with screens. The concentration scale is the same on all of the figures for ease of comparison. It can be seen that the addition of the screens reduces the area of high concentration, but also causes some eddies with infectious particles carried to the other side of the room around the screens. This could cause a higher risk of infection in a person sitting or standing close to the screen than the one farther away. The infected patient is located in the sitting plane. The concentration in the room is similar at the sitting and standing heights.

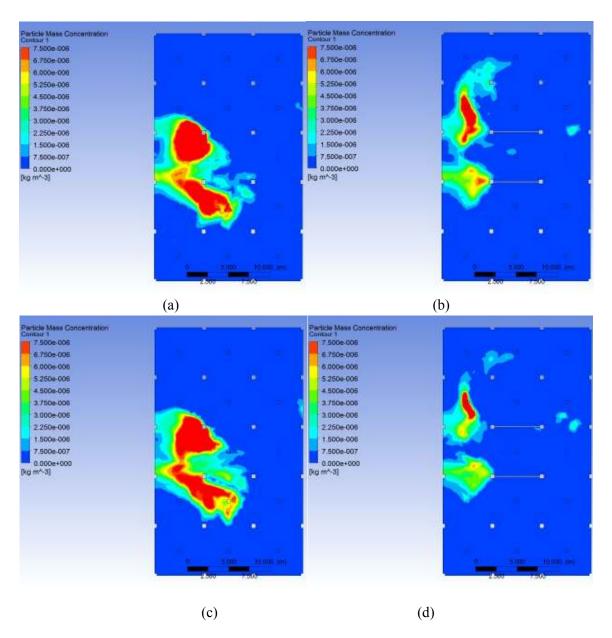


Figure 2: Top view of the concentration contours with the infected patient 1 near the center of the room (a) seated height (b) seated height, screens added to room (c) standing height (d) standing height, screens added to room

Similar set of contour maps are shown in Figure 3, but for the infectious patient located in the corner of the seating area. The same scale is used for comparison purposes. The proximity of the outlet vent pulls the TB particles out of the room in that direction effectively, reducing overall concentration of TB particles in the room compared with Figure 2.

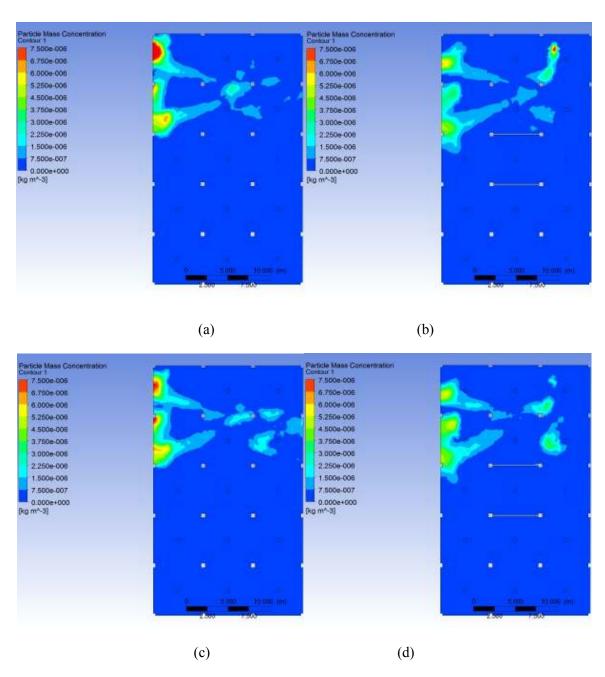


Figure 3: Top view of the concentration contours with the infected patient 2 near the top of the room (a) seated height (b) seated height, screens added to room (c) standing height (d) standing height, screens added to room

A 3-dimensional concentration map is shown in Figure 4. This is a 3-D depiction of steady state flow of circulating air through the room and a steady injection of infected particles by the patient. The steady induction of particles is analogous to an infected patient coughing at a constant rate, which is a typical

assumption in the literature. Projections of this concentration map at the sitting and standing level planes are shown in Figures 2 and 3.

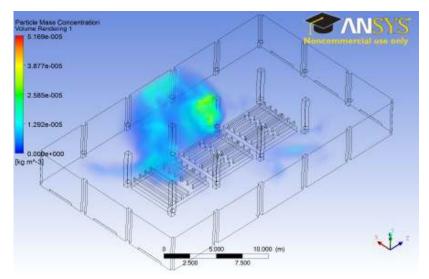


Figure 4: Isometric view of the concentration distribution of the patient sitting near the center of the room, room without screens

In addition to the visual representation of the concentration, it can be output numerically at all of the grid points in the mesh. We use this to populate an Excel-based model of the room for further analysis. First, we subdivide the room into 0.5 meter by 0.5 meter blocks to represent possible locations for susceptible patients to stand or sit in the room. (See Figure 5.) Note that this is an approximation of the more accurate CAD rendering (Figure 1). Each of the chairs in the room is represented by a block (squares), shaded regions represent places that patients cannot be (because they are between chairs, they are nurses' stations or equipment is located there in the actual clinic in Africa), and we assume that standing patients in the open spaces will be located in one of the 0.5X0.5m blocks. The location of infectious patient 1 is represented by the chair with the red horizontal lines and patient 2 by the chair with green vertical lines.

The concentration measurements from Fluent at seated height and standing height is exported to Excel. Because Fluent uses a mesh grid, these thousands of points from the grid are scattered throughout the room. A Visual Basic script was written to select sample concentrations for each of the 0.5m x 0.5m Excel boxes. Using a variant of the Wells-Riley model, the relative risk is estimated for a susceptible patient located at each of the locations in the Excel grid. If it is a chair location, the risk is selected at seated height and if it is an open location, at standing height. Red locations are the highest risk, yellow are moderate risk, and blue are low risk. The process is repeated for each of the four cases outlined above, using the same risk scale for all four cases. Results are shown in Figure 5.

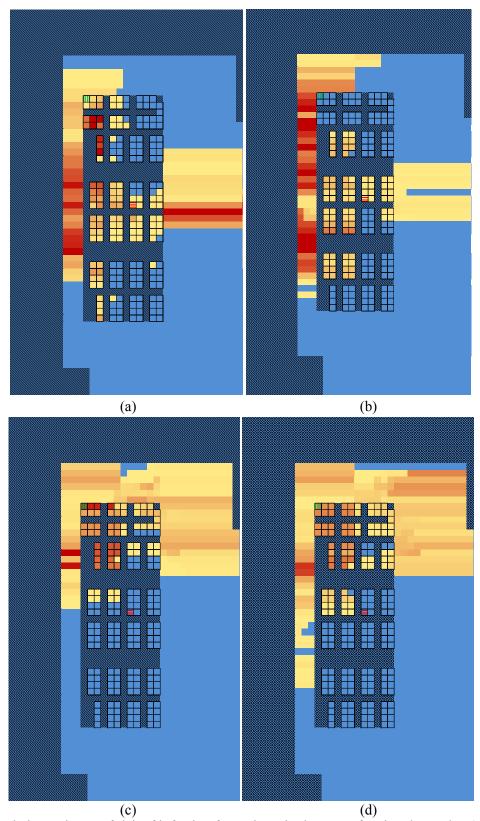


Figure 5: Relative estimate of risk of infection for patients in the case of patient located at (a) center of room, (b) center of room with screens, (c) top of room, (d) top of room with screens

These results give some insight into the spread of disease in a medium sized clinic. Due to the air flow in the large space, and vent location, locations of high risk are not necessarily where one might assume. Areas of high risk are found a significant distance from the infectious patient. The direction of the infectious patient's cough has a huge impact on the risk. Also, as seen in the concentration contours, the screens cause the concentration of particles to behave differently. In the case of the patient located in the center of the room (a and b), the partitions move the high risk area from the seats to the open area. With the infectious patient in the corner (c and d) the risk is also moved away from the seated area. Careful placement of screens, taking into account vent locations, could be an effective strategy to reduce risk in patient areas.

It is notable that in all cases, large areas of the room have very little risk of infection. This is in sharp contrast to the equal mixing of air assumption typically used in the literature, and gives motivation for further study in this area.

#### **CONCLUSIONS AND FUTURE WORK**

The research presented here is just the beginning of many opportunities to use operations research paired with CFD for clinic design as well as administrative decisions within existing clinics. Currently we are working on ways to accurately pair the Wells-Riley disease model with the output from the CFD model to obtain a realistic measurement of risk. Rather than using concentration of infectious particles, such as the output of CFD, the Wells-Riley model requires an estimate of the number of "quanta" emitted by the infectious patient, which is the number of infectious droplet nuclei required to infect (1 - 1/e) susceptible people [4]. In the literature, these are estimated based on actual cases of disease, but under the exact assumption of equal mixing of air that we are relaxing in our work. Pairing the widely accepted Wells-Riley model with our model should lead to broader support in the medical community.

We next would like to expand the interventions that we are studying, including different configurations and sizes of screens, the impact of vent and window locations, changes in ventilation rate, use of ultraviolet radiation, and patient masks. Also important will be including the cost-effectiveness aspect. Clinics in resource-constrained countries are in need of better understanding of which combinations of interventions will give them the most return on their investment. We would also like to look at expanding the model to include different types of layouts, multiple rooms and multiple infectious persons in the room.

# **ACKNOWLEDGEMENTS**

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#### AMBULANCE REDEPLOYMENT: FACT OR FICTION

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#### **ABSTRACT**

Demand for ambulances is known to fluctuate spatially and temporally by day of the week, and time of day. Faced with fluctuating demand during the day, EMS managers have the option of redeploying their fleet to compensate for such varying demand. We conducted a small survey, with a random sample of counties from North and South Carolina, in order to explore the impact of fleet redeployment on day-to-day operations. Survey results suggest that EMS managers are aware of the benefits and drawbacks of redeployments. Such shifting of personnel, while better able to cover a region with fluctuating demand, can cause fatigue and loss of morale amongst ambulance crewmembers.

Keywords: Location problems; Emergency Response Systems; Ambulance Deployment.

#### INTRODUCTION AND MOTIVATION

Historically, ambulances have been located at fire stations, hospitals, and/or ambulance-specific stations [1]. As communities realize population growth, demand for ambulance services has grown in parallel [2], typically requiring the establishment of additional bases. In an effort to assist/inform the making of strategic-level ambulance location (base) decisions, researchers developed a variety of static ambulance location models [3]. Since demand for ambulances fluctuates spatially and temporally by both day-of-the-week, and time-of-the-day, the building of permanent (fixed) bases to cover such varying forms of demand is indeed costly and may, in fact, be ineffective.

Recent advances in computing, geographic information systems (GIS), and commercially available software tools (e.g., MARVLIS [4]), as well as the availability of geographic positioning system (GPS) signals, have enabled emergency medical systems (EMS) managers to implement redeployment plans [5, 6]. Redeployment is defined as moving ambulances from one part of a city to another when faced with a fluctuating demand scenario. There are generally two types of redeployment plans: (1) Multi-period and (2) real-time. The former are created *a priori* and utilize call volume forecasts for various sectors of a city, and for a few hour-blocks, in order to redeploy a fleet in anticipation of demand shifts in space and magnitude. Under a real-time redeployment plan, when one or more vehicles are dispatched, the remaining available ambulances are relocated to ensure that the region is covered to the greatest extent possible. Although this strategy is expected to improve coverage statistics there is some evidence that it can have counterproductive effects also. Therefore, we conducted a small survey, based on a random sample of counties from North and South Carolina, in order to explore the impact of fleet redeployment on day-to-day operations. Survey results suggest that EMS

managers are aware of the benefits and drawbacks of redeployments. Such shifting of personnel, while better able to cover a region with fluctuating demand, can cause fatigue and loss of morale amongst ambulance crewmembers.

The remainder of this paper is organized as follows. In the next section, we review the relevant literature and show some gaps in the literature. In the following section we present and discuss the results of our survey and conclusions and directions for future research are discussed in the last section.

# BACKGROUND AND LITERATURE REVIEW

The literature on location models in general and ambulance location problems in particular, is rich and diverse. In this regard, we refer the reader to ReVelle et al. [7] for a comprehensive review of location modeling, and to Brotcorne et al.'s [3] review of recent developments in ambulance location problems. The readers can trace earlier developments in Shilling et al. [8] and Owen and Daskin [9].

# **Recent Developments in Coverage Models**

The first wave of published location models were deterministic in nature [10, 11], and, thus, did not account for the probability that a particular ambulance might be busy at a given time. This uncertainty of availability was subsequently addressed by probabilistic location models. Early such models [12, 13] used simplifying assumptions, e.g., all vehicles have the same busy probability while operating independently. In general, these earlier assumptions were not reflective of "real world" conditions where servers cooperate through centralized dispatching, and have varying busy probabilities. Batta et al. [14] and Rajagopalan [15] showed that using such assumptions in location models may lead to an overestimation of coverage, and an underestimation of the number of servers required.

More recently, in an effort to increase the realism of prescriptive models by reducing/eliminating simplifying assumptions, researchers have begun utilizing the descriptive hypercube model. Larson's hypercube model [16, 17] represents an important milestone in that it introduces a *spatially distributed queuing framework* for facility location problems [9]. This structure, and its various extensions, has been found particularly useful in determining performance of EMS systems [1, 14, 16, 18-23]. Erkut et al. [24] challenged the typical use of coverage metrics in both deterministic and probabilistic models. In doing so, they proposed a novel approach to incorporating survival functions by developing a maximal expected survival location model and extending it to include probabilistic response times. Rajagopalan and Saydam [25] subsequently developed the *minimum* expected response location model. This work was motivated by the fact that shorter response distances (equivalently, times) increase the likelihood of saving additional lives. Their model is based on Hakimi's *p*-median [26], and ReVelle and Hogan's α-reliable *p*-center, problem [27].

Common to these models is the assumption of a long-term perspective. Further, hourly and daily fluctuations in demand are generally not considered; instead, peak demand periods are used as an estimate of overall demand. Coverage, rather than number of redeployments, is considered the critical issue.

# **Redeployment Models**

As shown by Channouf et al. [28] and Setzler et al. [29], EMS demand is not static, but, rather, fluctuates throughout the week; day of the week; and hour by hour within a given day. When decision models assume a longer-term perspective, hourly and daily fluctuations in demand are generally overlooked and, as noted above, select peak demand periods are used as an estimate for overall demand.

Redeployment models, on the other hand, consider operational -level decisions that managers make on a daily, or hour-by-hour, basis, in an attempt to relocate ambulances in response to demand fluctuations over both time and space. The few redeployment models currently found in the literature are of two forms: (1) Real time, where ambulance redeployment is considered with every call, and (2) multi-period, where an ambulance redeployment plan considers an entire day or week based on demand forecasts.

# **Real Time Redeployment Models**

Real time redeployment models typically relocate ambulances every time one is dispatched, or becomes available for dispatch, with the goal of providing maximum coverage at all times. One of the earliest examples of real time redeployment is that presented by Gendreau et al. [5]. The objective of their dynamic double standard formulation at time t (DDSM<sup>t</sup>) is to maximize backup coverage while minimizing relocation costs. In order to solve the resulting, rather complex model, particularly for short time intervals, the authors developed a fast tabu search meta-heuristic implemented on eight parallel Sun Ultra workstations. To test the quality of solutions found by the tabu search, they solved 33 random problems with a commercially available integer linear programming solver, CPLEX [30], and showed that the worst case departure from optimality was merely 2%. Using real data from the Island of Montreal, their tests indicated that the algorithm was able to generate new redeployment strategies for 95% of all cases.

More recently, Schmid and Doerner [31] extended Gendreau et al.'s [32] double standard model (DSM) from a single to a multi-period model. They also explicitly accounted for time-dependent variations in speed, and resulting changes to coverage. Further, vehicles may be relocated with such changes considered in the objective function. Note that neither model accounts for the probability that an ambulance will be unavailable.

One drawback with real-time redeployment algorithms is the need to compute a new solution whenever a vehicle is dispatched to a call. This can be time consuming, or even

infeasible, when calls arrive in quick succession throughout the day [33]. By design, these models are not useful for scheduling, or day-to-day operational plans. Regarding the latter, EMS managers must know (be able to accurately predict) the number of ambulances, and their locations (posts) during different time intervals. This can be accomplished by multi-period redeployment models.

# **Multi-period Redeployment Models**

The earliest multi-period redeployment model was developed by Repede and Bernado [34] who extended Daskin's maximum expected coverage location model (MEXCLP) [12] to multiple time intervals. In doing so, the authors sought to capture the temporal variations in demand; hence, they termed their model TIMEXCLP. This model was incorporated into a decision support system (DSS) developed for EMS in Louisville, Kentucky. A recent and important strategic redeployment model is the dynamic available coverage location model (DACL) of Rajagopalan et al. [6]. This structure seeks to minimize fleet size while meeting specified coverage requirements. Its approach incorporates the uncertainty of vehicle availability using Marianov and ReVelle's available coverage concept [35]. Unlike the previous models discussed here, DACL specifically uses the Jarvis hypercube approximation [25] to calculate vehicle-specific busy probabilities, thus removing the simplifying assumptions made in earlier models. DACL is solved using tabu search and the solution validated via simulation. Importantly, the model allows for relocations but does not account for relocations in the objective. A comparison of redeployment models are show in Table 1.

In an effort to investigate the prevalence and importance of redeployment practices, we conducted a survey of executive leaders of EMS agencies in North and South Carolina. Results of the survey are presented in the next section.

Model	Туре	Objective	Coverage Constraint	Server Availability
Gendreau et. al [5]	Real Time	Maximize the total demand covered at least twice within a radius $(r_I)$ minus the a penalty term to reflect the change from the current state of the system	All demand is covered within radius $(r_2)$ and proportion of all demand covered within $(r_l)$	Assumed to be always available. Deterministic
Schmid and Doerner [39]	Real Time	Maximize the total demand covered at least twice within a radius	All demand is covered within radius $(r_2)$ and proportion of all demand covered within $(r_1)$	Assumed to be always available. Deterministic
Repede and Bernado [40]	Multi Period	Maximize the total demand covered over multiple time intervals	A proportion of demand is covered	All servers are assumed to be busy with the same probability and they are assumed to operate independently
Rajagopalan et. al [6]	Multi Period	Minimize the number of servers over multiple time intervals	A proportion of demand is covered	Each individual server busy probability calculated and server co-operations taken into consideration

Table 1: Comparison of Redeployment Models

# SURVEY OF REDEPLOYMENT PRACTICES IN NORTH AND SOUTH **CAROLINA**

In order to better understand current EMS operations, and ascertain whether the negative employee impact reported in the initial interview is widespread or unique to the one situation, a questionnaire was developed. The instrument utilized a Likert scale to measure attitude concerning redeployment. Respondents were requested to indicate degree of agreement/disagreement with the following statements:

- Multiple redeployments lower ambulance crew morale.
- Multiple redeployments increase crew's dissatisfaction with job.
- Multiple redeployments increase crew's fatigue.
- Multiple redeployments improve coverage of area.
- Multiple redeployments shorten response time.
- Multiple redeployments help to balance workloads.

Additional questions collected data on whether or not the agency redeployed the benefits and limitations of redeployment, and on descriptors of the territory. The latter included square miles, county, and fleet size.

An on-line survey methodology for collecting the data was judged to be an effective means of collecting the data. Schaefer and Dillman (1998) [38], for example, concluded that e-mail surveys provide more detailed and comprehensive information than do mail surveys. In addition, respondents are more likely to complete and return an e-mail survey.

The sample frame was defined as those experienced in making the redeployment decisions and managing the ambulance crews. Obtaining a list of all EMS executive leaders' email addresses for the two states under study insured that the sample frame could produce data from a planned and known sample of individuals. Clearly, the targeted email messages offered control over those who responded to the survey. All noted EMS leaders (N = 140) received an email with an appeal to participate in an on-line survey. Given the limited time and scope of the survey, we decided to constrain the sample frame to 140 possible respondents in the North and South Carolina region. In order to encourage the sampled leaders to respond, the email stressed both the importance of the information requested, and the ease of responding. A copy of the results was also offered subsequent to project completion. The realized response rate was 18.57% (n = 26). The average response rate for email surveys is 20.7% with a standard deviation of 40.5% [39]. A response rate of 18.57% is thus well within the expected response rate for email surveys.

The small sample size precludes a meaningful statistical analysis of the survey. However, given the survey's principal purpose, which was to determine whether counties other than Charlotte-Mecklenburg practiced redeployment, as well as the perceived or

documented advantages and disadvantages of redeployment, we believe frequency counts are sufficient.

# **Survey Results**

We now briefly describe those results of the survey that pertain to the current paper. Ten of the 26 respondents do not use redeployment. The reasons given for keeping ambulances at fixed stations, or their post, were either related to coverage or perception that redeployment negatively impacts upon staff. In the words of one of the respondents: "Street corner deployment is a morale breaker for employees and affects recruitment/retention." Since each of the remaining 16 of 26 respondents represents a different county in North and South Carolina, we are able to conclude that these 16 counties do, indeed, practice redeployment. Figure 1 shows the perceptions EMS managers have regarding the advantages and disadvantages of redeployment.

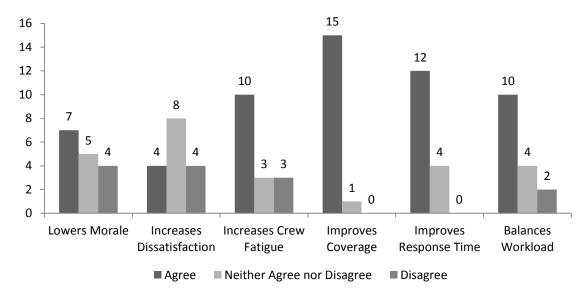


Figure 1: Responses regarding on the impact of redeployment

From these results, we found strong agreement of the positive impact resulting from redeployment (improving coverage, response time and balancing workloads). With respect to its negative aspects, there is some disagreement on whether redeployment increases dissatisfaction and reduces morale of the crew. However, the majority of respondents agree that it does indeed increase crew fatigue. Fatigue-related problems cost America an estimated \$18 billion a year in terms of lost productivity [40], while fatigue-related drowsiness on the highways contributes to more than 1500 fatalities, 100,000 accidents, , and 76,000 injuries annually [40]. If we can reduce the number of redeployments without sacrificing coverage, we would be able, at least to some extent, address the problem of ambulance crew fatigue.

#### SUMMARY AND CONCLUSIONS

"Cities and counties that locate their ambulances in street corners and parking lots and redeploy them when the demand changes achieve greater coverage but at a certain cost" [41]. In this paper, we have studied the phenomenon of ambulance redeployment, including a brief survey that sought to understand the perceived advantages and disadvantages of such redeployment. There was broad general agreement on the potential advantages (improved coverage, improved response time, balanced workload); but, at the same time, a significant concern about fatigue within the ambulance crew due to the frequency of redeployments. We believe it is important that future location models take into account this aspect of redeployment when locating their ambulances. Presently, we are conducting experiments with a prototype Dynamic Redeployment Coverage Location (DRCL) model which addresses this issue by jointly minimizing both the number of servers and redeployments while maintaining adequate coverage.

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# BALANCING INVESTMENT IN FEDERALLY OUALIFIED HEALTH CENTERS AND MEDICAID FOR IMPROVED ACCESS AND COVERAGE

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# **ABSTRACT**

Two important measures of disparity in health care services are lack of access to care and lack of insurance coverage. The objective of this study is to find a balanced investment between CHC expansion and relaxing Medicaid eligibility to improve both access (by increasing the number of CHCs) and coverage (by CHC and Medicaid expansion). The comparison is achieved by integrating mathematical models with several data sets that allow for specific estimations of healthcare need. In this paper we compare the two programs using the state of Pennsylvania as a test case. Our results have implications for policymakers on how increasing access or increasing coverage affect primary care, and our estimates of healthcare need can also be used for other resource allocation problems.

#### **INTRODUCTION**

Providing comprehensive healthcare services to all the members in a community is important for the achievement of health equity and for increasing community members' quality of life. However, there are many disparities that exist in health care services that affect not only individuals but also the entire community. Two important measures of disparity are a lack of access to care and a lack of insurance coverage.

It is well known that having a source of primary care has many health benefits [1] including improvements in health status [2,3], fewer hospitalizations [4], additional physician visits [5], more control over treatable diseases [6,7], and fewer preventable hospitalizations [8,9]. Many people do not have a main source of primary care, however, which may be due to a lack of insurance, the fact that not all doctors take Medicaid patients, or because of a limited supply of primary care physicians where they live. According to "Kaiser Health Facts", the percentage of population in primary care shortage areas is 11.8% in the US [10]. One of the specific goals of the Healthy People 2020 initiative is to "Increase the proportion of persons who have a specific source of ongoing care" [11].

The number of people without health insurance across the nation is rising. Census data show that 50.7 million Americans were uninsured in 2009, an increase of 4.4 million from the number of uninsured in 2008 (16.7% of the US population [10]). This lack of adequate coverage makes it difficult for people to obtain the health care they need and, when they do get care, typically leads to a financial burden on the individual.

Current policy efforts focus on the provision of access to health care and insurance coverage. This includes expanding federally qualified health centers (CHCs) and relaxing eligibility requirements for Medicaid. Healthcare reform will provide \$11 billion to expand CHCs over the next 5 years (2011-2015), and beginning in 2014, Medicaid rules will be modified so that more people will be eligible [12].

The CHC Initiative is one program designed to improve access to primary care, particularly for needy populations. These centers provide primary and preventive healthcare, outreach, dental care, some mental health and substance abuse treatments, and prenatal care, especially for people living in rural and urban medically underserved communities. Over 90% of CHC patients live with incomes below 200% of the federal poverty limits, and over 40% of CHC patients are uninsured. Expanding CHCs could increase access to primary care for those who currently do not have it. In addition, it could increase the availability of free or lower cost services for those who remain uninsured, increasing not only access to primary care but also coverage of insurance. Another alternative for provision of coverage is expanding Medicaid eligibility. Medicaid is a state-administered health insurance program for low-income people, families and children, the elderly and people with disabilities. While it has no effect on increasing access, it would increase the number of people who have health insurance coverage.

The objective of this study is to find a balanced investment between CHC expansion and relaxing Medicaid eligibility to improve both access (by increasing the number of CHCs) and coverage (by CHC and Medicaid expansion). The comparison is achieved by integrating mathematical models with several data sets that allow for specific estimations of healthcare need. There are several tradeoffs. For example, Medicaid has to be offered to all people meeting the income eligibility limits, regardless of their explicit need and may not be sufficient to increase access. On the other hand, CHCs require a fixed cost to build and operate, and may also serve persons living in the area who are not among the neediest.

In this paper we compare the two programs using the state of Pennsylvania as a test case. Our results have implications for policymakers on how increasing access or increasing coverage affect primary care, and our estimates of healthcare need can also be used for other resource allocation problems.

#### LITERATURE REVIEW

By many measures, CHCs are improving the healthcare of the community. Research has found that they reduced hospitalizations, reduced mortality, reduced usage of emergency rooms, and increased visits to physicians [5, 13, 14]. It has also been found that their quality of service is comparable to other types of primary care [15], and may be cost-effective for Medicaid patients as compared to some other sources of care [14, 16]. While 75% of uninsured persons in the United States report that they have a source of primary care, approximately 99% of CHC users do [17]. In addition, with the implementation of health care reform, the importance of the CHC will be growing [18].

To maximize the improvement from CHCs, Griffin, Scherrer, and Swann [19] developed an optimization model to determine the CHC locations, the services to offer at each, and the capacity level of the services and facilities. This mathematical method can determine the best resource allocation over a network when the demand for a service differs by location. The model incorporates the fixed cost of opening an organization, the variable operating cost according to the level of capacity chosen, and the demand for services from the surrounding area. The objective of the optimization model is to maximize the number of patients served by CHCs. Since this objective is to increase the number of patients with a primary source of care regardless of their current status, some people may be offered a source of care where they did not have one previously, while others may not be part of a medically underserved population and switch from

hospital care to a primary care physician at the CHC. The solution, therefore, may not be good at improving health care disparities for needy populations. In order to consider medical need, we estimate the local demand according to current access and insurance status, and define special target groups. In addition, we develop a multi-objective approach to maximize health care access, coverage, and CHC utilization in order to help reduce the aforementioned disparities.

There are a few studies that explicitly consider how delivering care through CHCs compares to other alternatives. Okada, et al. [5] tried to determine the effect of CHCs and Medicaid service on health care through surveys, and Cunningham, et al. [20] used data from the Community Tracking Study and CHC reports to compare the impact of expanding CHCs to increased insurance coverage. Shi and Stevens [21] also compared the primary care experiences of CHC uninsured and Medicaid insured. Using three aspects of primary care experience: access, longitudinality, and comprehensiveness, they found that CHCs could fill an important gap in primary care for Medicaid and uninsured patients. They also report that Medicaid insurance remains fundamental to accessing high quality primary care, even within CHCs.

However, these comparisons of delivery alternatives do not take into account the specific location of CHCs to improve a particular measure based on geographical and demographic differences in communities. We develop an integrated model to examine the impact of both increasing the current government budget for CHCs in Pennsylvania and expanding Medicaid through relaxing the income eligibility limits. We consider the geographical and demographic differences in our model and find a balanced investment between these two policies.

# MULTI OBJECTIVE MODEL for CHC LOCATIONS

The objective of previous work is finding optimal CHC locations to maximize total number of people who can be served throughout CHCs. However, we can reduce health status disparities such as lack of access and coverage more effectively if we categorize the population according to current access and coverage status and give them different priorities. Table 1 shows the six population groups according to their current access status (served and underserved) and coverage status (private, public, and no insurance).

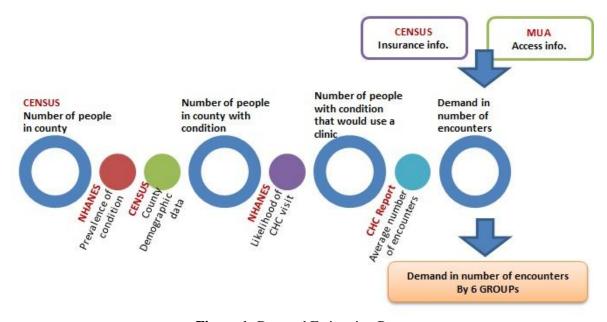
**Table1:** Population group by access and coverage

Coverage Access	No Insurance	Public Insurance	Private Insurance	
Underserved	1	2	3	
Served	4	(5)	6	

We introduce a multi-objective model to decide the optimal CHC locations considering target groups with different priorities. Demand is estimated based on current access and coverage status in order to target groups to be considered preferentially.

# **Demand Estimation**

The possible demand of each facility differs according to the level of need in the community, which may depend on demographics or other characteristics. While national data is publicly available for the prevalence of health conditions (e.g., National Health and Nutrition Survey (NHANES) [22], there is little data available for smaller regions such as counties or voting districts for several types of conditions. In their previous work, Griffin, Scherrer, and Swann [19] therefore derive local (county level) estimates using a two-stage approach combining data from the NHANES and from the U.S. Census [23]. Figure 1 shows the demand estimation process used. We modify their procedure by applying insurance and access information from CENSUS and MUA (Medically Underserved Area) data [24] in order to divide demand into the 6 different population groups mentioned previously. Insurance information can be found in both NHANES and the CENSUS. Logistic regression was used to estimate the prevalence of a condition. The independent variables were age, gender, race, and insurance status.



**Figure 1:** Demand Estimation Process

To estimate access at the county level, we use the data from U.S. Health Resources and Services Administration (HRSA) [24]. They provide Health Professional Shortage Area (HPSA) designation by region. If a county has some HPSA area, population group, or facility, the ratio of the aggregated designation HPSA population to the total population will be assumed as the fraction of the population who do not have access. If a county does not have any HPSA area, the fraction of the population for the county who do not have access is assumed to be zero.

## **Location and Service Selection Model**

Before the impact of investment in CHC expansion can be compared to the alternative of relaxing Medicaid eligibility, we must first determine the best way to invest in CHCs. In this section we present a multi-objective model to determine the location of CHCs and which services should be offered for a particular budget.

The following are the indices and parameters used in the model.

Indices

*i* : CHC location

z: Population location

*j* : Service type (General, OBGyn, Dental, Mental)

k : Capacity (small, medium, large)

*l*: Distance level (0, ~10mile, ~20mile, ~30mile)

 $g_1$ : Insurance group (Private, Government, None)

 $g_2$ : Access (access, no access)

#### Parameters

FL: fixed cost per location

 $FS_k$ : fixed cost per capacity level

 $VS_i$ : variable cost per service

 $RB_{q1}$ : Reimbursement rate

 $CAP_{jk}$ : Number of patients of service type j that can be served at level k

 $P_l$ : maximum percentage of z's population that can be served at distance level l

 $n_{zjg_1g_2}$ : demand for service j in county z of insurance and access group

 $m_{izjg_1g_2}$ : maximum demand of county z can be served CHC located county i

 $I_{izl}$  1 if distance level between i and z is greater than l, 0 otherwise.

We categorize demand by insurance and access group, which makes it possible to give different priorities for the groups. We set the first priority to maximize insurance coverage (eq1), which is the sum of encounters of the uninsured population ( $g_1 = 3$ ). The second priority is to maximize access (eq2), which is from the underserved population ( $g_2 = 2$ ). Finally, we maximize utilization of CHCs by providing the most weighted services (eq3). Note that this last priority is the same objective used in [19].

# Objective:

$$1^{st}$$
 objective (Max Coverage): max  $\sum_{\substack{izjg_2 \ g_1=3}} w_j \ y_{izjg_1g_2}$  (Eq.1)

$$2^{nd}$$
 objective (Max Access): max  $\sum_{\substack{izjg_2 \ g_2=2}} w_j y_{izjg_1g_2}$  (Eq.2)

$$3^{rd}$$
 objective (Max Utilization): max  $\sum_{izjg_1g_2} w_j y_{izjg_1g_2}$  (Eq.3)

To define decision variable  $y_{izjg_1g_2}$ , we assume that the proportion of CHC encounters in each group will follow the same rate of estimated demand at the population location. This variable is defined by the ratio of each group in the estimated demand  $(n_{zjg_1g_2})$  at the location to the total number of encounters  $(y_{izj})$ .

$$y_{izjg_1g_2} = y_{izj} \times \frac{n_{zjg_1g_2}}{\sum_{g_1g_2} n_{zjg_1g_2}}$$
 for i, z, j, g<sub>1</sub>, g<sub>2</sub> (Eq.4)

The remaining constraints follow the work of Griffin et al. [19]. Constraint (5) is the budget constraint and (6) enforces patients can only be served if there is capacity available for them at that service level. Constraint (7) states that there can only be as many locations offering service type j as there are open locations, and, combined with constraint (8), implicitly requires that patients of type j can be served at facility i only if that center is open and offering service j. Constraint (8) only allows the proportion of patients that are eligible based on the distance calculation to be served. Constraint (9) enforces the maximum total percentage of location i's population served by locations more than each distance level away.

$$\sum_{i} FL c_{i} + \sum_{ijk} FS_{k} s_{ijk} + \sum_{izjg_{1}g_{2}} VS_{j} RB_{g1} y_{izjg_{1}g_{2}} \leq B$$
 (Eq.5)

$$\sum_{z} y_{izj} \le \sum_{k} CAP_{jk} s_{ijk} \quad for i, j$$

$$\sum_{k} s_{ijk} \le c_{i} \quad for i, j$$
(Eq.6)
(Eq.7)

$$\sum_{k} s_{ijk} \leq c_i \qquad for i, j$$
 (Eq.7)

$$\sum_{i} I_{izl} y_{izj} \le P_{l} \sum_{g_{1},g_{2}} n_{zjg_{1}g_{2}} \qquad \text{for } l, z, j$$

$$y_{izj} \le \sum_{g_{1},g_{2}} m_{izjg_{1}g_{2}} \qquad \text{for } i, z, j$$
(Eq. 9)

$$y_{izj} \le \sum_{g_1,g_2} m_{izjg_1g_2} \qquad for i, z,j$$
 (Eq.9)

#### Results

We solved the model at the county level using data for the state of Pennsylvania. Pennsylvania has 67 counties, and the full data for the model including variable and fixed costs, prevalence estimates, and demand estimates are available from the authors upon request. To see the effect of our multi objective model, we also ran the single objective model (Eq. 3 only) for comparison. The model was solved using SAS/OR. Processing time was approximately 5 minutes for the single objective problem and more than 15 minutes for the multi objective problem.

**Table 2:** Satisfied demand from optimal solutions (budget \$50M)

		Single Objective	Multi Objective
Total		27.2%	24.8%
Access Group	Served	28.7%	21.7%
	Underserved	6.9%	67.1%
Insurance Group	Private Insurance	29.7%	21.4%
	Public Insurance		29.7%
	No Insurance	20.7%	31.1%

Table 2 shows the percent of total demand which can be served by CHCs with a \$50 Million budget across the six different populations. Although the single objective does somewhat better at providing more services overall, the multi-objective model does a much more effective job at satisfying demand from the targeted groups. A map showing the resulting CHC locations for both models is show in Figure 2.

#### **BALANCED INVESTMENT in CHCs and MEDICAID**

While CHCs play a vital role in improving public health, Medicaid also remains an important component in reaching those without current access to healthcare. For this reason we built a model to compare the effect of investment in CHC expansion and Medicaid eligibility, considering the appropriate related tradeoffs.

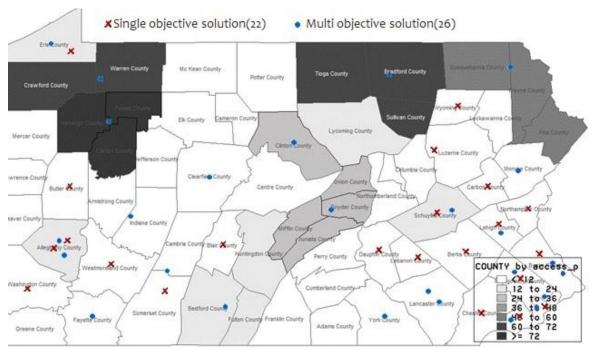


Figure 2: CHC optimal locations comparing current access status

#### Model

For the multi-objective model, since expanding Medicaid is only related to insurance coverage, the first objective is modified to the following:

1<sup>st</sup> objective (Max Coverage): max 
$$x + \alpha f\left\{\sum_{\substack{izjg_2 \\ g_1=3}} w_j y_{izjg_1g_2}\right\}$$
 (Eq.10)

where x is a new decision variable for the number of new Medicaid enrollments and f(y) is a transformation function which converts the number of encounters to the number of people who can be covered by a CHC to make it comparable with the number of Medicaid enrollments. We use weight  $\alpha$  to compare coverage between Medicaid and CHCs, compensating for the quality of coverage from those two policies not being equal. For example,  $\alpha = 0.5$  implies that CHC coverage for one person has 50% of the value to overall public health coverage objectives as Medicaid coverage for one person would (perhaps due to the additional services available through Medicaid insurance that are not available at a CHC). This weighting factor can be adjusted by policy makers. The Medicaid component is added to the budget constraint (11) where M is average annual cost for a new enrollment of Medicaid (\$3500 for the state of Pennsylvania). Demand constraint (12) is added with the upper limit for new enrollment of Medicaid constrained by  $d_i$ , the total uninsured population.

$$\sum_{i} \operatorname{FL} c_{i} + \sum_{ijk} FS_{k} s_{ijk} + \sum_{izjg_{1}g_{2}} \operatorname{VS}_{j} RB_{g1} y_{izjg_{1}g_{2}} + Mx \leq B$$
 (Eq.11) 
$$x \leq \sum_{i} d_{i}$$
 (Eq.12)

According to (12),  $x/\sum_i d_i$  fraction of the uninsured population gain government insurance. Therefore we assume that demand from the uninsured group will decrease by the same ratio, and the same amount will move to the demand of the government-insured group. The calculation for the amount of demand moved  $(A_{zjg_2})$  is as follows:

$$A_{zjg_2} = n_{zj(g_1=3)g_2} \times \frac{x}{\sum_i d_i} \qquad for z, j, g_2$$
 (Eq.13)

Since the demand for the non-insured population will move to the public insurance population, y for the public insurance group will be increased by  $A_{zjg_2}$  while the portion of the no insurance group will be decreased by  $A_{zia_2}$ . Therefore the definition of y will be adjusted as follows.

$$(g_1 = 1):$$
  $y_{izjg_1g_2} = y_{izj} \times \frac{n_{zjg_1g_2}}{\sum_{a_i, a_i} n_{zjg_1g_2}}$  for  $i, z, j, g_2$  (Eq.14)

$$(g_1 = 2):$$
  $y_{izjg_1g_2} = y_{izj} \times \frac{n_{zjg_1g_2} + A_{zjg_2}}{\sum_{g_1g_2} n_{zjg_1g_2}}$  for i, z, j,  $g_2$  (Eq.15)

$$(g_{1} = 1): y_{izjg_{1}g_{2}} = y_{izj} \times \frac{n_{zjg_{1}g_{2}}}{\sum_{g_{1}g_{2}} n_{zjg_{1}g_{2}}} for i, z, j, g_{2} (Eq. 14)$$

$$(g_{1} = 2): y_{izjg_{1}g_{2}} = y_{izj} \times \frac{n_{zjg_{1}g_{2}} + A_{zjg_{2}}}{\sum_{g_{1}g_{2}} n_{zjg_{1}g_{2}}} for i, z, j, g_{2} (Eq. 15)$$

$$(g_{1} = 3): y_{izjg_{1}g_{2}} = y_{izj} \times \frac{n_{zjg_{1}g_{2}} - A_{zjg_{2}}}{\sum_{g_{1}g_{2}} n_{zjg_{1}g_{2}}} for i, z, j, g_{2} (Eq. 16)$$

Since x and y are both decision variables, these equations are nonlinear, and the model turns into MINLP. To make the problem tractable, we divide the problem into eleven different problem sets, linearizing the last constraints and studying the resulting shape.

#### **Results**

Table 3 shows the results from an example where the total budget for CHC and Medicaid is set at \$100M. Eleven levels of investment for Medicaid ranging from 0% to 100% of the total budget are used. We first determine the number of possible Medicaid enrollments (x) from the amount of Medicaid investment, then make different demand sets considering the demand change (13) from these Medicaid enrollments, and finally apply the remaining budget to CHC expansion. For example, the 5<sup>th</sup> problem set in Table 3 represents that \$40M will be invested in Medicaid, which means we can support 11,429 new Medicaid enrollments (at the previously mentioned average cost in PA of \$3500 per new enrollment). This number is approximately 1% of the uninsured population of Pennsylvania, so all the demand for the uninsured group will be decreased by approximately 1% and the same amount will be added the government insurance group. We can then solve the problem from Section 3 of this paper using these adjusted demand sets and a \$60M CHC budget.

To see how much the coverage and access improves in each problem, we pick the number of people who gain primary care service from the optimal solution as an indicator. For the coverage improvement, we count both the new Medicaid enrollments and number of people who gain primary care service through CHCs among the uninsured group (g1=3) from the optimal solution, and compare it with the total uninsured population in the state of Pennsylvania. For the access improvement, we count the number of people who gain primary care service among the underserved group (g2=2) and also compare it with the total underserved population.

**Table 3:** Balanced coverage example with \$100M budget

	Cost		Coverage		Access			
	Total Cost \$100M			Uninsured: #991,388 9.8% of total pop.			No Access : #811,459 6.5% of total pop.	
	%of	CHC	Medicaid	New	Coverage	Coverage	Access	Access
	Medicaid	Cost	Cost	Medicaid	by CHC	Imprvmt.	by CHC	Imprvmt.
		(\$M)	(\$M)	Enrollment				
				$x_i$				
1	0	100	0	0	67047.29	6.76%	89248.45	8.89%
2	0.1	90	10	2857	61754.23	6.52%	87907.82	8.75%
3	0.2	80	20	5714	56224.14	6.25%	87363.56	8.70%
4	0.3	70	30	8571	50377.49	5.95%	86307.92	8.59%
5	0.4	60	40	11429	44131	5.60%	83395.54	8.30%
6	0.5	50	50	14286	37640.85	5.24%	79986.34	7.96%
7	0.6	40	60	17143	30796.14	4.84%	75998.85	7.57%
8	0.7	30	70	20000	23733.26	4.41%	67967.3	6.77%
9	0.8	20	80	22857	15858.68	3.91%	57961.87	5.77%
10	0.9	10	90	25714	8140.98	3.41%	41816.31	4.16%
11	1	0	100	28571	0	2.88%	0	0.00%

Figure 3 shows the results from three different total budgets (\$100M, \$200M, and \$300M). For the smallest increase of budget (\$100M), investing the entire budget in CHC is the best solution. However, in the results from larger budgets, the peak on the coverage improvement curve is a balanced investment between the two. This peak is at 30% Medicaid investment for the \$200M problem and 50% for the \$300M problem. This is likely in part because the cost effectiveness of CHCs expanding becomes lower as more clinics are added, making it more cost-effective to reach the additional people with individual insurance.

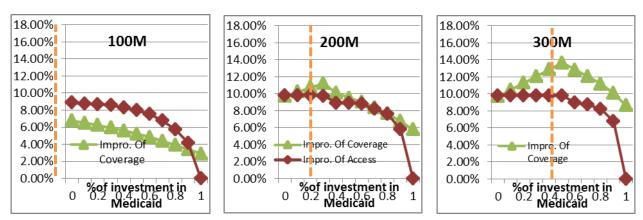


Figure 3: Balanced investment in CHCs and Medicaid for total budgets of \$100M, \$200M, and \$300M.

#### CONCLUSION

Both Medicaid and CHC expansion can improve health outcomes for populations that are either uninsured or without any source of primary care. With limited budgets for expanding these programs, it is important to know the optimal mix of expansion. Therefore in this work we suggest a multi criteria optimization model for a balanced investment in CHCs and Medicaid expansion. In our test case, CHCs are the more cost effective alternative for increasing both access and coverage for smaller budgets (\$100M), but Medicaid becomes a beneficial alternative for larger budgets. We plan to expand this work substantially, and include sensitivity analysis.

This model also has the advantage of being able to find the optimal CHC locations specifically to improve access and coverage. A benefit of the optimization model used in this work is that it considers the entire CHC organizational network in its solutions - geographical information, local estimates of need, and also current health care access and coverage status.

There are several limitations to this study. First, we assume there is enough physician capacity. In reality, either Medicaid or CHC expansion would require additional medical personnel capacity. For CHCs, the issue is recruiting physicians to work, some in rural settings. For Medicaid, the issue is physician participation in the Medicaid program - whether they are willing to accept new Medicaid patients and, if so, how many. In addition, we do not explicitly model other safety net providers such as hospital sponsored outpatient clinics, rather assuming that the services they provide would be independent of CHC or Medicaid expansion.

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# STUDENT PERCEPTIONS OF OVERWEIGHT MANAGERS

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#### **ABSTRACT**

Obesity is a current and growing concern in America and has been the subject of much research. Some examination is in the area of anti-fat bias or in the perceptions of people classified as fat. Much of the work on this topic is contained in the social psychology literature, while only some research has examined obesity in organizations. Previous research has used several terms to describe overweight people, but study looks at the semantic differences in personality characterizations which might occur while describing a manager as oversight, obese or fat. The identification of these characterizations is the first step in ways to combat these stereotypes in the workplace.

#### LITERATURE REVIEW

Karris (1977), in a study of renters, found evidence to support the idea that the anti-obese bias was as real as racism. Those who were obese were treated differently than other people. In addition, Hiller (1981) found that overweight persons were subject to negative personality characterizations. Her experimental study found perceptions that overweight people were more likely to be thought of as sad or have other negative semantic differences in comparison to others. Schwartz et al. (2006) found that this bias was related to one's own body image. Wang et al. (2004) discovered support for the perceptions that fat people were lazy but interestingly found that fat people did not show in-group preference as other "out-groups" do.

A 1979 study found that fat people should not even apply for some jobs as those hiring stereotyped jobs as to whether fat people would be appropriate for them (Larkin & Pines 1979). A 2006 study found similar results in that some "out of sight" jobs were perceived to be more suitable for fat people (Venturi, Castelli & Temelli 2006). In addition, the results of an experimental interview simulation found evidence of bias (Pignatori 1994).

This preliminary literature review seems to indicate that bias toward overweight persons exists. The purpose of this study is to find if this bias only exists in a visual form or is it also carried out by verbal means? Also, is there a difference in characterization, which is related to a semantic difference in words used to describe fat or overweight individuals?

# **SAMPLE**

The data was collected in 2010 from a sample of students attending introductory management classes at a major university in the southeastern United States. The students in these classes were in both business and non-business majors. The instrument included the Schein 92 item descriptive index as well as demographic data such as sex, age, college major, class, and self- identified body type. Of the surveys distributed, there were 278 usable responses, which was sufficient for analysis. TABLE ONE displays the data summary.

TABLE ONE SAMPLE DATA

	Number	Percentage
MALE	155	56
BUSINESS MAJOR	179	64
SOPHOMORE	86	31
JUNIOR	154	56
SENIOR	34	12
SLIM	118	45
MEDIUM	136	49
LARGE	19	6
AVERAGE AGE	20.5	

# **METHOD**

This study used the 92-item Descriptive Index originated by Schein (1973, 1975). This instrument has been used with success with many previous studies (c.f. Brenner, Tomkiewicz & Schein, 1989; Heilman, Block, Martell, & Simon, 1989; Dodge, Gilroy, & Fenzel, 1995; Tomkiewicz & Brenner, 1996; Tomkiewicz, & Bello, 1997; Tomkiewicz, Brenner & Adeyemi-Bello, 1998, and Tomkiewicz, 1999) to define male, female, African-American, white, and Hispanic race stereotypes and the characteristics of managers and successful middle managers. Four forms of this index were used. Wherein Schein originally had respondents describe women in general, men in general and middle managers, respondents in this study were asked to describe male managers in general; male overweight managers; male obese managers and male fat managers. Males were selected as research seems to indicate males and female managers and overweight individuals are viewed differently. Also definitions of overweight and obese were provided to the students.

The instructions on the four forms of the descriptive index were as follows:

On the following pages you will find a series of descriptive terms commonly used to characterize people in general. Some of these terms are positive in connotation, others are negative, and some are neither very positive nor very negative.

We would like you to use this list to tell us what you think male managers in general are like, or male overweight managers or male obese managers or male fat managers. In making

your judgments, it may be helpful to imagine that you are about to meet a person for the first time and the only thing you know in advance is that the person is a male manager (overweight male manager or obese male manager or fat male manager). Please rate each word or phrase in terms of how characteristic it is of male managers in general or overweight male managers or obese male managers or fat male managers.

The ratings of the descriptive terms were made on a 5-point scale, ranging from 1 (not characteristic) to 5 (characteristic) with a neutral rating of 3 (neither characteristic nor uncharacteristic).

Each respondent will receive only one form of survey.

The full Schein instrument is contained in APPENDIX ONE. Demographic data was collected from the respondents as the literature indicates these data are important in influencing attitudes. Traditionally, the Schein is analyzed by the use of intra-class coefficients and analysis of variance. These techniques indicate if there is resemblance between the various groups—compared one to another.

#### **ANALYSIS**

Intra-class correlation coefficients (r') from two randomized groups analyses of variance were computed to determine the degree of similarity between the groups. All combinations of male managers in general; fat male managers; obese male managers; and overweight male managers, for the total sample were compared (c.f. Hays, 1963: 424). Male and female respondents were also analyzed separately. The classes, or groups, were the 92 descriptive items for each of the four groups. The larger the value of r', the more similar observations in the same class tend to be. Thus, the smaller the within-item variability, relative to the between-item variability, the greater the similarity between the mean item ratings of either the descriptions of managers in general and obese male managers, and so forth.

For the entire sample there was not significant resemblance between male managers in general and fat male managers (r'=.17,  $p\le.052$ ), between male managers in general and obese male managers (r'=.054,  $p\le..318$ ) or between male managers and overweight male managers (r'=.013,  $p\le.547$ ). Thus there is no resemblance between the perceptions of male managers in general and any group with a weight descriptor—fat, overweight or obese.

The three groups with weight descriptions were then compared to each other. Fat male managers show resemblance to overweight male managers (r'=.372,  $p\le.001$ ); fat male managers show resemblance to obese managers (r'=.263,  $p\le.009$ ) and the perceptions of obese male managers resembles that of overweight male managers (r'=.82,  $p\le.000$ ). While the sample in general did not see a resemblance between male managers in general and any male manager with an excess weight description they did see similarity between all male managers described as being outside the weight norms.

The data was then examined by looking at the responses of males and females. Male respondents found a resemblance between male managers and obese male managers (r'=257,  $p\le006$ .) but found no resemblance between male managers and fat male managers (r'=.092.  $p\le..190$ ) or male managers and overweight male managers (r'=.134,  $p\le.099$ ).

Male respondents did not see similarity between fat male managers and obese male mangers (r'=.041,  $p\le.348$ ) or fat males and overweight male mangers (r'=.124,  $p\le.119$ ) but interestingly did find resemblance between obese male mangers and overweight male managers (r'=.610,  $p\le.000$ ).

The female respondents did not perceive resemblance between male mangers in general and any male manager with a descriptor indicating excess weight. Male managers in general compared to

fat male mangers (r'=.065 p $\leq$ .268); compared to obese male mangers (r'=.050 p $\leq$ .317) and overweight male mangers (r'=.-179 p $\leq$ .957). The female respondents did, however, see all three groups with excess weight descriptors as resembling each other; fat male mangers compared to obese male mangers (r'=.620, p $\leq$ .000); fat male mangers compared to overweight male mangers (r'=.754, p $\leq$ .000) and overweight managers compared to obese male mangers (r'=.695 p $\leq$ .000).

#### **DISCUSSION**

While the overall examination did not find a resemblance between male mangers in general and those described as having excess weight, the study did find similarity between all three groups that were outside the norm. The females in the sample perceived all groups in the same manner, while the males found a resemblance between male mangers in general and obese managers and only found overweight and fat male mangers to resemble each other.

It would appear that females react more strongly to any description of a manager with excess weight. Conventional wisdom would suggest that this perception is negative. Males on the other hand appear to make a distinction between obese as a descriptor and either fat or overweight. It can also be surmised that the descriptors fat and overweight are perceived negatively. Hence, the idea that how a manager is described is related to the perception of that manager further research is needed. The data will be analyzed to determine if, in fact, the perceptions of managers with descriptions outside the norm for weight are more negative than those for a male manager in general. Future research should apply this analysis to female managers and determine if they are perceived more negatively than male managers who are outside the weight norms.

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#### **APPENDIX ONE**

#### **INSTRUCTIONS - DESCRIPTIVE INDEX**

On the following pages you will find a series of descriptive terms commonly used to characterize people in general. Some of these terms are positive in connotation, others are negative, and some are neither very positive nor very negative.

We would like you to use this list to tell us what you think managers in general are like. In making your judgments, it may be helpful to imagine that you are about to meet a person for the first time and the only thing you know in advance is that the person is a male manager [or fat male manager or overweight male manager or obese male manager depending on the survey ]. Please rate each word or phrase in terms of how characteristic it is of managers in general.

The ratings are to be made according to the following scale:

- 5 Characteristic of managers in general
- 4 Somewhat characteristic of managers in general
- 3 Neither characteristic nor uncharacteristic of managers in general
- 2 Somewhat uncharacteristic of managers in general
- 1 Not characteristic of managers in general

Place the number (1, 2, 3, 4, or 5) which most closely represents your opinion on the line next to each adjective.

- 5 Characteristic
- 4 Somewhat characteristic
- 3 Neither characteristic nor uncharacteristic
- 2 Somewhat uncharacteristic
- 1 Not characteristic

Curious	Vigorous	
Consistent	Timid	
High need for power	Sophisticated	
Sympathetic	Talkative	
Fearful	Strong need for security	
Adventurous	Forceful	
Leadership ability	Analytical ability	
Values pleasant surroundings	Competitive	
Neat	Wavering in decision	
Uncertain	Cheerful	
Creative	High need for autonomy	
Desire to avoid controversy	Able to separate feelings from ideas	
Submissive	Competent	
Frank	Understanding	

Courteous	Vulgar	
Emotionally stable	Sociable	
Devious	Aggressive	
Interested in own appearance	High self-regard	
Independent	Grateful	
Desire for friendship	Easily influenced	
Frivolous	Exhibitionist	
Intelligent	Aware of others' feelings	
Persistent	Passive	
Objective	Decisive	
Speedy recovery from emotional	Not uncomfortable about being	
disturbance	aggressive	
Shy	Direct	
Firm	Hides emotion	
Prompt	Authoritative	
Intuitive	Self-confident	
Humanitarian values	Sentimental	
Knows the way of the world	Steady	
Dawdler and procrastinator	Assertive	
Quarrelsome	Feelings not easily hurt	
Industrious	Dominant	
Well informed	Tactful	
Nervous	Helpful	
Reserved	Strong need for achievement	
Ambitious	Deceitful	
Not conceited about appearance	Generous	
Strong need for social acceptance	Bitter	
Hasty	Logical	
Obedient	Skilled in business matters	
Desires responsibility	Selfish	
Self-controlled	Demure	
Modest	Kind	
Self-reliant	Strong need for monetary rewards	

# EXPLORING THE IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGY ON INDIVIDUALS PERCEPTIONS TOWARDS BANNED BOOKS

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#### **ABSTRACT**

For several years numerous books have been banned in communities across United States. However, the emergence of information and communication technologies (ICT) has not only enriched individual's knowledge but also has provided wider access to information. This study explores how ICT has changed human attitudes towards challenging books and previously banned books. The findings from this study can help us understand the impact of ICT on individuals' actions towards challenging books. From a broader perspective, it can enrich us on how the community at large is reacting towards the *banned books*.

#### INTRODUCTION

Throughout the history of the United States, libraries have been established to provide access to materials independent of content, but these actions have not been without controversies [5]. In many communities, individuals have challenged materials freely available through the library, resulting in a list of *banned books*, books which contain material objectionable to the individual or the society at large. Numerous books have been banned in communities across the United States since the early 1900's, but since 1990, the American Library Association Office of Intellectual Freedom has annually tracked the statistics of book challenges.

The emergence of information and communication technologies (ICT) has enriched the individual's access and exchange to information [1]. In today's digital environment, information about objectionable material can be easily located and retrieved on the internet [2]. ICT is more increasingly used by individuals for their information processing and communication purposes. New technological innovations such as social networking and Web 3.0 services have eliminated the barriers to free flow of information

[8]. People are becoming increasingly aware about what and why individual books have been challenged. More interestingly, the objections are becoming more specific and not generic anymore [5]. For instance, the challenges listed for the book The Chocolate War in year 1981 was "offensive language and explicit descriptions of sexual situations in the book" compared to year 2007 was "peppered with profanities, ranging from derogatory slang terms to sexual encounters and violence" [4 pages 174-176]. More interestingly, this book which was banned in the 1980's has become widely available in the library collections and is allowed for reading with parental permission [4]. This shows that the human attitudes towards challenged books have been changing along with the emergence of other contextual factors such as technology [12]. Thus it is imperative to understand how the advent of ICT has influenced the individuals' perception towards banned books. The main objective of this study is to explore the questions: How ICT influence individual reasoning toward challenged books? How ICT impacts the specificity of the book challenges? Doing so will help us understand individuals reasoning towards the banned books, in general it will depict if individuals have a greater opportunity to make themselves aware of the objectionable content prior to drawing personal conclusions. From a broader perspective, it can enrich us on how the community at large is reacting towards the banned books. From a librarian standpoint, we believe there will be a transition in their roles towards banned books, that is, they will no longer act as gateways to the information, but now act as educators on issues of book challenges.

#### **BACK GROUND LITERATURE**

### **Banned Books and Information and Communication Technology**

The issue of banned books has been escalating since early ages which began censoring materials based on religion, politics, or profit [5, 7]. Though more popular throughout history in authoritarian regimes, religious institutions, including the Roman Catholic Church, have participated in book banning, with the church confiscating books and persecuting individuals found to be in possession of banned materials [3]. Even though the United States does espouse democratic ideals, book banning has been enforced by law and government institutions. In particular, book banning has been enforced by the United States Postal Service through The Comstock Act of 1873, which outlawed the mailing of "obscene, lewd, and/or lascivious" materials [3]. The involvement of religious groups, law, and public agencies highlight the intensely social nature of book challenges. Nevertheless, libraries have traditionally provided access to materials, even those that may have been outlawed based on The Comstock Act [5]. Technology is increasingly changing how individuals interact with libraries, who now serve increasingly as a gateway to resources in digital formats through public internet access instead of the traditional role as a repository of books [6]. In particular, ICT has helped individuals overcome personal, economic and geographical barriers to access of information about books giving them opportunity to learn about the book [8]. This is evident in recent initiatives including Google Books, Project Gutenberg, HathiTrust Digital Library and International Children's Digital Library. In summary, individuals now have multiple venues providing access to books and other information.

More recent studies observe that digital technologies have changed the face of censorship and book banning [9]. Likewise, new digital inventions such as e-commerce, social networking have brought a big relief from the persistent impediments to free expression and greatly increased access to banned books [5, 8]. It has widely noted that ICT has facilitated access and exchange of information [6]. For instance, an individual can share his/her thought on sites such as Twitter, Facebook and get feedback from millions of users [10, 11]. Thus the individuals can now form their own opinions based on the free exchange of information rather than abiding by existing norms. Extending this rationale to banned books, we contend that individuals will have greater specificity when presenting reasons for book banning.

#### METHODOLOGY

To address the research objectives, statistics collected by the American Library Association will be used. Even though book banning has existed since the early 1900's, we have chosen to use data from 1990 through 2010, when the American Library Association began tracking statistics. Data on the total number of book challenges, reason for challenge by year, type of library in which the challenge occurred by year, book descriptions and the individual or group challenge initiator by year will be utilized to examine the impact of ICT on banned books. Due to confidentiality requirements, no personally identifiable information will be included in the statistical data provided by the American Library Association. The process for acquiring the data has been initiated, and the approval process is in progress. The data will be analyzed to determine overarching trends and patterns.

#### POTENTIAL IMPLICATIONS AND CONCLUSIONS

We expect to see a change in the overall trends of book banning, pre and post digital era, due to the influence of ICT on information access and exchange. In addition, the findings may depict the changes in overall reasoning behind book challenges. We hope that there will be variations in the number of books being challenged and the number of challenges for each book due to ICT. Finally, due to increased information access and exchange, the individuals may be more familiar with the content of challenged books, which could reflect in more informed judgments regarding book challenges. In conclusion, we hope ICT has widened the opportunity for access to banned books, which, in turn has enhanced individual intellectual freedom.

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# HOW DO MOBILE DEVICES INFLUENCE **WORK-LIFE BALANCE?**

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# **ABSTRACT**

Increased capabilities of mobile devices have influenced the ubiquity of computing resources so that individuals are always connected to both work and life. This study seeks to further previous qualitative research on the influence of mobile devices on work-life balance. Through an examination of prior literature on the concepts of interest we develop a model to distinguish the hypothesized relationships and a survey to test the accuracy of our model. We seek to explain how mobile devices influence the worklife balance of business professionals by exploring the relationships between mobile device usage, productivity, employer expectations, flexibility of work structure and work-life balance. This research contributes to academic knowledge while also helping to better understand a practical problem that currently challenges companies.

#### Keywords

Mobile device, work-life balance, productivity, flexibility, work structure, employer expectations

# INTRODUCTION

Increased ubiquity of computing resources generated by the adoption and usage of mobile devices has changed the ways individuals in organizations communicate and interact with one another (Mazmanian, Orlikowski, & Yates, 2004). These devices are viewed as an instrument to increase productivity by improving response time, preparedness, unobtrusiveness, and the conception of existing in an "always-on environment" (C. A. Middleton, 2007). Work-life balance theories examine boundaries that individuals form between work and life and how much "spillover" occurs (Hill, Hawkins, Ferris, & Weitzman, 2001). This research seeks to explain how mobile devices influence the work-life balance of business professionals. There have been various qualitative studies published recently that attempt to explore the impact of mobile devices on business professionals (Mazmanian, Orlikowski, & Yates, 2004; C. A. Middleton, 2007; C. a Middleton & Cukier, 2006; Prasopoulou, Pouloudi, & Panteli, 2006), but no explanatory work has been conducted to date that seeks to understand how this technology influences work-life balance. In order to develop a deeper understanding of the concepts that are included in this study, first it is necessary to examine previous research in the chosen areas. Then, we will discuss our research methodology followed by our model and research hypothesis and finally, the conclusions and implications section.

# LITERATURE REVIEW

Mazmanian, Orlikowski, and Yates (2004) conducted related research on mobile device usage focusing on one particular type of smartphone, Blackberries. In this qualitative study of Blackberry usage in a small financial services firm, the authors argue that mobile device usage leads to a "social dynamic that requires the reconfiguring of public (work) and private (home) boundaries (Mazmanian et al., 2004). This study confirmed individuals' reconfigurations of expectations and norms of work, shifting individual choices about control, interaction, and responsiveness. Their interviews of employees at this company revealed a creation of shared assumptions of constant availability and accountability and an increasing compulsiveness to respond. This study also suggests that mobile devices entail unanticipated consequences such as addiction, withdrawal, and dependence on the technology. Our study will seek to explain these findings with empirical evidence providing support. Work-life balance has been an important area of research in the human resources field for over twenty years. Relevant research on the effects of mobile devices suggests studies such as ours to further understanding of this phenomenon (Ayyagari et al., 2011; Mazmanian et al., 2004; C. A. Middleton, 2008).

#### **Productivity**

Concepts of interest in the domain consist of productivity, employer expectations, flexibility in work structure, and work-life balance. The main reason businesses choose to adopt Information Systems (IS) is to improve productivity (Brynjolfsson, 1993; Dong, Xu, & Zhu, 2009; Hitt & Brynjolfsson, 1996). The IS discipline itself hinges on the idea that the use of technology will expedite business processes and ultimately increase profits and/or lower costs. Only a small amount of qualitative research has been conducted that discusses the increase in productivity with the use of mobile devices in the work environment (Fui-Hoon, Siau, & Sheng, 2005). Contrarily, much of the focus of more recent research in this area has been on the negative impacts of mobile device usage (Mazmanian et al., 2004; C. a Middleton & Cukier, 2006; Turel & Serenko, 2010; Turel, Serenko, & Bontis, 2011; Wright Jr, Mooney, & Parham, 2011). Productivity is often defined as output over input but as a construct in academic research it has rarely been used as it is often very hard to define outside of situational environments. Productivity is extremely relevant in the Operations Management field and is often linked with the use of IT to increase efficiency thereby improving productivity. Unlike much of the mobile device research that has focused on the negative impacts we seek to better understand how this technology has influenced productivity and then what impact that has had on employer expectations and flexibility in work structure.

#### **Employer Expectations**

Another area of interest in the discussion of mobile device usage is employer expectations. The ubiquity of mobile devices allows working professionals to be constantly connected with their work environments. Much of the qualitative work conducted to date paints a negative impact on the use of mobile devices. "In general...people's expectation levels have gone up...People presume that it's fairly easy to reach you 24/7" (Mazmanian et al., 2004). We propose that with this increase in productivity due to mobile device usage there is a corresponding increase in employer expectations where employees are expected to conduct work related tasks during periods that were not possible before the adoption of mobile devices. With this technology employees are expected to answer emails and phone calls while away from work at an increasing rate. Mazmanian (2004) also gives an example of an employee being able to send and receive text messages and emails while attending an important meeting through the use of their mobile device. This allowed the employee to be more informed and able to respond without disrupting the flow of the meeting. We seek to better understand how mobile device usage and productivity influence employer expectations.

#### Flexibility in Work Structure

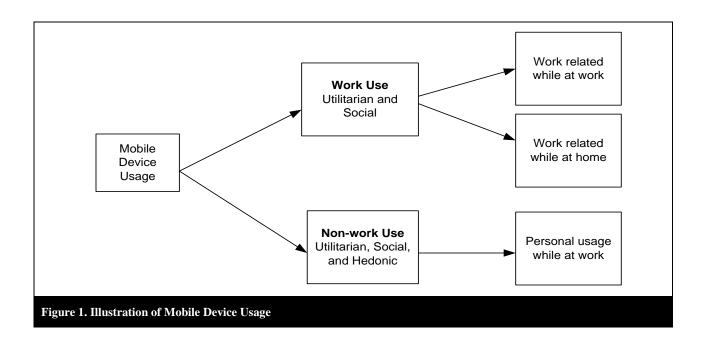
Hill, Hawkins, Ferris, and Weitzman (2001) found that perceived job flexibility enables more employees to have work-life balance. They also found that perceived job flexibility enables employees to work longer hours before impacting work-life balance (Hill, Hawkins, Ferris, & Weitzman, 2001). Flexibility in job structure allows employees more freedom to choose when, where, how, and with whom they wish to invest in work activities and we propose that flexibility should benefit the work-life balance of employees. We seek to understand the influence that mobile devices have on these concepts and correspondingly how changes in these concepts influence the work-life balance of individuals. Flexibility in work structure can take on many different forms. Some working professionals are required to spend more than forty hours a week in an office setting while sales persons and other professionals have a much less structured work environment. We propose that the ability of an employee to have some decision making in work structure would benefit their work-life balance as they would palpably choose a structure that has benefit to their work-life balance.

#### Work-Life Balance

The concept of work-life balance is one of the most researched areas in the field of human resources(Chang, McDonald, & Burton, 2010). Work-life balance refers to an individual's perception of harmony or equilibrium between work and life domains. Work-life balance can be operationalized as low conflict or high satisfaction in both work and life domains(Chang et al., 2010). Ayyagari, Grover, and Purvis (2011) recently conducted a study on a closely related phenomenon called technostress. In this study they suggest that technostress is influenced by increased use of mobile devices in which they treat technostress as a black box and suggest that the technology itself influences this phenomenon. We argue that the technology alone does not add to technostress(conflict in work-life balance), but rather changes in the constructs of our study(due to mobile device usage) create the conflict in work-life balance.

#### Mobile Device Usage

Previous IT usage research has characterized three main classifications that are distinguished by the way in which participation occurs and more specifically the purpose of IT use. The three classifications consist of utilitarian, hedonic, and social behaviors. For our purposes these constitute how individuals choose to use their mobile devices. Utilitarian usage is described as facilitating effective and efficient action(Wakefield & Whitten, 2006). Examples of utilitarian behaviors include activities such as using email, retrieving documents, searching for information, ecommerce related actions, financial transactions, etc. While much of previous research has focused on work related utilitarian use, there is also a function of utilitarian use that can be associated with using a mobile device for non-work related activities. This latter usage has been ignored by previous research but is important to include as we seek to fulfill our research question of how mobile devices influence work-life balance. Another usage classification that can be found in the literature is hedonic behaviors, which are defined as actions that generate pleasure from the consumption or use of a product(Schroeder, 2010). Some examples of hedonic behaviors include playing games, watching videos, or participating in other enjoyable entertainment related actions. The last classification of behavioral usage of IT is social behaviors, which are described as using IT to communicate which is influenced by social pressures(Orlikowski & Scott, 2008). Examples of this type of usage include text messaging, calling, or communicating with others through social networking sites or applications. While incorporating these three classifications that have been used in previous research we found it necessary to distinguish between usage for work and non-work activities (personal). Our novel categorization can be seen in figure 1 below. Usage for work purposes contains both utilitarian and social behaviors while non-work use contains all three classifications. This categorization helps us to differentiate usage and is helpful in determining influence on employer expectations and flexibility.



# RESEARCH METHODOLOGY

A quantitative methodology was used in order to add statistical support to previous research that suggests that mobile device usage influences work-life balance. A survey of individuals was created and administered to test the relationships between mobile device usage, productivity, employer expectations, flexibility of work structure and work-life balance. After developing an initial instrument a pretest was conducted to revise the survey instrument in ensuring that the items are easily understood (Straub, 1989). This pre-test was administered to 11 IS doctoral students who were advised to review each item carefully in order to validate the content and provide suggestions to improve the survey. Responses were used to revise the survey instrument and ensure the measures are reliable through this assessment of content validity. A pilot study was conducted using an MBA class of working professionals to review the items and ensure that there are no major issues in the development of the survey. The full study will involve large-scale data collection involving employees from a diverse number of companies and job responsibilities. Research on this phenomenon is severely lacking and the relevance of this topic will only increase as mobile devices evolve and become increasingly interconnected with our everyday lives.

# MODEL AND RESEARCH HYPOTHESIS

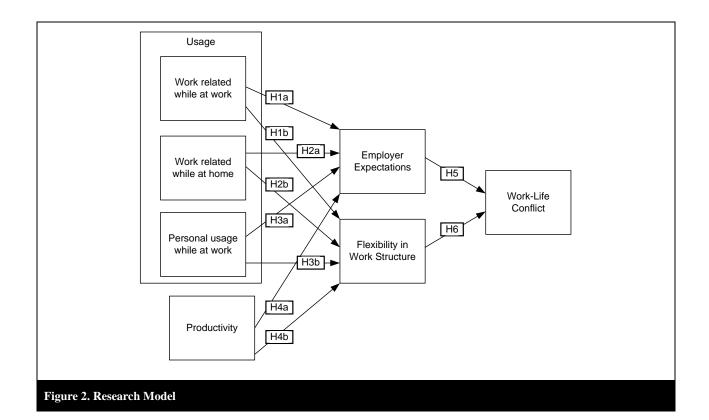
This paper seeks to explain how the phenomenon of mobile devices influences the work-life balance of business professionals. Our study is interested in the relationships between mobile device usage, productivity, employer expectations, flexibility of work structure and work-life balance. Figure 2 presents the research model including the theoretically derived hypotheses and clarifies the relationships between the constructs. In order to explain how mobile devices influence work-life balance we must study the relationships between these concepts.

#### Mobile Device Usage and Employer Expectations

In the previous qualitative studies by Mazmanian, Orlikowski, and Yates (2004) and Middleton (2008) one common theme that was presented was to understand why employees were increasingly using these devices when they were aware of the negative effects that resulted from too much use. As individuals increase their usage of mobile devices employers and coworkers become accustomed to this behavioral change and therefore their expectations also change. In order to operationalize employer expectations we used a negative connotation and used the construct work overload. As employer expectations increase an employee will consequently experience work overload. Questions for this construct were adapted from Moore (2000). Mobile device usage that consists or work related activities will influence employer expectations thus,

H1a: Mobile device usage (work related while at work) will be positively related to employer expectations (work overload).

H2a: Mobile device usage (work related while at home) will be positively related to employer expectations (work overload).



On the contrary, the use of mobile devices for personal activities will have a much different influence on employer expectations. Thus,

H3a: Mobile device usage (personal usage while at work) will be negatively related to employer expectations (work overload).

#### Mobile Device Usage and Flexibility in Work Structure

With the increased ubiquity made possible by the use mobile devices many corporations are becoming more flexible with employee work schedules. Increased capabilities of mobile devices have allowed individuals to complete work tasks that were previously only capable with a computer. We adapt this measure of our instrument from work that was previously published by Hill, Hawkins, Ferris, and Weitzman (2010). As the capabilities of mobile devices increase individuals are finding that they are capable of conducting work tasks more efficiently and also able to conduct personal activities while at work more easily. Therefore the more an individual uses a mobile device for work and non-work related activities the more efficiently they begin to complete those tasks. Thus,

Mobile device usage H1b (work related while at work), H2b (work related while at home), H3b (personal usage while at work) are positively related to flexibility in work structure.

#### Productivity and Employer Expectations/Productivity and Flexibility in Work Structure

In order to operationalize productivity for the use of this study we adapted our measure from work by Moore and Benbasat (1991) which was actually labeled as usefulness. These questions center on the two main objectives of productivity which are to increase efficiency and effectiveness. Productivity is defined by scholars as output over input and these measures are focused on increasing output and decreasing input. As productivity with a mobile device increases an employer's expectations will consequently increase resulting in a higher expectation for the employee to be more productive. Thus,

H4a: Productivity will be positively related to employer expectations (work overload)

As productivity increases not only does this allow for individuals to complete more work but it also allows individuals more flexibility. An increase in productivity allows for individuals to complete their work more efficiently which creates a shift in how they spend their time. In addition to an increase in work responsibilities some companies will allow for more flexibility in work structure to accommodate this shift in time. Thus,

*H4b Productivity will be positively related to flexibility in work structure* 

# Employee Expectations and work-life conflict/Flexibility in work structure and work-life conflict

Work-life conflict has been shown to significantly influence an individual's psychological state. Employee expectations or as we have operationalized this measure as work overload has been included in studies with work-life conflict to measure strain on individuals(Ayyagari, Grover, & Purvis, 2011), but in this study we make a direct relationship between the two constructs. An increase in employee expectations causes a shift in behaviors in which there must also be a shift in the work-life balance of an individual. Thus.

H5: Employee expectations (work overload) will be positively related to work-life conflict

Conversely, an increase in flexibility in work structure should allow more freedom of the individual to conduct work related activities. An individual that has more flexibility will schedule work related activities at a time that best meets the needs to maintain a work-life balance. Thus,

H6: Flexibility in work structure will be negatively related to work-life conflict

# CONCLUSION AND IMPLICATIONS

Using analysis of the pilot data as a guide, there appears to be support for the model which links mobile device usage to work-life conflict. With a small sample size that exists with pilot studies we used simple regression to better understand our model and test the relationships that are presented. At this stage in the research we have sought to provide a conceptual model that represents a practical problem that exists. The pursuit of further research will seek to empirically test these relationships that have been presented in the qualitative studies mentioned previously. Prominent IS researchers have issued a call for research that is relevant and practical. One novelty to our research is the classification scheme of mobile device usage. This classification could be used to better understand a number of relevant research areas that are applicable to the field of IS. The full study will provide a data set better representative to test the relationships that are present in the model and further support the presented hypothesis.

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#### **ESSENTIALS OF CYBERSECURITY**

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#### **ABSTRACT**

The ongoing effectiveness and efficiency of modern networked computer systems is a function of five basic attributes: availability, accuracy, authenticity, confidentiality, and integrity. The concepts apply to information, computers, networks, and other elements of coordination, cooperation, and control, and they apply to government, business, education, and private individuals. The concerns normally involve the Internet as a communication facility – hence the name Cybersecurity. The purpose of this paper is to give a composite picture of what cybersecurity is all about, identify the important literature on the subject, and describe how it differs from everyday information security affecting individuals and computer activities.

#### INTRODUCTION

It is well established that cybersecurity is a complicated and complex subject encompassing computer security, information assurance, comprehensive infrastructure protection, commercial integrity, and ubiquitous personal interactions. Most people look at the subject from a personal perspective. Is my computer and information secure from outside interference? Is the operation of my online business vulnerable to outside threats? Will I get the item I ordered? Are my utilities safe from international intrusion? Have I done enough to protect my personal privacy? Are my bank accounts and credit cards safe? How do we protect our websites and online information systems from hackers? The list of everyday concerns that people have over the modern system of communication could go on and on. Clearly, concerned citizens and organizations look to someone or something else, such as their Internet service provider or their company or the government, to solve the problem and just tell them what to do.

So far, it hasn't been that simple and probably never will be. The digital infrastructure based on the Internet that we call cyberspace is something that we depend on every day for a prosperous economy, a strong military, and an enlightened lifestyle. Cyberspace, as a concept, is a virtual world synthesized from computer hardware and software, desktops and laptops, tablets and cell phones, and broadband and wireless signals that power our schools, businesses, hospitals, government, utilities, and personal lives through a sophisticated set of communication systems, available worldwide. However, the power to build also provides the power to disrupt and destroy. Many persons associate cybersecurity with cyber crime, since it costs persons, commercial organizations, and governments more than a \$1 trillion per year.<sup>1</sup> However, there is considerably more to cybersecurity than cyber crime, so it is necessary to start off with concepts and definitions.

#### CONCEPTS AND DEFINITIONS

Cyberspace has been defined as the interdependent network of information technology infrastructure, and includes the Internet, telecommunications networks, computer systems, and embedded processors and controllers in critical industries.<sup>2</sup> Alternately, cyberspace is often regarded as any process, program, or

<sup>&</sup>lt;sup>1</sup> Remarks by the U.S. President on Securing Our Nation's Cyber Infrastructure, East Room, May 29,

<sup>&</sup>lt;sup>2</sup> National Security Presidential Directive 54/Homeland Security Presidential Directive 23 (NSPD-54/HSPD-23).

protocol relating to the use of the Internet for data processing transmission or use in telecommunication. As such, cyberspace is instrumental in sustaining the everyday activities of millions of people and thousands of organizations worldwide.

The strategic plan for the U.S. Department of Homeland Security lists five main missions for the period 2012-2016, listed as follows:<sup>3</sup>

Mission 1: Preventing Terrorism and Enhancing Security

Mission 2: Securing and Managing Our Borders

Mission 3: Enforcing and Administering Our Immigration Laws

Mission 4: Safeguarding and Securing Cyberspace

Mission 5: Ensuring Resilience to Disaster

Clearly, the placement of cybersecurity as one of the five major strategic missions of the Department of Homeland Security (DHS) is a sure-fire indication that an underlying problem exists with the global dependence on the Internet that is summarized in the following introductory quote from the DHS report:

Cyberspace is highly dynamic and the risks posed by malicious cyber activity often transcend sector and international boundaries. Today's threats to cybersecurity require the engagement of the entire society – from government and law enforcement to the private sector and most importantly, members of the public – to mitigate malicious activities while bolstering defensive capabilities.

Ensuing policy goals and objectives to achieve cybersecurity could therefore include:

#### Goal 4.1: Create a Safe, Secure, and Resilient Cyber Environment

Objective 4.1.1: Understand and prioritize cyber threats

Objective 4.1.2: Manage risks to cyberspace

Objective 4.1.3: Prevent cyber crime and other malicious uses of cyberspace

Objective 4.1.4: Develop a robust public-private cyber incident response capability

#### Goal 4.2: Promote Cybersecurity Knowledge and Innovation

Objective 4.2.1: Enhance public awareness

Objective 4.2.2: Foster a dynamic workforce

Objective 4.2.3: Invest in innovative technologies, techniques, and procedures

While the line between policy and operations may be a blurred line in some instances, a necessary requirement of cybersecurity is to have security operations be part of a stated set of objectives.

#### **CYBER ATTACKS**

Cyber attacks can be divided into four distinct groups: 5 cyber terrorism, cyber war, cybercrime, and cyber espionage. It would seem that cybercrime and cyber espionage are the most pressing issues, but the others are just offstage. Here are some definitions:

<sup>&</sup>lt;sup>3</sup> http://www.dhs.gov/xlibrary/assets/dhs-strategic-plan-fy-2012-2016.pdf.

<sup>&</sup>lt;sup>4</sup> Ibid. p.12.

<sup>&</sup>lt;sup>5</sup> Shackelford, Scott L., In Search of Cyber Peace: A Response to the Cybersecurity Act of 2012, Stanford Law Review, March 8, 2012, (http://www.stanfordlawreview.org).

Cyber crime is the use of computers or related systems to steal or compromise confidential information for criminal purposes, most often for financial gain.

Cyber espionage is the use of computers or related systems to collect intelligence or enable certain operations, whether in cyberspace or the real world.

Cyber terrorism is the use of computers or related systems to create fear or panic in a society and may not result in physical destruction by cyber agitation.

Cyber war consists of military operations conducted within cyberspace to deny an adversary, whether a state or non-state actor, the effective use of information systems and weapons, or systems controlled by information technology, in order to achieve a political end.

As such, cybersecurity has been identified as one of the most serious economic and national security challenges facing the nation.<sup>7</sup>

#### THE COMPREHENSIVE NATIONAL CYBERSECURITY INITIATIVE

In order to achieve cybersecurity, from individual, national, organizational, or global perspectives, a proposed set of major goals has been developed:<sup>8</sup>

To establish a front line of defense against today's immediate threats

To defend against the full spectrum of threats

To strengthen the future cybersecurity environment

Starting from the top, the President has directed the release of a summary description of the Comprehensive National Cybersecurity Initiatives, summarized as follows:

Initiative #1. Manage the Federal Enterprise Network as a single network enterprise with Trusted Internet Connections.

**Initiative #2.** Deploy an intrusion detection system of sensors across the Federal enterprise.

**Initiative #3.** Pursue deployment of intrusion prevention systems across the Federal enterprise.

**Initiative #4.** Coordinate and redirect research and development (R&D) efforts.

**Initiative #5.** Connect current cyber ops centers to enhance situational awareness.

**Initiative** #6. Develop and implement a government-wide cyber counterintelligence (CI) plan.

**Initiative #7.** Increase the security of our classified networks.

Initiative #8. Expand cyber education.

**Initiative #9.** Define and develop enduring "leap-ahead" technology, strategies, and programs.

<sup>&</sup>lt;sup>6</sup> Lord, K.M. and T. Sharp (editors), America's Cyber Future: Security and Prosperity in the Information Age (Volume I), Center for New American Security (June 2011), (http://www.cnas.org).

National Security Council, The Comprehensive National Cybersecurity Initiative, The White House, (http://www.whitehouse.gov/cybersecurity/comprehensive-national-cybersecurity-initiative).

<sup>&</sup>lt;sup>8</sup> I<u>bid.</u>, p.1.

**Initiative #10.** Define and develop enduring deterrence strategies and programs.

Initiative #11. Develop a multi-pronged approach for global supply chain risk management.

**Initiative #12.** Define the Federal role for extending cybersecurity into critical infrastructure domains.

The basic idea of the twelve initiatives is to address current and future cybersecurity issues by combining the resources of the Federal government, local and state governments, and the private sector to provide a strong response to future cyber incidents and by strengthening public/private relationships.

#### CRITICAL INFRASTRUCTURE AND KEY RESOURCES

The present concern over cybersecurity is the result of a variety of cyber attacks, intrusions, and countermeasures that have occurred globally in recent years. The threat scenarios are multidimensional and attribution is cumbersome to ascertain. Moreover, exposure to cyber threats can be direct or indirect, resulting from a dependence on one or more elements of critical infrastructure. The scope of inherent infrastructure has grown from ten in the year 2003<sup>9</sup> to eighteen in the year 2012.<sup>10</sup> The underlying philosophy is that once the critical areas are identified, a public/private dialog can be established to achieve a measurable amount of cybersecurity. Each of the six critical areas are classed as major and are assigned a Sector Specific Agency (SSA) by the Department of Homeland Security as part of the National Infrastructure Protection Plan (NIPP), intended to set national priorities, goals, and requirements for effective allocation of resources.<sup>11</sup> The major areas are:

Chemical
Commercial Facilities
Critical Manufacturing
Dams
Emergency Services
Nuclear Reactors, Materials, and Waste

The manner in which the public/private coordination and collaboration is executed is a matter of public debate. The key point is that a cyber intrusion in a major area can indirectly endanger a large number of people, governmental organizations, and commercial facilities.

The remaining twelve critical areas are assigned to existing governmental offices, as reflected in the following list:

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Agriculture and food – Department of Agriculture and the Food and Drug Administration

Banking and Finance – Department of the Treasury

Communications – Department of Homeland Security

Defense Industrial Base – Department of Defense

Energy – Department of Energy

Governmental Facilities – Department of Homeland Security

Information Technology – Department of Homeland Security

National Monuments and Icons – Department of the Interior

Postal and Shipping – Transportation Security Administration
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<sup>&</sup>lt;sup>9</sup> The White House, *The National Strategy to Secure Cyberspace*, February, 2003, p. xiii.

<sup>&</sup>lt;sup>10</sup> Homeland Security, *More About the Office of Infrastructure Protection*, p. 1, (http://www.dhs.gov/xabout/structure/gc\_1189775491423.shtm).

<sup>&</sup>lt;sup>11</sup> <u>Ibid.</u>, p.1.

Healthcare and Public Health - Department of Health and Human Services Transportation Systems - Transportation Security Administration and the U.S. Coast Guard Water – Environmental Protection Agency

National and global protection necessarily involves the establishment of a framework to provide the following:<sup>12</sup>

The exchange of ideas, approachs, and best practices

The facilitation of security planning and resource allocation

The establishment of structure for effective coordination among partners

The enhancement of coordination with the international community

The building of public awareness

The identification of the areas of critical infrastructure is significant because of the wide diversity of cyber threats, vulnerabilities, risk, and problem domains. Moreover, critical elements possess a wide variety of technological attributes that require a range of solutions.

#### **SUMMARY**

The paper gives an overview of the emerging discipline of cybersecurity that adds a policy level to the longstanding subjects of information security, computer security, and network security. Concepts and some basic definitions are covered. Cyber attacks are divided into cyber crime, cyber espionage, cyber terrorism, and cyber war. A comprehensive overview of the subject matter is given through the National Cybersecurity Initiative, and the notion of the critical infrastructure is explored in some detail.

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# **AUTHOR INFORMATION**

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# BRANDING A"PUBLIC" UNIVERSITY: PUBLIC POLICY OR A BUSINESS DECISION?

#### **ABSTRACT**

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Naming a new product or service in a consumer goods firm generally involves a fairly straightforward process: conduct research with a defined group of experts and target customer segments, make a decision, then design and implement a plan of action, all within 3-6 months. Yet, one public university reported that "this [name] change was 20 years in the making and did not happen without a tremendous amount of effort on the part of administrators, faculty, students, alumni and many elected officials at all levels of government" (Haytko, Burris and Smith, 2008).

The technological, government, and competitive environment in which universities operate has changed radically in the past 15 years, forcing marketing to the forefront of university leadership. This case study investigates a small, rapidly growing public comprehensive teaching institution operating with a state university system as it considered a name change as part of a larger rebranding effort.

The University of South Carolina "Small Town" seeks to grow to a "full service" university to serve a geographic region with exceptionally low educational attainment. Fundamental to its entrepreneurial growth plan is attracting students from outside the region. A change in the descriptor after the words "University of South Carolina" to more powerfully connect the university to its coastal location appeared to have significant potential to accelerate its growth.

Comprehensive universities operating within state university systems are interesting subjects for a case analysis involving autonomy and the politics of state support. Independently accredited as universities, they run their own academic programs and manage their own tenure lines. Increasingly they bear the brunt of head to head competition with for-profit institutions.

The challenges of bringing strategic marketing change to higher education are, ironically, ingrained in the very character of a public university: the dependence on financial and political support from many constituents and the consensus model of governance. The roles the various actors in the re-branding decision—legislators, system leadership, university chancellor, advisory board, marketing lead--chose to play are described—and the complex interactions and conflict among them explored. Public policy, managerial implications and future research are suggested.

# GLOBAL DIVERSITY IN OPINIONS ON FISCAL SUSTAINABILITY: RESULTS FROM AN INTERNATIONAL SURVEY OF PUBLIC OPINION

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#### **ABSTRACT**

In the aftermath of the global financial crisis and ongoing fiscal difficulties in the United States and Europe, the discussion of governmental fiscal sustainability and the role of government in society is intense and ongoing. In late spring 2011, a group of students and faculty members from Coastal Carolina University conducted a multi-national survey of public opinion related to fiscal sustainability was conducted. This paper reports the results and methodology of the study.

#### INTRODUCTION

In mid-May of 2011, a group of students and faculty members from Coastal Carolina University embarked on a three week study abroad program with the theme of fiscal sustainability. The program traveled through five European countries spending time at various European partner schools. As part of the program, students and faculty developed a survey instrument to gather public opinion of various topics related to the overall question of government's role in society and the fiscal sustainability of government policies in the United States and Europe. Students, staff, and faculty from the U.S. school and the European partner schools were involved in the survey project to various degrees.

While the research question itself is important, the primary motivation for the study was to provide the student participants with a real world exercise in managing a multicultural research project. With guidance, the students would encounter and manage issues arising from differences in language, cultural norms in subject-researcher interaction, and societal structures.

The survey instrument was developed in English and then translated and calibrated for use in France, German, Belgium, Holland, and the Czech Republic. The original English version of the survey is presented as Appendix One. Survey data was then collected in various public settings both before departure from the United States and as the group traveled. The resultant data provides an interesting glimpse of differences between the various countries.

This paper details the process of constructing and administering a survey instrument in a multinational setting. This includes outright translation and calibration of survey categories and data ranges to account for differences in currencies, government structure, and societal norms. In addition, the problems of on the street administration of surveys in the different settings are discussed. Then, the collected data is analyzed and contrasts are drawn between various national and demographic subgroups.

#### **SURVEY INSTRUMENT**

The survey is structured around seven major questions relating to the respondents attitudes toward public expenditures and their funding. The main questions are presented in Table One. Problems 2, 4, 5 and 9 contain additional subparts relating to specific categories of governmental expenditures. These subpart categories are presented in Table Two. In addition, problem 9 requires responses indicating which of the six survey countries spends the largest amount (per capita) in each category. Problem 8 responses were limited to three types of tax.

**Table One: Major Questions of the Survey** 

1.	In general, I am familiar with how my government spends on important functions.		
2.*	I am familiar with how my government spends on the following functions:		
3.	In general, I am satisfied with how my government spends public funds on important functions:		
4.*	I am satisfied with how my government spends on the following functions:		
5.*	* It is important that my government spends substantially on the following functions:		
6.	I am satisfied with the overall level of taxes in my country.		
7.	I am satisfied with the overall tax rates in my country when compared to other industrialized		
8.	For each of the following, please indicate whether you feel the level of this type of tax should be increased, unchanged, or decreased in your country.		
9.*	For each of the following societal functions, indicate your perception of which of the six countries listed spends the LARGEST amount of public funds per capita.		

**Table Two: Government Expenditure Subpart Categories** 

	tuble 1 wo. Government Expenditure Subpart Categories		
a.	Family Assistance		
b.	Road, Mobility, and Public Transport		
c.	Retirement		
d.	Healthcare		
e.	Education		
f.	National Security		
g.	Foreign Assistance		
h.	Assistance to Poor and/or Unemployed		

In addition to the perception questions above, the respondents were also asked for demographic information. These questions concerned age, nationality, education, marital status, and the like. As the project progressed, it became apparent that it would be necessary to modify the demographic questions to account for variation in national norms. For example, the system of education varies significantly among the countries in the survey. For comparison, the educational level questions from the English and German language version of the surveys are presented in Table 3. The German system places heavy emphasis on apprenticeships and alternate forms of practical training which do not have direct corollaries in the U.S.

system. It was therefore necessary to provide a different, larger set of educational level response options for the German language version. This in turn necessitated a combining of various categories in the one version to allow quantitative comparisons. The combinations are subject to cultural biases of the researchers. Note throughout, the English language versions were developed for the U.S. setting.

Table Three: Comparison of English and German Educational Level Categories

English	What is your highest level of education/training?
	[ ] High school [ ] Associates/Apprenticeship [ ] Bachelor's [ ] Master's [ ] Doctoral [ ] Other (specify)
German	Berufsausbildung: [ ] Kein Abschluss [ ] Hauptschule [ ] Realscule [ ] Fachhochschulreife [ ] Abiture [ ] Abgschlossene Lehre [ ] Universitätsabschluß (Bitte Grad angeben): [ ] Bachelor's [ ] Master's [ ] Doctoral [ ] Andere (angeben)

A second example is the general perception of income distributions evidenced in the variations of household income response categories. While those preparing and testing the English language version accepted several higher income categories, both the French and German colleagues involved in the respective translations felt that the higher income categories were inappropriate and might be perceived as oddly or offensively unrealistic by the respondents.

In addition, the French and German translation consulting colleagues selected distinctly different upper categories. These, along with the English language versions are presented in Table Four. Note that the French and German categories are stated in euros while the U.S. version is stated in U.S. dollars. In each case, the U.S. based researchers deferred to the European colleagues with respect to the selection of the categories. At the time of the survey, the exchange rate between the U.S. dollar and the euro was 1.42 in U.S. direct terms. Thus, the top categories for the English, French, and German survey versions are greater than \$250,000, \$213,000, and \$85,200.

Prior to departing on the trip, the American students were given short cultural familiarization sessions at their home U.S. university. These sessions were conducted by French and German nationals on faculty at the home university. In addition to basic greetings and interaction phrases, the students were taught what to expect in terms of street level interactions. This was done in anticipation of the student researchers conducting surveys in urban settings in the various European countries visited. Table Five reports the key phrases presented to the students in the French and German language training sessions. While individual biases must always be considered, it is noteworthy that the French language session instructor felt that the inclusion of the adjective "American" in describing one's student status, the German language session instructor felt it would be better not to include one's nationality.

**Table Four: Income Categories** 

English	What is your combined total annual household income (\$)?  [ ]Less than 25,000 [ ] 25,000 to 50,000 [ ] 50,001 to 75,000 [ ] 75,001 to 100,000 [ ] 100,001 to 125,000 [ ] 125,001 to 150,000 [ ] 150,001 to 175,000 [ ] 175,001-250,000 [ ] greater than 250,000
French	Quel est les revenue annuel de votre ménage (€)?  [ ] Moins de 25,000 [ ] 25,000 to 50,000 [ ] 50,001 to 75,000 [ ] 75,001 to 100,000 [ ] 100,001 to 125,000 [ ] 125,001 to 150,000 [ ] <b>Plus de 150,000</b>
German	Wieviel Jahreseinkommen steht ihrem Haushalt zur Vefügung(€)?  [ ]Weniger als 10,000 [ ] 10,001 - 15,000 [ ] 15,001 - 25,000 [ ] 25,001 - 45,000 [ ] 45,001 - 60,000 [ ] mehr als 60,000

Table Five: Key French and German Phrases Taught to U.S. Student Researchers.

French	Bonjour Excusez-moi Parlez-vous anglais? Je suis un étudiant américain/une étudiante américaine Je m'appelle Merci beaucoup
German	Guten Tag Entschuldigen Sie Sprechen Sie Englisch? Ich bin ein Student Mein Name ist Dankeschoen

#### **RESULTS**

The student researchers were originally tasked with collecting at least two surveys in each of the countries visited. With six countries (Belgium, Czech Republic, France, Germany, Netherlands, and the United States) and eighteen student researchers, this should have yielded at least 108 surveys. Some researchers delivered more than their required number, and the final data set contained 132 surveys. In this paper, only the largest three of the respondent nationalities are presented.

The respondents were asked to rate the agreement with the statements from strongly disagree to strongly agree. These responses were coded 1 to 5, with 5 being the highest level of agreement. The means of the ratings are reported in the following tables. For the most part, there are no significant differences between the national groups.

Table 6: Means for U.S. (n=21), Germany (n=46), and France (n=29)

Table 6. Freals for C.S. (II-21), Germany (II-40), and France (II-25)	U.S.A	France	Germany
I am familiar with how my government spends on the following functions:			
Family Assistance	3.48	3.66	3.17
Roads, Mobility, and Public Transport	3.67	3.76	3.33
Retirement	3.62	3.48	3.20
Healthcare	3.52	3.72	3.24
Education	3.57	3.66	3.42
National Security	3.62	3.00	2.78
Foreign Assistance	3.24	3.17	2.93
Assistance to Poor and/or Unemployed	3.70	3.59	3.42
I am satisfied with how my government spends on the following functions:			
Family Assistance	2.67	3.46	2.93
Roads, Mobility, and Public Transport	3.00	4.00	2.80
Retirement	2.76	3.59	2.93
Healthcare	2.85	3.76	3.09
Education	2.62	3.10	3.09
National Security	3.24	2.90	3.07
Foreign Assistance	2.71	3.28	2.23
Assistance to Poor and/or Unemployed	2.71	3.14	2.91
It is important that my government spends substantially on the following functi			
Family Assistance	3.24	3.66	3.71
Roads, Mobility, and Public Transport	3.95	4.00	3.33
Retirement	3.71	4.07	3.59
Healthcare	3.95	4.38	3.70
Education	3.95	4.48	3.87
National Security	3.70	3.97	3.20
Foreign Assistance	2.95	3.62	2.44
Assistance to Poor and/or Unemployed	2.90	3.83	3.29

For each of the following, please indicate whether you feel the level of this type of tax should be increased, unchanged, or decreased in your country.			
Personal Income Tax	2.38	2.34	2.57
Value Added Tax (VAT)	2.00	2.41	2.35
Corporate Income Tax	1.71	2.28	2.07

# Table 7: Difference in Means: Germany vs. France

	t	p
In general, I am familiar with how my government spends on the following functions.	96	Not significant
In general, I am satisfied with how my government spends on the following functions.	.62	Not significant
I am satisfied with the overall level of taxes in my country.	1.77	Not significant
I am satisfied with the overall tax rates in my country compared to other industrialized countries.	.67	Not significant

# Table 8: Difference in Means: Germany vs. U.S.

	t	p
In general, I am familiar with how my government spends on the following functions.	1.11	Not significant
In general, I am satisfied with how my government spends on the following functions.	2.70	P<.01
I am satisfied with the overall level of taxes in my country.	18	Not significant
I am satisfied with the overall tax rates in my country compared to other industrialized countries.	74	Not significant

#### **CONCLUSIONS**

This paper has presented the results of a multinational public opinion survey conduct by student participants in a 2011 travel study program. While the empirical results generally do not show significant differences between the nationality groups, the overall process was a challenging exercise for the student researchers. Despite potential biases arising from the heavy representation of student aged respondents, there are a few noteworthy contrasts.

The process of developing, translating, and administering the survey instrument provided an opportunity for the students to encounter and explore cultural differences which many had not examined before. Thus, the survey project served as an enriching component of the travel study program.

# OPERATIONS RESEARCH FOR FAMILY VIOLENCE NEEDS ASSESSMENT IN THE STATE OF GEORGIA

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#### **ABSTRACT**

We detail the background, OR methodology, and practical results from a needs assessment of domestic violence services completed for Georgia's Family Violence Unit. We created a mixed-integer optimization model to balance the geographic distribution of shelters and supply of shelter beds with the demand for services. The impact of various distance constraints and capacity restrictions were studied. Results from the model, and application of the results within the FVU, will be discussed.

#### **BACKGROUND**

Domestic violence is a serious problem both nationally and within the state of Georgia. Studies show that 1 in every 4 women will experience domestic violence in her lifetime and between 3.3 and 10 million children witness some form of domestic violence annually. Witnessing violence between one's caretakers is also the strongest risk factor of transmitting violent behavior from one generation to the next. [2] Domestic violence continues to be a leading cause of injuries for girls and women between the ages of 15 and 44 in the state of Georgia. [2] In Georgia, at the time of this study, the Family Violence Unit (FVU) fell under the Division of Family and Children Services (DFCS) in the Georgia Department of Human Resources (DHR).

FVU funds a statewide network of 45 certified domestic violence shelters providing both shelter and outreach services and one additional shelter providing only outreach services. Shelter services are defined as all of the services provided to family violence victims who are physically housed in the shelter. Outreach services are similar services provided to victims living in the community who are not housed in the shelter. The shelters are operated by private, nonprofit organizations, and provide 24-hour crisis lines; legal and social service advocacy; children's programs; parenting support and education; emotional support; household establishment assistance; follow up services and community education. All of the services are free and confidential. The service area for each shelter is defined geographically by county, with each of Georgia's 159 counties assigned to exactly one of the 45 shelters that provide shelter services. This current allocation is illustrated in Figure 1. [4] The bold numbers on the map are shelter locations, and the shading represents the counties assigned to that shelter. In 2006, these certified family violence agencies received 96,110 crisis calls and sheltered 4,588 adult and 4,788 child victims of family violence. [2]

Due to budget pressures and perceived differences between the effectiveness of various shelters, FVU needed a more concrete method to determine geographic placement of shelters in Georgia to meet the demand for family violence services. In particular, the needs assessment was commissioned to answer two questions:

- (1) Are certified violence shelters in Georgia geographically placed to meet the domestic violence needs of Georgians? If not, where are there gaps?
- (2) Within Georgia's network of violence shelters, what is the optimal mix of shelter versus outreach services' locations to best meet the needs of Georgians?

In order to answer these questions, the authors created a mathematical model to balance the geographic distribution of shelters or supply of shelter beds with the demand for family violence services. The model and results are detailed below.

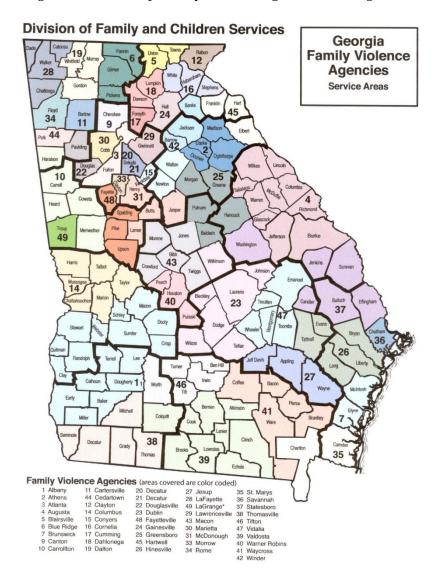


Figure 1: Location of Family Violence Agencies in Georgia

#### **OPTIMIZATION MODEL**

As is typical of not-for-profit scenarios, a basic cost minimization or profit maximization objective was not appropriate for this problem. Primary concerns from FVU included equitability of the solution (not favoring one geographic region of the state over the rest), the need to not deviate significantly from the current network, and capacity benchmarks. FVU was also especially interested in being provided a range of solutions. If closing several different shelters would provide near-optimal solutions, this information would allow them the flexibility to factor shelter performance and political issues into their decisions.

#### Data and demand

We first estimated the county-level demand for services. Available relevant data included:

- Law enforcement data: incident-based family violence data and temporary protection orders (TPO) data available through the Georgia Bureau of Investigation (GBI) reported by county in calendar year 2006. [1]
- Hospital data: the number of visits (all hospital admissions and ER visits) with an intentional injury diagnosis available through the Georgia Hospital Association (GHA) reported by county in calendar year 2006. Diagnosis was defined using ICD-9 (International Classification of Diseases, Ninth Revision) codes for intentional injury in the range of E960-E969: "homicide and injury purposely inflicted by other persons". All intentional injury visits were used as proxies for violence in a community rather than any codes specific to the type of perpetrator or victim. [3,7]
- Georgia Division of Public Health data: drug overdoses (defined as the misuse or overuse of any medication or drug, including alcohol and tobacco) from the OASIS database. [6]
- Census data: county-level population estimates, percentage of the county population living in poverty, percent Caucasian, percent male, and percent of births to unwed mothers.
- FVU programmatic data: the number of crisis center calls fielded per county and the number of bednights provided to victims by service region (shelter) available through monthly administrative data collected by FVU in calendar year 2006.

Running regression models on the available data in Minitab, the most important predictors of county-level need for domestic violence services per person were determined to be intentional injury hospital visits per capita, percentage of the population living in poverty, number of TPOs issued per capita, and an indicator for whether or not a shelter is currently in the county. Using results applied to Census data, local county-based estimates of demand were obtained, using similar methods to Griffin, Scherrer, and Swann. [5] These demand estimates were then included in the geographic optimization model to produce the results discussed in the following section.

#### **Equitability**

An equitable solution would provide similar service levels for each geographic region across the entire state. For that reason, we chose an objective function that would maximize the minimum percentage of demand served across all counties. However, equitability also needs to consider the distance that victims would need to travel to receive services. While demand is currently relatively low in some of the more distant counties, based on insights from the statistical model used to predict demand, demand may increase significantly if new shelters are added in closer proximity to these counties. This suggested that distance from a shelter does impact the service seeking patterns of victims. Choosing the distance constraint is not trivial. In areas without public transportation, the victim may or may not have access to transportation. Also, travel times can vary significantly based on the type of road. Through discussions with FVU it was determined that a 30-mile distance from center of a resident's county to the center of the county containing the shelter would be a reasonable targeted maximum distance, though we also looked at some 40 mile instances, as explained below.

#### **Deviations from current network**

Reasonable solutions to the problem could not involve completely recreating the network. FVU was interested in the results that could be achieved by opening a small number of additional shelters and by closing the residential component of a small number of current shelters; switching their focus over to

outreach only. Therefore, we considered combinations that included opening up to five additional shelters and converting up to ten current shelters to outreach.

#### Capacity

Current shelters range from 8 to 52 beds, in addition to the one location that offers outreach services only (no beds). We discussed with FVU that, when considering a capacity goal, program officials and policy makers should weigh the need to maximize the number of full beds while minimizing the number of clients refused services due to capacity constraints. This balance is difficult to achieve when trying to set capacity goals for a network with variability in shelter size, variability in family size, and timing of need. Through conversations with FVU staff and a review of preliminary results, the shelter capacity goal was set at 75 percent for most of the models in this report to best balance the aforementioned competing goals and ensure realistic expectations for the smaller, non-metro shelters.

#### The model

As mentioned above, we chose to model the problem with an equitability objective – maximizing the minimum fraction of the county's demand served. The optimization model is as follows:

#### Notation:

Indices:

i = index of demand nodes (centers of all counties in GA)

j = index of all potential shelter locations (centers of all counties in GA)

#### Decision variables:

 $x_{ij}$  = fraction of county *i* demand served in county *j* 

 $y_{ij} = 1$  if county i is assigned to a shelter in county j; 0 otherwise

 $s_i = 1$  if there is a shelter located in county i; 0 otherwise

#### Data:

 $d_i$  = demand in county i in bednights

 $c_i$  = capacity of shelter in county j in bednights

 $D_{ii}$  = distance from demand node i to potential shelter location j, in miles

SM = maximum number of shelters allowed

DM = maximum distance allowed between counties for assignment

(set to the maximum of the distance to the closest shelter and the 30 or 40 mile target distance)

$$\max (\min x_{ii}) \qquad (1)$$

s.t. 
$$\sum_{j} y_{ij} = 1 \quad \forall i$$
 (2)

$$0 \le x_{ij} \le y_{ij} \quad \forall i, j \quad (3)$$

$$y_{ij} \le s_j \quad \forall i,j \quad (4)$$

$$y_{jj} = s_j \quad \forall j \quad (5)$$

$$\sum_{i} x_{ij} d_{i} \leq s_{j} c_{j} \quad \forall j \quad (6)$$

$$\sum_{j} s_{j} \leq SM \quad (7)$$

$$y_{ij}D_{ij} \leq DM \quad \forall i, j \quad (8)$$

$$s_{j}, y_{ij} \in \{0,1\} \quad \forall i, j \quad (9)$$

Constraint (2) ensures that every county is assigned to exactly one shelter. Constraints (3) and (4) ensure that demand from counties is only assigned to open shelters, and constraint (5) requires that if a shelter exists in a county then the residents of that county are assigned to it. Constraint (6) is the capacity constraint and constraint (7) caps the number of shelters that can be opened. Constraint (8) requires that no one travel farther than the maximum pre-determined distance. Constraint (9) is the integrality constraint.

#### **RESULTS**

#### **Current network**

We first analyzed the current network. Without the addition of a distance constraint, the current network of shelters adequately meets the need for domestic violence services statewide, except for a few counties – mainly in the metro Atlanta area – that currently have their own shelters, but not enough capacity in that shelter to serve the demand in that home county. Due to the firm requirement that each county be assigned to exactly one shelter, the only way to fix that problem is by adding capacity to those shelters, so we gave FVU that list. Then, to avoid infeasible solutions for the rest of the analysis, *the capacity constraint in that subset of counties was set to allow the exact predicted demand from that county.* 

While network capacity is acceptable in the state overall, there are significant problems with the distance many victims currently need to travel to reach their assigned shelter. In the current network, 40 counties (25.2% of Georgia's counties) are assigned to shelters more than 30 miles away (center of resident's county to the center of the county containing the shelter) and 19 counties to shelters more than 40 miles away. Twenty-four counties are more than 30 miles away from the *closest* shelter (which they may or may not currently be assigned to) and 6 are more than 40 miles from their closest shelter. Because of this, it is not possible to create a solution in the current network where no county's victims travel more than 40 miles. In addition, in a solution where counties can be assigned more than 40 miles away only if they are being assigned to the closest shelter, there would be insufficient capacity at the shelters in the southernmost part of the state. However, because of the excess capacity in the northern part of the state, several shelters (at least 5) could be switched to outreach without impacting the overall service level of the state. Similar results are found with a maximum distance of 30 miles, as opposed to 40.

Opening new shelters is one way to solve the distance problem, and generate solutions that satisfy the desired equitability constraints from FVU. If 5 shelters are switched to outreach and then 5 additional ones opened (keeping the total number of residential shelters constant) a network can be designed with a maximum distance of 30 miles and all demand satisfied. In addition, demand is currently very low in some of the counties that are quite far from current shelters. Based on our insights from the regression model mentioned above, that demand is likely to increase significantly with shelters added in those regions.

Catoosa Rabur Union Gilme Gordon Forsyth Cherokee Polk Cobb Gwinnett Haralson Clayton Heard Butts Wilkinson Screven Twiggs Emanue Taylor Muscoge Treutlen Chattahoochee Marion Macon Telfair Jeff Davis Chathan Randolph Lee Turner Coffee McIntosh Tift Pierce Colquitt Miller Brooks Echols

Figure 2. Counties the Model Chose to Place Additional Family Violence Shelters

# **Adding shelters**

In order to identify general areas of the state in need of additional shelter services, multiple scenarios of adding shelters to the model were run, using both the 30 and 40 mile distance constraints. We ran scenarios ranging from adding one to five shelters to both the current network and to a network that switched five shelters to outreach at the same time. Results are displayed in Figure 2 by the number of times a county was chosen to receive a new shelter. The darker the color of the shaded county, the more times it was chosen by the model as a county that may be in need of additional shelter services.

We found that there is strongest need for additional shelters in the southwestern part of the state based on distance, not demand, though locating a shelter there would also likely increase the demand for services, as mentioned above. There is also a need in the more central southern part of the state. This is from a combination of distance and demand. If we reassigned every county to their closest shelter, the shelter in Ware County would be over capacity. Finally, there is a need for an additional shelter in the central eastern portion of the state. This one is also capacity-driven because if all the counties in that region were assigned to Richmond County that shelter would be too full.

# Switching shelters to outreach

FVU was also interested in evaluating whether there was an excess of shelters in certain regions of the state. This question was answered in a similar manner to identifying areas of additional need. Multiple

scenarios were run to identify areas of the state with excess capacity, ranging from shifting 1 to 10 shelters to outreach, while adding 0 to 5 shelters. Results were mapped in Figure 3 by the times a shelter was shifted to outreach by the model. In Figure 3, the darker the color the county is shaded, the more often it was chosen by the model to shift to outreach services. Several shelters (at least five) could be switched to outreach without impacting the overall service level. In general, there is excess capacity in the northern part of the state, specifically in the arc above the northern suburbs of Atlanta, and in the northeastern area. There is also excess capacity in the southeast, with four shelters currently in the counties along the coast.

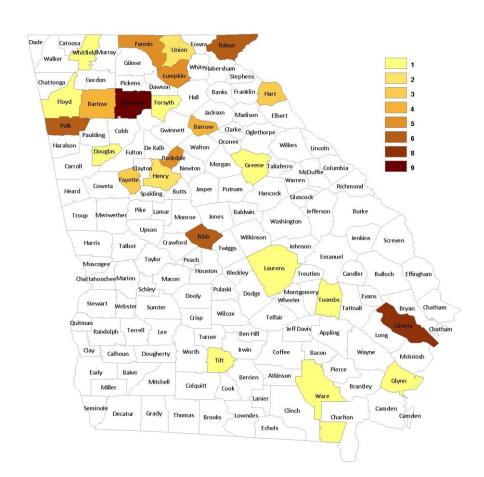


Figure 3. Counties the Model Chose to Shift to Outreach Services

### **CONCLUSIONS**

This work illustrates an excellent opportunity for operations research to serve the public sector. FVU had a problem that was adaptable to mathematical modeling, but often organizations that are not familiar with modeling are hesitant to blindly trust models. By providing them a set of robust solutions and explaining the patterns that we found, we were able to foster trust in the modeling process. The solutions were presented in a way that preserved their ability to use important, but subjective, knowledge to make the final decisions.

### **Future work**

In future research, it would be interesting to consider multi-criteria decision making into the model to factor in issues of shelter performance and other preferences for which shelters are switched to outreach. In addition, FVU noted that the shelters work closely with the judicial system. Some judges are frustrated by working with multiple shelters that are in many cases assigned to the same judicial circuit. For that reason, it might be helpful to take judicial circuits into consideration in shelter allocation decisions in the future.

### **ACKNOWLEDGEMENTS**

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### CODES OF ETHICS FOR MANUFACTURERS: A DESCRIPTIVE STUDY

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#### **ABSTRACT**

This paper presents a practitioner oriented paper that lists the components included in codes of ethics in two diverse industries and five companies within each of the industries. The codes of ethics are compared regarding structure and level of detail of the codes. The paper also compares similarities and differences of issues covered across and within industries. This information can be used by companies desiring to benchmark their codes of ethics and identify areas for improvement, provide a starting point for companies which are developing codes for the first time, and by academics teaching business ethics.

#### INTRODUCTION

Most industries, public and private companies, and professional organizations have codes of conduct or codes of ethics, which generally refer to the same types of documents. This study uses the terms consistently with the respective company's usage or interchangeably in general contexts. In compliance with Section 406 of the Sarbanes-Oxley Act of 2002 (SOX), the Securities and Exchange Commission (SEC) issued a January 2003 rule requiring all SEC registrants to disclose whether the registered company has adopted a code of ethics for the issuer's senior financial officers and if one has been adopted, the code's contents (17 CFR Parts 228, 229)[1]. If a code of ethics has not been adopted, the reason for not adopting a code must be disclosed. The rule also defines the term *code of ethics* and states how the company's code of ethics should be made available to the public. Some companies may choose to meet the SEC's rules by adopting separate codes of conduct for senior financial officers, and others may choose to modify existing codes to incorporate SEC mandates. Because of the expected increased availability of company's codes of ethics on the web and the lack of information about the commonalities and differences between codes of ethics, this paper begins a stream of research that examines and compares codes of ethics across industries and corporations. These types of descriptive studies can benefit academics teaching business ethics, companies seeking to refine and improve their codes of ethics by benchmarking the codes of others, as well as provide a starting point and guidance for businesses developing codes of ethics for the first time.

The research begins with a brief review of the literature on writing codes of ethics, and then compares different codes of ethics in the manufacturing industries of guided missile and space vehicle (NAICS 336414) and rubber and plastics footwear (NAICS 316211) [17]. The industries were selected because of the significant difference in the products being manufactured. Although both industries include publicly traded companies, being in an industry involving significant United States government contracts manufacturing in the United States should impose significant ethics challenges for the missile and space vehicle manufacturing industry. The rubber and plastics footwear industry without the reliance on significant government contracts should also have significant ethics challenges as a result of global manufacturing practices in countries with significant differences in ethical standards. The examination of

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the codes of ethics in these two industries identifies significant industry specific differences in codes of ethics, as well as commonalities across industries and companies.

## WRITING CODES OF ETHICS

What is a code of ethics? According to Shapiro's article in Inc.com, a code of ethics consists of principles and values that a business believes in and wants to guide the way the business functions. The code may be based on the business's core values or mission and may provide detailed information about how employees, business partners, and vendors should behave when working with or on behalf of the company [20]. If codes of ethics capture core values and/or general societal ethical concerns, then there should be common topics across companies' and professional organizations' code of ethics. However, what may be an important issue to one company may not be important or apply to another company or industry.

When faced with having to write a code of ethics, companies may seek the codes of ethics for companies respected by management or seek out topic experts who provide models, such as the issues and the stakeholder models. The Center for the Study of Ethics in the Professions at the Illinois Institute of Technology (IIT) uses the issues model in its "Index by Code Provision." The index lists several common issues and the names of professional organizations, societies, and a few companies (Coca Cola Company and Intel) which include the identified issues in their codes of ethics. The common issues include academic ethics, authorship, sustainable development and environmental ethics, gifts and gratuities, privacy, and professional competence. Other key areas identified on the list include conflicts of interest, and use of company assets [14]. In "Developing an Effective Code of Ethics: Contents of a Code of Ethics," the Institute of Business Ethics extends the list. Additional issues include how the organization competes, bribery and facilitation payments, safeguarding important information, human rights, and timely payments to suppliers [12].

The stakeholder's model is also described by the Institute of Business Ethics. Instead of focusing on an organization's issues when writing a code of ethics, the stakeholder model centers on the stakeholder's concerns. Stakeholders include employees, customers, shareholders, suppliers, and society. The Institute suggests including instructions on how to use the code, an ethical decision-making framework, suggestions for code implementation and reinforcement, and how to assess the code's effectiveness [12].

Although the SEC's mandated code of ethics (issues model) for senior financial officers of publicly traded companies is tailored for financial reporting, it could be slightly modified to serve as the code of ethics for most entities. The SEC defines a code of ethics as written standards that are reasonably designed to deter wrongdoing and to promote (17 CFR Parts 228, 229) [1]:

- 1. Honest and ethical conduct
- 2. Avoidance of conflicts of interest
- 3. Full, fair, accurate, timely and understandable disclosure in public and SEC related communications
- 4. Compliance with applicable governmental laws, rules, and regulations
- 5. The prompt internal reporting of any violations in the code
- 6. Accountability for adherence to the code

When writing a code of ethics, Shapiro warns that companies must determine the appropriate level of detail for the code [20]. Should the code be a brief statement that is easy to read and understand or a detailed document containing desirable and undesirable behaviors? Take for example the code of ethics

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for Mary Kraft Staffing and HR Solutions in Maryland. The company's one page code of ethics consists only of seven statements [9]. Kraft Food Company's Code of Conduct consists of 10 rules communicated in an easy to read 15-page document that is colorful and uses a large size font and straightforward language [16]. Wal-Mart's "Statement of Ethics" is basic but yet detailed. The 36 page document provides the company's three basic beliefs and guiding principles which guide the expected behaviors of its employees [22]. Similar to Wal-Mart, Coca-Cola's 49-page "Code of Business Conduct" begins with its five guiding principles and then provides expected behaviors [4]. Boeing has a one page code of conduct [2] which is supported by the more detailed 37 page "Ethical Business Conduct Guidelines [13].

Codes of ethics (or conduct) will vary depending upon a company's management perception of what it needs in order for management, board members, employees, vendors, and business partners to behave in ways that benefit the company, but are still considered ethical. In Bullock and Panicker's 2003 study of scientific societies' codes of ethics, the authors found that the codes were broader and more general (breadth) when the society's members and their activities were more diverse. Conversely, depth describes the level of detail in the code [3]. The Lockheed Martin "Setting the Standard- Code of Ethics and Business Conduct" [19] has much more depth to it than the code of ethics for Mary Kraft Staffing and HR Solutions [9]. Bullock and Panicker speculate that the depth of a society's code is affected not only by the diversity of the membership's activities, but also the amount of regulation affecting the society membership [3]. The American Institute of Certified Public Accountants' (AICPA) "Code of Professional Conduct" is an example of a code of an extremely detailed code for association members. AICPA members are highly regulated by state licensing boards and who must also comply with regulatory agencies such as the SEC and the Public Company Accounting Oversight Board (PCAOB). The AICPA's code for its members includes basic principles and detail guidance supporting the principles. The complex and highly detailed rules are in place to help protect the profession's valued reputation in the market place and support the profession's self-regulation processes [11].

The codes of ethics also vary greatly according to the industry and a company's mission, such as the differences between Lockheed Martin [19] and Nike [15]. Lockheed Martin makes defense and military equipment and Nike produces shoes and other sports attire for consumers. Since Lockheed Martin designs and manufactures its product under government security, it manufactures in the US. Nike contracts with non-US factories to manufacture its products. Nike calls its code of ethics that applies to all employees "Inside the Lines". In addition they have a "Code of Conduct" that applies all the manufacturers around the world who produce the Nike brand, as well as a "Code of Conduct" for those who produce the affiliated brands, such as Cole Haan [18]. Because of industry differences, Lockheed Martin and Nike do not share the same ethical issues and concerns [19][15][18].

For example, some of the items on Nike's Code of Conduct for its international contractors [18], which do not apply to Lockheed Martin [19], include:

- Employees are age 16 or older
- Compensation is timely paid
- Working hours are not excessive (specified as not over 60 hours per week)

However, several issues apply to both companies' code of ethics, such as:

Lockheed Martin	Nike
Maintain a safe and healthy work environment	The workplace is healthy and safe
Zero tolerance for discrimination and harassment	Contractor does not discriminate

### STUDY DESCRIPTION

In addition to Lockheed Martin and Nike, the study includes eight other firms, the five largest companies (based on revenue) in each of the two industries as defined by the 2007 North American Industry Classification System (NAICS) codes, the Office of Management and Budget's system for classifying North American business entities in North America. The NAICS codes replaced the Standard Industrial Classification System (SIC) [17]. Companies from Lockheed Martin's NAICS code 336414 (Guided Missile and Space Vehicle Manufacturing) included in the study are Boeing [13], United Technologies [10], Northrup Grumman [21], and Honeywell [5]. From Nike's NAICS code 316211 (Rubber and Plastics Footwear Manufacturing), the other firms included in the study are VF [6], Polo Ralph Lauren [8], Phillips-Van Heusen [7], and Levi Strauss [23]. For descriptive purposes, the two NAICS codes are referred to as Defense Manufacturing and Sportswear, respectively. Except for Levi Strauss, all companies are publicly traded. All ten of the companies had their codes of ethics posted on their website which cover, at a minimum, all directors, officers, executives, board of director members, and all other employees.

## **RESULTS**

The codes of ethics (or conduct) available on the websites of the 10 companies in the defense manufacturing and sportswear industries (NAICS Code Sections 336414 and 316211, respectively) were companywide codes [17]. If the companies had separate codes of ethics for senior financial officers, the company-wide codes were not required to be in compliance with the SEC's code of ethics requirements (17 CFR Parts 228, 229) [1]. Compliance with the SEC requirements is not addressed by this study.

Table 1 gives a list of the various content items that the sample companies chose to include in their general codes of ethics. Also, the codes studied reflect a particular point in time as shown in the References. Companies continually review and update their codes of ethics based on various factors in their company, the industry, and the global economy. Because the wording varied between the ten firms, there is some interpretation applied in distinguishing similarities and differences, which could be the subject of a future paper.

#### **Code Structure**

The company codes are expected to be followed by board of director members, officers, directors, employees, and often other parties who represent the organization or company suppliers. However, document length, level of detail and references to additional documents vary across industries and companies per Table 2. Table 2 summarizes the characteristics of code structure by company and industry. Due to various wording and organization in the 10 codes of conduct, an extensive comparison becomes complex and beyond the scope of this paper.

The code length ranged from 7 to 48 for all 10 companies. The sportswear companies tended to be shorter with a range of 7 to 32 pages. The page length range for the defense manufacturers' codes was 17 to 48. Three sportswear companies had codes of less than 10 pages (Polo Ralph Lauren, VF, and Phillips-Van Heusen) with Nike and Levi Straus having codes of 32 and 20 pages, respectively. In contrast, the defense manufacturers average page length was 32, over double that of the sportswear companies' average length of 15 pages. All five of the defense manufacturers' codes were longer that the sportswear company 15-page average. Honeywell had the longest code length of 48 pages.

Table 2 reports the number of content items included in each company's code, while the codes for the 10 companies include similar, as well as different issues and concerns as identified in Table 3. The number

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of content items range from 13 to 20 for all of the companies and for each industry. In general, the defense manufacturers tend to have more items than the sportswear companies. The average number of items for the defense manufacturers and sportswear companies are 18 and 16, respectively.

TABLE 1 -CODE OF CONDUCT CONTENT ITEMS

	Component Description		Component Description		Component Description
1	Business courtesies (gifts, entertainment, kickbacks)	12	Waivers and amendments	22	Loans to directors, officers, and employees
2	Conflicts of interest	13	Fair dealing (supplier related)	23	Desired company culture
3	Corporate opportunities	14	Anti-trust	24	Mandatory ethics training
4	Confidential information	15	Political activity	25	Whistleblower retaliation
5	Use of company systems and assets	16	Good citizenship	26	Cooperation with investigations
6	Use of company information	17	Agents, consultants and other third parties	27	International activities
7	Disclosures & fraud	18	Social responsibility	28	Government contracts
8	Accounting and reporting	19	Product Safety	29	Parties covered by the code
9	Treatment of others	20	Company credit card use	30	Decision-making process
10	Working environment	21	Related to family members	31	Factors considered in the decision-making process
11	Code enforcement and violations			•	

For more information and clarity, all but two of the codes of ethics refer to documents external to the codes. The documents include corporate legal procedures and various corporate policy statements, in areas such as environmental, social responsibility, and sustainability. For example, United Technologies' Code provides a list of four situations which could result in a conflict of interest. The code also references a more detailed policy statement on conflicts of interest. The two codes without references to additional documents are Boeing and VF.

TABLE 2 - CODE OF ETHICS STRUCTURE

	D	Defense Manufacturing			Sportswear					
Company	LM [19]	B [13]	UT [10]	NG [21]	H [5]	PRL [8]	VF [6]	N [15]	LS [23]	PVH [7]
Length of document in pages	38	37	19	17	48	7	9	32	20	7
Number of different code content items (listed in Table 1)	20	20	18	13	21	13	17	17	20	14
References additional company documents	Y	N	Y	Y	Y	Y	N	Y	Y	Y

Company Abbreviations:

LM: Lockheed Martin, B: Boeing, UT: United Technologies, NG: Northrup Grumman, H: Honeywell

PRL: Polo Ralph Lauren, VF: VF, N: Nike, LS: Levi Strauss, PVH: Phillips-Van Heusen

Y: Yes, N: No

#### **Common Issues**

The codes for all 10 of the companies address with varying levels of detail conflicts of interest, gifts, entertainment, and other payments (such as kickbacks), financial reporting related topics, and cost accountability. All 10 of the companies discuss avoiding actual or potential personal conflicts of interest. Personal conflicts of interest are defined as conflicts between the best interest of the employee and the company's best interest. The individual companies vary in the topics discussed in the conflicts of interest area. Four of the sportswear companies (all except VF Corporation) and four of the defense manufacturers (all but Lockheed Martin) extend the conflict of interest policy to the immediate family of the employee. The codes for VF Corporation and Nike specify that the employee should not own stock or have an investment with a supplier, customer, or contractor. All five of the defense manufacturers allow non-significant ownership. Levi Strauss and Philips Van-Heusen state that the employee cannot be simultaneously employed by a competitor, customer, or supplier while the defense manufacturers may allow certain outside employment if properly approved.

The defense manufacturers provide details in the area of gifts, entertainment, and other payments, especially for those involving government officials and employees. For example, Lockheed Martin's code includes the allowable dollar amounts for gifts and entertainment and explicit rules about interactions with government and nongovernment persons. Boeing's broader discussion refers the reader to the U.S. Government Standards of Conduct and rules for procuring products and services. The code for United Technologies references the specific guidelines and requirements for interacting with the government. Honeywell makes a point of stating that gifts and business entertainment may result in conflicts of interest. All of the sportswear companies address gifts in some way, but the Philips Van-Heusen code only addresses gifts to U.S. government personnel and foreign government officials. While VF also prohibits gifts to government officials, Nike, Levi Strauss, and Polo give specific policies related to foreign governments. For the sportswear companies, only Polo and Nike give dollar limits for gifts given or received.

Financial reporting is a fairly broad category. The codes for United Technologies and Honeywell explicitly state that public and SEC related communications will be full, fair, accurate, timely and include understandable disclosures. The codes for Polo and VF specify that they will meet all SEC reporting requirements. All 10 companies address the need for accurate accounting, especially in the area of recording costs, a key concern in government contracting.

TABLE 3 – EXAMPLE SIMILARITIES AND DIFFERENCES IN CODES OF ETHICS

		D	efense	Manufa	acturing	7		S	portsw	ear	
	Company	LM [19]	B [13]	UT [10]	NG [21]	H [5]	PRL [8]	VF [6]	N [15]	LS [23]	PVH [7]
1	Conflicts of Interest	X	X	X	X	X	X	X	X	X	X
2	Gifts, Entertainment and Other Payments	X	X	X	X	X	X	X	X	X	X
3	Financial Reporting	X	X	X	X	X	X	X	X	X	X
4	Code Accountability	X	X	X	X	X	X	X	X	X	X
5	Political Interactions	X	X	X	X	X		X	X	X	
6	Government Interactions (Federal)	X	X	X	X	X					
7	Loans to Officers, Directors, and Employees					X				X	

Company Abbreviations:

LM: Lockheed Martin, B: Boeing, UT: United Technologies, NG: Northrup Grumman, H: Honeywell PRL: Polo Ralph Lauren, VF: VF, N: Nike, LS: Levi Strauss, PVH: Phillips-Van Heusen

The last issue common to all of the codes, code accountability, requires all covered parties to report violations and puts code violators on alert that disciplinary actions may follow. The codes also indicate whom parties should consult if additional guidance is needed. All 10 companies included accountability in their codes.

### **Differences in Issues**

Table 3 provides three examples of content areas which are not included by all of the companies: political interactions, government interactions and loans to officers, directors, and employees. Political interactions include political contributions and lobbying activity. All five of the defense manufacturers require individuals subject to the code to comply with the laws governing political contributions. Lobbying activities are restricted to those authorized to do so. Unlike the other four manufacturers, United Technologies' code expressly encourages all employees, directors and officers to be informed voters. VF, Nike, and Levi Strauss also include political activity in their codes, with all three forbidding the use of company funds or company time for political activity.

Although all 10 companies require compliance with local, federal, and international laws, only the five defense manufacturers expand on the laws that govern them. As mentioned in the previous section, the manufacturers' codes all require compliance with the federal government's requirements for gifts and entertainment (see Table 3). Lockheed Martin includes the specific dollar limits for gifts and entertainment involving government employees and officials. Boeing includes information about interacting with government employees about potential employment or contract hiring. Honeywell's code prohibits hiring third parties to make improper government payments.

The last issue addressed in this study involves loans to officers, directors, and employees. Only Honeywell and Levi Straus address the issue of loans. Honeywell prohibits loans from any entity or individual who does business with Honeywell. None of the defense manufacturers specifically address loans to any third parties. The Levi Strauss policy applies to loans from the company to the employee and requires approval in writing by the Senior Vice President, Worldwide Human Resources and by the Chief Financial Officer. Levi Strauss was the only private company in the study set, which may explain why they are the only company that would have any provision for employee loans.

## SUMMARY, CONCLUSIONS AND ISSUES FOR FURTHER RESEARCH

This paper provides a brief overview and literature review of the issues a company might consider and approaches for writing or reviewing a corporate code of ethics, including consideration of the SEC requirements for publically traded companies. In order to compile a fairly broad list of ethical issues, the paper lists the code of conduct items found in the review of five companies in each of two dissimilar industries, guided missile and space vehicle manufacturing (defense) and rubber and plastics footwear manufacturing (sportswear). For example, obvious differences were that the defenses industry has more government interaction and the sportswear industry has more international manufacturing subcontractors or suppliers.

The structure of the ten codes of ethics are compared based on the length of the document in pages, number of different code components, and whether the code referenced additional company documents, such as codes for top executives and financial officers, or social responsibility codes. The paper also provides some examples of issues where there were similarities between all the codes, such as conflicts of interest and financial reporting. A firm must consider the specific industry and company situation when preparing their code of ethics, but the information here provides a basis for comparison.

This study can then be expanded several ways. First, Table 3 only compares seven of the 31 items listed in Table 1, so a more detailed comparison of the similarities and differences would be appropriate. The codes of ethics were broadly interpreted, with similar wording subjectively grouped together, leaving an opportunity for a more detailed analysis of the variety of wording. The study could also be expanded to include additional companies or other industries. As mentioned above, most of the codes of ethics referred to other documents, but this study did not include the related documents, which could either resolve differences (with issue being included elsewhere) or result on more differences (with new issues included in the other documents). Another extension would be a detailed analysis of how each of the public companies addresses the SEC mandates regarding codes of ethics.

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# THE EFFECT OF SPIRITUALITY ON WORKPLACE ETHICS

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#### **ABSTRACT**

The issue of ethics in the Management Science field has been recognized for a number of years, and researchers have focused on ethics in organizations, including the investigation of ethical culture, the incorporation of ethical codes, and the development of ethical climates. But, it is the individual employee's personal ethical framework that influences individual ethical behavior, so a more proper unit of analysis when investigating ethics might be the individual. One of the factors that has been hypothesized to impact ethics in the workplace is spirituality, but relatively little empirical research has assessed this proposed relationship. Based on a sample of 261 employees, spirituality was found to be a statistically significant predictor of ethics in the workplace. Additionally, age of the employee, having an employer code of ethics, and having had ethics training were also found to be significant predictors of workplace ethics. Implications are discussed in this paper.

### INTRODUCTION

The issue of ethics in the Management Science field has been recognized for a number of years. Singer and Singer noted in 1997 the developments that had occurred in the field in the previous 15 years or so that were directly related to business ethics, but also noted the lack of attention these developments had received in the mainstream business ethics literature. Ten years later, Brans and Gallo (2007) noted the growing interest and awareness of the relevance of ethics in Management Science and provided a historical account of the evolution of concern about ethics in the field, noting the discussion of ethics among MS researchers in the 1950s as well as the beginning of the development of ethical codes and guidelines for the field in the 1970s and 1980s.

Ethics researchers have focused much attention on ethics in organizations, including the investigation of ethical culture, the incorporation of ethical codes, and the development of ethical climates. But, it is the individual employee's personal ethical framework that influences individual ethical behavior, so a more proper unit of analysis when investigating ethics might be the individual (Al-Khatib *et al.*, 2004). Researchers have been interested in the effects of situational or contextual variables on ethical behavior (e.g., Ford and Richardson, 1994; Jones and Kavanagh, 1996; Mesmer-Magnus and Viswesvaran, 2005; Robertson and Ross, 1995; Trevino, 1986), but have also developed theoretical models that attempt to explain the behavior of individuals when faced with ethical choices, including those faced by businesspeople (Jones, 1991; Trevino, 1986).

The determination of the factors that influence individual ethics in the workplace is of primary concern to the study of ethics in the workplace, but relatively little attention has been paid to this question (Giacalone and Jurkiewicz, 2003). One of the factors that has been hypothesized to influence individual ethics is spirituality. The purpose of this paper is to investigate the influence of spirituality on individual ethics in the workplace.

# **Spirituality**

Spirituality is one of the factors that has been hypothesized to impact ethics in the workplace, but some

of the research on ethics has treated and spirituality as interchangeable with religiosity. Vitell and Paolillo (2003) use the terms "religiosity/spirituality" and "religious/spiritual" when developing their hypothesis concerning religiosity and ethical beliefs, and Vitell, et al. (2005) suggest that the reason that extrinsic religiousness has no impact on ethical beliefs is that extrinsic religiousness does not involve spirituality, which implies that intrinsic religiousness does involve spirituality. While some authors assume that religiousness and spirituality are indistinguishable, others argue that they are different and unique. King and Crowther noted in 2004 that the field has moved towards considering them as separate constructs, and this trend has apparently continued as evidenced by the large amount of research assessing spirituality as a construct independent from religiousness. The current research treats spirituality as an independent construct in order to assess its effects on workplace ethics.

An ever-growing body of literature on spirituality has been developing in recent years. Much attention has been devoted to developing models and theories of spirituality in the workplace (e.g., Ashmos and Duchon, 2000; Mohamed, Wisnieski, Askar, and Syed, 2004; Pawar, 2009a) and identifying various approaches and conceptualizations of workplace spirituality (e.g., Gotsis and Kortzei, 2007; Pawar, 2008a, 2008b; Karakas, 2010). However, relatively little empirical research has been conducted to assess the impact of spirituality in the workplace. Studies have investigated the effects of spirituality on outcome variables such as job satisfaction, job involvement, organizational commitment, organizational identification, organizational frustration, work rewards satisfaction, and perceptions of unethical business activities (Giacalone and Jurkiewicz, 2003; Kolodinsky, Giacalone, and Jurkiewicz, 2007; Rego and Cunha, 2008; Pawar, 2009b), but these efforts have been relatively few.

Thus, the current paper makes contributions in two ways: the primary contribution is to add to the body of knowledge regarding the determinants of ethics in the workplace, and, secondarily, we extend the empirical research on the effects of workplace spirituality.

H1: Spirituality will be positively associated with workplace ethics.

### **METHOD**

## Sample

The sample consisted of 261 people working in organizations located in the southeastern United States. Females comprised 52% of the sample; 63% of the respondents were Caucasian, and 27% were African-American; 59% were between 20 and 39 years of age, with another 36% between the ages of 40 and 59; and 71% had at least a college degree.

### Measures

The dependent variable in the analysis was workplace ethics, which was measured with the Ethics Sensitivity Scale developed by Newstrom and Ruch (1975) and used by Al-Khatib, et al., (2004) and others, consisting of 14 items (e.g., "concealing one's errors at work" and "taking longer than necessary to do a job") on a 5-point Likert-type scale anchored by "strongly believe it is wrong" and "strongly believe it is not wrong," with higher values indicating stronger belief that the behavior is wrong.

Spirituality was measured with the Human Spirituality Scale (Wheat, 1991), a 20 item, 5-point, Likert-type instrument, where higher values on the response scale indicate a higher degree of spirituality. This instrument is a measure of global spirituality and has been validated and used in prior research (Wheat, 1991; Belaire and Young, 2000; Young, et al., 2000; Giacalone and Jurkiewicz, 2003). Items were reverse scored in the scales wherever necessary; the Cronbach's alpha reliability estimates of the scales used in study ranged were .822 and .942 for the workplace ethics scale and the Human Spirituality Scale,

respectively.

We also included demographic variables in our analysis: age (using the midpoint of the category of each respondent), gender, race (coded as Caucasian or other), education (coded as high school degree or less, or some college or higher), and sector of employment (public or private). We also asked whether respondents had ever received ethics training from their employer or professional association, if their employer had a formal code of ethics, and if there was a code of ethics for their occupation or profession.

#### **RESULTS**

Multiple regression analysis was used to test the hypothesis, which predicted a positive association between spirituality and workplace ethics. The results are provided in Table 1. The first model included only the demographic variables. As can be seen, the partial slopes for age (p<.01) and for the presence of an employer code of ethics (p<.05) were statistically significantly different from zero. The slope for ethics training was marginally significant. Spirituality was added as a predictor in the second model; as can be seen in table 1, the slope for spirituality was significantly different from zero (p<.001), and there was a significantly higher  $R^2$  (p<.001) for the second model. Thus, strong support was provided for Hypothesis 1. Additionally, both age (p<.05) and an employer code of ethics (p<.05) remained significant predictors of workplace ethics in the second model, as was ethics training (p<.05).

TABLE 1
REGRESSION RESULTS

	Mode	el 1	Mod	el 2		
Predictor	β	Т	β	Т	$\Delta R^2$	F
Sector	-0.0831	-0.72	-0.0729	-0.69		
Race	-0.0498	-0.50	-0.1205	-1.31		
Rducation	0.0551	0.27	0.0498	0.26		
Age	0.0117	2.71**	0.0078	1.95*		
Ethics Training	0.1699	1.48ª	0.1922	1.82*		
Occupational Code of Ethics	-0.0756	-0.47	-0.1649	-1.12		
Employer Code of Ethics	0.3176	2.28*	0.2297	1.78*		
Gender	0.0878	0.90	-0.0528	-0.57		
Spirituality			0.7167	6.71**	*	
R <sup>2</sup> ***p<.001, **p<.	8. 01, *p<.	.5% 05, ap<.10	22	2.8	.143	46.5***

Another question that arose concerns whether public sector workers might differ in their perceptions of ethics from other types of workers and if the relationship between spirituality and workplace ethics might be different for public sector workers versus private sector, so we performed checks for the moderating as well as the main effects for sector of employment. The results were non-significant for the main effect of sector of employment in all of the models and also for the moderating effect, when tested.

### **CONCLUSION**

The results indicate that spirituality is a significant predictor of workplace ethics. The slope for spirituality was statistically significant and was positive, providing evidence of a positive relationship between spirituality and workplace ethics. Additionally, the amount of explained variation was significantly higher in the second model, when spirituality was added as a predictor, indicating that spirituality has substantial explanatory power in predicting the ethics of individual employees' in the workplace. Spirituality apparently has an important role to play in the determination of ethical beliefs concerning behaviors at work. People who exhibit a higher degree of spirituality have more of a tendency to view ethically questionable behaviors as wrong compared to those who exhibit a relatively less spiritual nature. People who are more spiritual, then, may be less likely to engage in manipulative behavior at work, to conceal errors at work, to falsify reports, and to engage in other such unethical behaviors.

Additional interesting results involved the other variables. We found a positive relationship between age and workplace ethics. Our data indicate that as employees grow older, they become more ethical in their view of questionable workplace behaviors. We also found that training in ethics, provided either by the employer or a professional association, and the existence of an employer code of ethics was positively related to workplace ethics; apparently, employers might be able to take proactive steps to influence their employees' views towards acceptable behavior in the workplace.

Our research has important implications for practicing managers. It might be beneficial to establish and promote a code of ethics for the organization, and to either provide training in ethics for employees or provide encouragement and support for employees to receive training through their professional association. Also, the results indicate that people who are more spiritual may also be relatively less likely to engage in unethical activities. Thus, organizations might be able to find an advantage in encouraging and/or developing spirituality among employees and incorporating spirituality in the selection process. However, managers must take into account anti-discrimination laws, particularly the Civil Rights Act of 1964, and ensure that both current and prospective employees are not subjected to unequal treatment. Managers should strive to create a workplace where tolerance is promoted.

Of late, there has been increasing interest in helping organizations integrate spiritual values into the workplace. Authors are suggesting that organizations should find ways to enhance spirituality in the workplace (e.g., Garcia-Zamor, 2003; McLaughlin, 2005; Pawar, 2009a; Karakas, 2010). Indeed, the *Journal of Organization Change Management* dedicated two issues to this topic (Neal and Biberman, 2003, 2004). Emphasizing and modeling spiritual integrity in the workplace can enhance the personal integrity and well-being of the individuals who are employed there, so that both employees and employers might benefit.

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### EFFICIENT METHODS IN SIMULATION MODELING AND PROGRAMMING

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#### **ABSTRACT**

In the real world related Monte Carlo simulation modeling and programming, application of efficient methods plays a very important role. We discuss some efficient methods, such as Bootstrap resampling, Variance Reduction, and random number reusing techniques. Our study shows that the reused pseudo random numbers are less random and less uniform. We provide a feasible method to improve the quality of reusing pseudo random numbers with detailed procedure of implementation.

### **Keywords**

Bootstrap, Variance Reduction, pseudo random number, Linear Congruential Generator, Reusing random number

#### INTRODUCTION

Due to the complexity of real world problems, Monte Carlo simulation may be the only feasible method of solving these problems. Simulation itself is efficient, accurate, and easy to implement. In Monte Carlo simulation modeling and programming, application of efficient methods plays a very important role.

We review and discuss some efficient methods in simulation modeling and programming. In general, we use all available information to fit system variables into existing distributions. Therefore, we generate system variables based on these fitted distributions. Sometimes, the fitted distributions are not reliable and not robust due to the limited data information. Bootstrapping is resampling technique without using a theoretical or simulation model. No distributions are needed to simulate the system. Under the limited situation of information, Bootstrapping is more accurate and easier to implement. This method generates samples from the data set directly.

The accuracy of simulation outputs are evaluated by the common standard: sample variance or standard error. We discuss some variance reduction techniques in simulation modeling, programming, and output analysis. Simulation efficiency means increasing the output accuracy without any additional simulation cost. We do know that if we want to improve accuracy of one more digit, we need to increase the iteration number of simulation by 100 times. The new cost of simulation is 100 times.

Monte Carlo simulation requires generating lots of random numbers. Reusing the generated random numbers is an efficient technique in simulation programming. In Monte Carlo simulation, all random numbers are pseudo random. They are deterministic numbers on a cycle with a period. They act like random numbers but are not true random numbers. There is a quality issue of reusing pseudo random numbers here. These reused random numbers are less uniform and independent. The period number is reduced. We provide a feasible method to pull the period back to the original level. Two different situations are discussed with detailed implementation procedures.

### EFFICIENT METHODS IN SIMULATION

In modeling and solving real world problems, sometimes the closed-form models do not exist due to the difficulty and complexity of these problems. In other situations, even if the closed-form models or solutions exist, the computational results cannot be derived in the time manner. For example, a fund manager has to decide what stocks should be dropped, kept, or added into the current portfolio. All analysis based on today's and previous historic data has to be done before the market open tomorrow. Monte Carlo simulation does provide an easy and efficient way to solve such complex problems [1] [4] [6] [7]. There are so many real world applications for computer simulation methods. For practitioners, simulation may be the only feasible resource to manage realities.

How to efficiently model and simulate a complex system is an important issue. In a general simulation procedure, all available information (data) is used to fit into an existing distribution. We generate samples from this distribution through simulation methods. Therefore we can evaluate the system performance measures from the simulation outputs. This method is referred as a parametric simulation [3] [6].

The parametric simulation has its limitations if the information is scarce. For example, we are interested in the average life time for a particular model of aircraft. The historic life time data is limited to a very small sample size. Small data set can be fitted into many distributions in statistics. However these fitted distributions (models) are not reliable. Bootstrapping is a nonparametric simulation method. It is a great method when only limited information is available. No theoretical and simulation models are needed. In addition to the efficiency, Bootstrapping is more accurate and easy to implement. We generate a sample directly from the available data set without using any distribution. This simulation method is also referred to as a resampling technique. It has become very popular in recent years for estimating such things as standard errors, confidence intervals, biases, and prediction errors. Its automatic nature and applicability to complicated problems have contributed to its popularity [3] [5].

A powerful tool, computer simulation is widely used in practice [1] [4] [6] [7]. However practitioners have paid less attention to the statistical analysis of computer simulation output results. How good are the simulation results? What is the common measurement for evaluating the accuracy of the simulation results? The variance is the common standard used to determine the accuracy for the significant and the swing digits [10].

In theory, the variance can be reduced if the sample size is increased. However, there is an extra cost of increasing the sample size. In general, if we want to improve the accuracy to one more digit, we need to run the simulation experiment 100 times more. That means the cost is 100 times greater [10]. Making the sample size bigger is not what we usually mean by variance reduction. There are many ways to reduce the variance in simulation implementations without any extra costs. Variance Reduction is a technique that reduces the variance of the point estimator to make the simulation experiment more efficient.

In system design (policy) evaluation, we should compare the alternative system under the similar conditions. Common Random Numbers are used in generating such systems for comparison [1] [6] [7]. The variance of the overall system performance (difference) is reduced due to the positive correlation between systems. Implementation of the Common Random Numbers technique can be difficult for some complex systems.

Antithetic Variates is a Variance Reduction technique in simulating a single system [1] [6] [7]. We generate pairs instead of a single variate. The pair itself is negatively correlated. We use the average of the pair as a single sample or observation point for simulation analysis. In theory, the variance will be reduced due to the negative correlation.

The main idea of Control Variates method is to take advantage of positive correlation between certain random variables to gain a variance reduction [1] [6] [7]. For example, in portfolio risk control, Coca Cola and Pepsi are in the same market sector. Their stock prices bounce up and down at the same time with positive correlation. We may use the stock price of Pepsi as a control variable to correct (adjust) the stock price of Coca Cola to obtain a variance reduction.

There are some other Variance Reduction methods, which involve high level implementation techniques, such as Importance Sampling, Stratified Sampling, and Conditioning methods [1] [6] [7].

In Monte Carlo simulation modeling and programming, random number generation is key. In the next two sections, we study the random number reusing method.

#### RANDOM NUMBER GENERATION

A great amount of random numbers is needed in Monte Carlo simulation implementation. Random numbers were originally generated either manually or mechanically using techniques such as spinning of wheels, dice rolling, or car shuffling [7]. The modern approach is to use computers to generate random numbers. Such random numbers are called Pseudo Random Numbers. By definition, random variates generated from the Uniform (0, 1) distribution are called random numbers.

In theory, pseudo random numbers are not random [1] [6] [7]. They are from a deterministic sequence of numbers in (0, 1). We assume that pseudo random numbers act like true random numbers.

The most commonly used random number generator is the Linear Congruential Generator (LCG), which was proposed by Lehmer [1] [6] [7]. This algorithm was used to generate pseudo random numbers in many software, such as Borland C/C++, IBM VisuaAge C/C++, Microsoft Visual/Quick C/C++, IMSL, Random class in Java API [9].

The LCG is defined by the recurrence relation:

$$W_{i+1} = (a W_i + c) \mod m$$

where a, c, n and  $W_0$  are non-negative integer constants.  $W_0$  is called the initial seed. This generates pseudo random integers,

$$W_i \in \{0, 1, ..., n-1\}.$$

The pseudo random numbers are,

$$U_i = \frac{W_i}{n}, i = 1, 2, ...$$

At most, this algorithm only produces n possible different numbers. If the generator has a full cycle, then its period is n. This means that all n numbers are different. Let  $U_n$  be any pseudo random number with period n, then it is a discrete uniform random variable in [0, 1] and

$$U_n \in \left\{ \frac{0}{n}, \frac{1}{n}, \frac{2}{n}, \dots, \frac{n-1}{n} \right\}.$$

This discrete Uniform (0, 1) random variable converges to the continuous Uniform (0, 1) random variable in distribution [9].

In a parametric simulation setting, there are mainly four different ways to generate system variates. The four methods are Inverse Transformation, Composition, Acceptance/Rejection, and Special Properties [1] [6] [7].

## ANALYSIS OF REUSING RANDOM NUMBER TECHNIQUE

For the simulation of a complex system, we are required to generate lots of random numbers. For example, the Acceptance/Rejection method is very costly in terms of using random numbers. In order to improve the simulation efficiency, can random numbers be reused as part of the simulation? Is there any quality issue on these reusing random numbers?

The reusing random number technique was introduced in [8]. For example, we want to generate the Double Exponential random variable with the following probability density function:

$$f(x) = \frac{1}{2} f_1(x) + \frac{1}{2} f_2(x),$$

here

$$f_1(x) = \frac{1}{\beta} Exp\left(\frac{x}{\beta}\right) I\{x < 0\}$$

$$f_2(x) = \frac{1}{\beta} Exp\left(-\frac{x}{\beta}\right) I\{x \ge 0\}.$$

We use the Inverse Transformation method to generate this variable. The simulation codes are listed as following,

• General Code:

```
u = rand() *call random number generator*

if (u < .5) then

u_1 = rand()

x = \beta \ln(1 - u_1)

else

u_2 = rand()

x = -\beta \ln(1 - u_2)

end if
```

• Efficient Code:

$$u = rand()$$
  
 $if (u < .5) then$   
 $x = \beta \ln(2u)$   
 $else$   
 $x = -\beta \ln(2(1 - u))$   
 $End if$ 

Comparing both codes, the efficient code only uses and reuses one random number. This code has the efficient advantage of reusing random numbers. What is the theoretical background of reusing random numbers? The theory is stated as follows.

**Theorem 1**: Let u be a Uniform (0, 1) random variable and  $C = \{u: 0 < a \le u \le b < 1\}$  be a condition. We define the conditional random variable  $u_c$  as follows

$$u_c = u | C$$
,

and then transfer  $u_c$  into the following random variable,

$$u_r = \frac{u_c - a}{b - a}.$$

Therefore  $u_r$  is Uniform (0, 1) random variable.

**Proof**: By definition,  $u_c$  is a Uniform (a, b) random variable. Then we enlarge (transfer) it from the sub

(a, b) into the whole interval (0, 1). This completes our proof:  $u_r$  is Uniform (0, 1) random

Here  $u_r$  is the random number for reusing. Theoretically speaking, this result is correct only for true random numbers. Due to the special property and structure of pseudo random numbers, we have a quality issue of reusing pseudo random numbers.

If a LCG has a full period n, there are only n different pseudo random numbers on the cycle. For example, if (a, b) = (0, .5), this implies that there are only n/2 different ready-to-reuse pseudo random numbers. Interval (0, .5) only contains 50% of the total different pseudo random numbers. Under the transformation, on interval (0, 1), at most, we have n/2 possible different values of pseudo random numbers. In the sense of uniformity and randomness, the quality of reusing pseudo random number is diminished. This means that the period was reduced.

How do we solve this problem? In order to maintain the same quality, we need to increase the period and pull it back to the original level. The technique of adding random numbers is one feasible way to produce a longer period [2]. The extra cost is negligible, since we are reusing random numbers. Here is the main result from [2]. If u and v are two independent Uniform (0, 1) variates, then u + v (modulo 1) is "closer" to Uniform (0, 1) than either u or v in the sense of uniform and independent.

Technically, how many random numbers do we need to add them up? The total length of each sub interval should not be less than 1, which is the length of the interval (0, 1). This number can be determined based on the values of a and b. For example, if (a, b) = (0, .5), we need at least two random numbers for addition. This method works while a and b are not fixed for every reusing pseudo random number. For example, pseudo random numbers are from the Acceptance/Rejection implementation.

For a single random number generator, if both values of a and b are fixed, adding up random numbers would not increase the period. We should use different random number generators to implement this idea. Specifically, we need equal numbers of generators and pseudo random numbers for this technique. In the sum combination of pseudo random numbers, only one pseudo random number should be selected from each generator. By doing this, the period quality problem will be resolved completely.

## **CONCLUSIONS**

We have discussed some important efficient methods in Monte Carlo simulation modeling, programing, and output analysis. The main result of this study is the technique of reusing pseudo random numbers. We derive the theoretical result to support this idea. The quality of reused random number has diminished in the sense of independent and uniform properties. The period of reused random number has reduced. We provide a feasible method of improving the length of the period. Adding random numbers is a way to create a longer random number generator period. We provide detailed steps of implementation in different situations.

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### A GENERALIZATION OF THE RELAXED CHOICE OF TECHNOLOGY MODEL

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### **ABSTRACT**

The relaxed choice of technology model in [1] is generalized. The generalization ensures that pollutants generated to satisfy both internal and external demands are controlled by choosing the right set of technologies.

### **INTRODUCTION**

The amount of pollutants produced when an item is manufactured depends on the raw material and the available technologies [1, 4]. The model in [1] shows that when an industry uses the best available raw materials for production, technology becomes a major factor in reducing industrial pollution. The objective of this paper is to generalize the relaxed model given in [1] so that the model could control the generation of pollutants needed for both internal and external demands.

The structure of the rest of the paper is as follows. In Section 2, the relaxed choice of technology model is presented. In Section 3, a generalization of the model is provided. An algorithm for solving the modified model is given in Section 4. In Section 5, we summarize our results.

## THE RELAX TECHNOLOGY MODEL

Consider an economy with n sectors each of which can produce at least one output. There are interactions among different sectors as an output from one sector can be used by other sectors for their production. As in the classical input-output model [4], we assume that prices are fixed and that demand quantities are stable. One period of activities will be considered.

The problem of interest is as follows: Given different technologies for the production of an item by sector j,  $j = 1, \ldots, n$ , which technology should be chosen by sector j so as to (1) satisfy permissible pollutant level for the sector, and (2) satisfy demand for sector j's output as much as possible.

Let

n = number of sectors in the economy

 $x_i =$ maximum amount of pollutants produced by sector j

 $m_j$  = number of different technologies available for the production of an output by sector j. Assume  $m_j \ge 1$ , j = 1, . . ., n

 $b^{j}$  = maximum amount of pollutants that sector j should produce in order to satisfy external demands for its services

 $a_k^j$  units of output of pollutants by sector j using technology i needed by sector k to produce one unit of its pollutants

Define the following matrices and vectors:

$$A^{j} = (a_{ik}^{j}), i = 1, ..., m_{j}, k = 1, ..., n, j = 1, ..., n.$$

 $E^{j}$  = an  $m_{j} x n$  matrix with 1s in column j and zeros in all other columns.

$$A = \begin{bmatrix} A^1 \\ \bullet \\ \bullet \\ A^n \end{bmatrix}, \qquad E = \begin{bmatrix} E^1 \\ \bullet \\ \bullet \\ \bullet \\ E^n \end{bmatrix}, \qquad Q^j = \begin{bmatrix} b^j \\ \bullet \\ \bullet \\ \bullet \\ b^j \end{bmatrix}, \qquad X = \begin{bmatrix} x_1 \\ \bullet \\ \bullet \\ \bullet \\ x_n \end{bmatrix}$$

If we set  $m = \sum_{j=1}^{n} m_j$ , then  $A^j$  is  $m_j \times n$ , A is  $m \times n$ ,  $m \ge n$ ,  $Q^j$  is  $m_j \times 1$ , and X is  $n \times 1$ .

## The Relaxed Model

The condition that the total amount of pollutants generated by sector j using technology i is equal to the amount required to satisfy inter-sector and external demands is equivalent to

Technology Choice Model (TCM):

$$(E^{j} - A^{j})_{i} X \leq Q_{i}^{j}, j = 1, ..., n,$$

$$X \geq 0$$
(1)

where  $i \in (1,...,m_j)$  and  $A_i = \text{row i of matrix A}$ . We note that  $(E^j - A^j)_i X \ge 0$ .

#### A GENERALIZATION OF THE RELAXED MODEL

The model in Section 2 is generalized in this section. The assumptions of the relaxed model apply.

Let  $p^j$  be the amount of pollutants that sector j should produce in order to satisfy internal demands for its goods and services; as well as meet emission restrictions. Define the vector  $P^j$  by

$$P^{j} = \begin{bmatrix} p^{j} \\ \cdot \\ \cdot \\ \cdot \\ p^{j} \end{bmatrix}$$

where  $j = 1, \ldots n$ .

The condition that the pollutants generated by sector j using technology i is at most equal to the amount produced for both internal and external demands is given by:

## Generalized Relaxed Technology Choice Model (GRTCM):

$$(E^{j} - A^{j})_{i} X \leq Q_{i}^{j}, j = 1,...,n,$$
 (2)

$$A_i^j X \le P_i^j \tag{3}$$

$$X \ge 0$$

where  $i \in (1,..., m_i)$  and  $A_i = \text{row i of matrix A}$ .

### **SOLVING THE GRTCM**

We consider solving the GRTCM in this section. Each sector j has  $m_j$  technologies to choose from for producing an item. Therefore, the total number of different combination of technologies available for the economy is  $T = \prod_{j=1}^n m_j$ . The problem can be solved by solving  $T = \prod_{j=1}^n m_j$  system of linear inequalities.

However, the condition  $X \ge 0$  makes it difficult to solve it efficiently using this approach. We will use a linear programming approach.

### Using a linear program

Solving the model by a linear program is preferable since that will take care of the non-negativity condition on the variables. Moreover, the use of linear programs allows for sensitivity analysis, a handy tool when there are changes in the pollution input – output coefficients or in the required pollutant levels. However, there is one problem with using a linear program. The linear programming approach requires an objective function, which is not available in the GRTCM model. This is easy to get around as given in the algorithms below.

Let S be a technology state of the economy. Then  $S = S(i_1,...,i_n)$  specifies the technology composition of the economy; where  $i_j$  means that sector j uses technology i in the production of its outputs. For each j, define

 $\alpha_i^j$  = amount by which technology i of sector j under estimates the total amount of pollutants that should be produced by sector j in order to satisfy external demands

 $\delta_i^j$  = amount by which technology i of sector j under estimates the total amount of pollutants that should be produced by sector j in order to satisfy internal demands

Define the following vectors:

$$\alpha^j = (\alpha_i^j), i = 1,...,m_j,$$

$$\delta^{j} = \left(\delta_{i}^{j}\right), \quad i = 1, ..., m_{j},$$

where j = 1, ..., n.

## Algorithm 1

1. For each technology state  $S = S(i_1,...,i_n)$ , solve the linear program  $LP_1(S)$ :

$$\operatorname{Min} z = \sum \left(\alpha_{i_j}^j + \delta_{i_j}^j\right)$$

St. 
$$\left(E_{i_j}^{\ j} - A_{i_j}^{\ j}\right) X + \alpha_{i_j}^{\ j} = Q_{i_j}^{\ j}$$
 (4)

$$A_i^j X + \left(\delta_{i_j}^j\right) = P_i^j \tag{5}$$

$$X \ge 0, \alpha_{i_i}^j \ge 0, \ \delta_{i_j}^j \ge 0.$$

where 
$$i_i \in S(i_1,...,i_n)$$
,  $i = 1,...,m_i$ ,  $j = 1,...,n$ .

2. If LP<sub>1</sub>(S) has a solution for any j,  $j \in (1,...,n)$ , with z = 0, then the solution solves the GRTCM. Otherwise, the GRTCM has no solution.

The following theorem shows that Algorithm 1 solves the GRTCM.

### Theorem 1

If the LP<sub>1</sub>( $\overline{S}$ ) has an optimal solution with objective function value  $z(\overline{S}) = 0$ , then the technology state  $\overline{S}(i_1,...,i_n)$  satisfies the pollutants emission requirement for the economy.

**Proof**: Suppose that there is a technology state  $\overline{S}(i_1,...,i_n)$  such that the  $\operatorname{LP}_1(\overline{S})$  has an optimal objective function value  $\operatorname{z}(\overline{S})=0$ . Then we have that  $\operatorname{\sum}\left(\alpha_{i_j}^j+\delta_{i_j}^j\right)=0$ . Since  $\alpha_{i_j}^j\geq 0$ ,  $\delta_{i_j}^j\geq 0$ , we have that for each  $\operatorname{j}$ ,  $\alpha_{i_j}^j+\delta_{i_j}^j\geq 0$ . Thus  $\operatorname{z}(\overline{S})=0$  implies  $\alpha_{i_j}^j=0$ ,  $\delta_{i_j}^j=0$ . That is, there is no under production of pollutants when  $\overline{S}(i_1,...,i_n)$  is applied to the economy. So  $\overline{S}(i_1,...,i_n)$  satisfies the pollution emission requirement of the economy. This completes the proof.

For each j, the pollutant quantity generated by the chosen technology gives exactly the amount that sector j should produce.

### Algorithm 2

Consider the LP2:

$$\max \quad \mathbf{z} = e^t \mathbf{X}$$

Subject to: 
$$(E-A)\mathbf{X} \leq Q$$

$$AX \le P$$
,  $X \ge 0$ 

where e = (1, ..., 1) is an  $n \times 1$  column vector.

If  $\overline{X}$  solves the LP2, then  $\overline{X}$  satisfies (E-A)  $\overline{X} \leq Q$ , A  $\overline{X} \leq P$ ,  $\overline{X} \geq 0$ , the system for the GRTCM. This observation justifies the following steps for solving the GRTCM.

**Step 1**: Determine all the technology composition of the economy.

**Step 2**: For each technology composition  $S(i_1, \dots, i_n)$ , solve the linear program:

LP(S): 
$$\max z = e^t X$$
  
Subject To  $\left(E^j - A^j\right)_{i_j} X \leq Q_{i_j}, i \in (1,...,m_j), j = 1,...,n$   
 $X > \mathbf{0}$ 

**Step 3**: If there exists a  $j \in \{1,...,n\}$  such that LP(S) has a solution  $\bar{X}$  with binding constraints, then  $\bar{X}$  solves the GRTCM. Otherwise, the GRTCM has no solution.

The technology chosen corresponds to the rows with binding constraints.

## **Example**

Consider an economy consisting of two sectors: auto and steel. Suppose that each sector has two technologies to choose from for producing steel and cars. Assume that in this economic system, the air pollution input-output coefficients and demand quantities are as given in Table 1.

Table 1								
Auto Steel								
Technology 1	0.25		1.00	0.056		0.12		
Technology 2	0.24		0.98	0.055		0.14		
Pollution for external demands (tons)		275			60			
Pollution for internal demands (tons) 225 40								

Table 1: Air pollution input-output coefficients

We want to select appropriate set of technologies that each sector can use to produce its products without exceeding the permissible levels.

### **Solution:**

The technology states are S(1, 1), S(1, 2), S(2, 1), S(2, 2), where, for example, S(1, 2) means that the auto sector uses technology 1 and the steel sector uses technology 2 for their productions.

For technology state S(1, 1), we have

$$A = \begin{bmatrix} 0.250 & 1.000 \\ 0.056 & 0.120 \end{bmatrix}, \quad E = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, E - A = \begin{bmatrix} 0.750 & -1.000 \\ -0.056 & -0.880 \end{bmatrix}, P = \begin{bmatrix} 275 \\ 60 \end{bmatrix}, P = \begin{bmatrix} 225 \\ 40 \end{bmatrix}$$

Solving the GRTCM by Algorithm 1 or Algorithm 2, we obtain X = (500, 100), where the answers may vary due to truncation errors. The rest of the solutions are given in Table 2.

Table 2								
	S(1, 1)	S(1, 2)	S(2, 1)	S(2, 2)				
$(x_1,x_2)$	(500, 100)	(490.625, 92.9682)	(489.9661, 99.3615)	484.7162, 95.290085)				
$\begin{bmatrix} E - A \\ A \end{bmatrix} X - \begin{bmatrix} Q \\ P \end{bmatrix}$	(0,0,0,0)	(0, -7.0313, -9.3750, 0)	(0, 0, -10.0339, -0.6385)	(0, -4.7099, -15.2838, 0)				

Table 2: Solution to all technology states

The solution corresponding to the technology state S(1, 1) is the one that satisfies the permissible pollutant levels and also has binding constraints. The binding constraints ensure that the sectors satisfy all their demands. Hence, the auto sector should use technology 1 and the steel sector technology 1, respectively, in their productions.

### CONCLUSION

The relaxed input-output pollution model formulated in [1] is generalized. The generalized model controls pollutant quantities needed for internal and external demands. The method is based on the input-output pollution coefficients.

The selection of appropriate set of technologies is done by solving the model using a linear program. The use of linear program makes it possible to perform sensitivity analysis when problem parameters need to be changed.

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### ON THE FAIRNESS OF THE GEORGIA OFFICIAL SPELLING BEE RULES

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#### ABSTRACT

We investigate the fairness of the Georgia Official Spelling Bee Rules. This is an important issue, since many students across the State of Georgia participate in such competitions. We perform the simulation optimization method and generate the Spelling Bee system with the Georgia Official Rules. Our simulation outputs show that the Georgia Official Spelling Bee Rules are not fair and are biased due to the random order of seat allocation. We also derive some theoretical results which are consistent with our simulation results.

### **Keywords**

Spelling Bee, probabilistic analysis, simulation modeling, output analysis

### **INTRODUCTION**

Spelling Bee is a competition designed for students at any grade between 4th and 8th to spell English words [4] [6]. In 1925, Nine US newspapers started the National Spelling Bee. When the Scripps Howard News Service took over the sponsorship of the program in1941, the name was changed to the Scripps National Spelling Bee. The competition's main objective is to help students to improve spelling, increase vocabulary, learn concepts, and develop correct English usage [6].

The Georgia Association of Educators (GAE) is the sponsor for the Georgia State Spelling Bee program [4]. This program offers Georgia students an opportunity to exhibit their proficiency in the art of spelling. The local Spelling Bee procedures, rules, and regulations are determined by the GAE.

In the general procedure of the Georgia Spelling Bee program, there are two phases [4]. In Phase I, the final two spelling winners will be determined. In Phase II, the champion spelling winner will be determined. The performance of all spellers is evaluated by the official rules [4]. Because many students across the State of Georgia participate in such competitions, it is important to investigate the fairness of the Georgia Official Spelling Bee Rules.

We study the fairness of the Georgia Official Spelling Bee Rules. Some theoretical results are derived. In probability [1] [7], we show that Georgia Official Spelling Bee Rules are not fair and are biased due to the random order of seat allocation. The current Spelling Bee system does not provide a fair measurement to evaluate all spellers' performance. The evaluation standard is not equally likely.

Due to the high complexity of the Spelling Bee models, theoretical results are difficult to derive. Computer simulation is a powerful tool for solving such real-world problems [2] [3] [5]. We use the simulation based performance evaluation method to model and simulate the Spelling Bee system. The implementation of simulation models is based on the Georgia Official Spelling Rules [4]. Our simulation results are consistent with our theoretical results, which also indicate the unfairness of the official rules.

In sensitivity analysis, our results show that the Spelling Bee system becomes more and more unfair (sensitive) when the difficulty level of spelling words goes up.

According to our study, the Georgia Spelling Bee system is unfair based on its current official rules. Most people will not notice that the system is unfair due to the varying levels of speller's preparation. The degree of how unfair the competition is seems less severe because the better spellers tend to stay in longer. Here, "Better spellers" means their level of preparation is high. Therefore, the Georgia Spelling Bee Official Rules need to be modified. There are other ways to make the Spelling Bee completely fair for all spellers. One feasible way is to adopt the Official Rules from the Scripps National Spelling Bee system.

### THE GEORGIA OFFICIAL SPELLING BEE RULES

Georgia Official Rules of the school, system, district, and state level Spelling Bees have been using statewide for so many years. In a general Spelling Bee setting, there are n spellers. Each speller has been assigned a seat randomly with a unique label number from #1 to #n. The spelling order under the Georgia official rules is the ascending order. In each round, the speller with a smaller seat label number goes first.

The Georgia Spelling Bee has two phases. Phase I consists of single elimination. Final two spelling winners will be determined by the following Rule #5 of the Georgia Official Spelling Bee Rules [4]:

"5. When a speller fails to spell a word correctly, he or she must step out of the Bee; and a different word shall be given to the next speller, except as provided for in Rules 13-15 of this section."

In Phase II, the champion spelling winner will be determined by the following official rules #13, #14, and #15 [4]:

- "13. When only two spellers remain in the Bee, the Bee procedure changes. When one speller misspells a word, the other speller shall be given an opportunity to spell that same word. If the second speller spells the word correctly, plus the next word on the caller's list correctly, then he or she shall be declared the Winner."
- "14. When one of the last two spellers misspells a word and the other, after correcting the error, misspells the new word called to him or her, then the misspelled new word shall be referred to the first speller. If the first speller succeeds in correcting the error in the word and correctly spells the next word on the caller's list, then he or she shall be declared the Winner."
- "15. When both spellers misspell the same word, both shall continue in the Bee, and the one who first misspelled the word shall be given a new word to spell. The Bee shall then resume under Rules 13-14."

If a speller is successful at the school system level, then he/she will have the opportunity to advance to the district competition. The district winners and runners-up compete in the state spelling bee with the state winner advancing to the national spelling bee [4].

## PROBABILISTIC ANALYSIS

As we discussed in the previous section, there are two phases in the Georgia Spelling Bee implementation. For a particular example in Phase I, if the first n-2 spellers are eliminated in the first round, the last two spellers are automatically being winners and will enter Phase II for further competition. If that is the case, we even do not have a chance to evaluate their performance, whatever their intelligence levels are. Thus we do have a reason to challenge the Georgia Official Rules. Does

every speller have the same chance to be the final two winners in Phase I? Do both final two winners have the same chance to be the champion winner in Phase II?

In order to ensure accurate results, we assume that all spellers have a uniform level of preparation. This means that all spellers have the same probability of spelling a word correctly. Furthermore, this uniform assumption also applies to the probability of spelling a referred word correctly in the next section.

Let p be the probability of spelling a word correctly for all spellers and let q be the probability of spelling a word incorrectly, which is equivalent to 1-p. By the model assumption, p is the level of preparation. Later on, we also use the term of passing rate for p. For the simplicity of the notation, we define  $p_i$  be the probability that the  $i^{th}$  speller is the first one eliminated in the first round  $(1 \le i \le n)$ . Who has the highest probability of being the first one eliminated in the first round of Phase I? It is a conditional probability. The condition is "be the first eliminated speller in the first round". We derive this probability now.

By definition, the i-1 spellers in front of the i<sup>th</sup> speller (with smaller seat label numbers) have spelled all words correctly and the  $i^{th}$  speller is the first one to spell the word incorrectly. Therefore,

$$p_i = p * p * ... * p * q = p^{i-1}q = p^{i-1}(1-p), for 1 \le i \le n.$$

Since 0 , this implies,

$$p_1 > p_2 > p_3 > \dots > p_n$$
.

The probability decreases as the seat label number increases. The speller with the seat label #1 has the highest probability of being the first one eliminated in the first round, and speller with the seat label #n has the least probability. This result disproves the fairness of the Georgia Spelling Bee system. In general, the speller with a greater seat label number has a lower probability of being eliminated in Phase I.

We summarize our results into the following table at different preparation levels for a 5 spellers system.

<b>Table 1</b> : The probabilities of being the first one eliminated
--

р	$p_1$	$p_2$	$p_3$	$p_4$	$p_5$	Range
0.10	0.90	0.09	0.009	0.0009	0.00009	0.89991
0.30	0.70	0.21	0.063	0.0189	0.00567	0.69433
0.50	0.50	0.25	0.125	0.0625	0.03125	0.46875
0.70	0.30	0.21	0.147	0.1029	0.07203	0.22797
0.90	0.10	0.09	0.081	0.0729	0.06561	0.03439

At each row, all probabilities are in descending order. The range value decreases as p value goes down. This indicates that the Georgia Spelling Bee system is sensitive to lower level of preparation p. From a different point of view, the p value can be explained as the level of spelling given words. When the difficulty of the words increases, the unfairness of the Georgia Spelling Bee Rules becomes more and more unfair.

Let's consider the last round situation in Phase I now. We are assuming that there are only the top three spellers left. Without loss of generality, we mark them with seat label numbers: #1, #2, and #3. The level of preparation for all three is still p. What is their probability of entering finals in the last round? Here, last round means that we have to eliminate only one speller to end Phase I. All probabilities of the remaining part of this section are conditional on the last round assumption. We define  $p_i$  be the probability that the  $i^{th}$  speller is entering finals in the last round  $(1 \le i \le 3)$ .

For the #1 seat speller, there are two cases of entering finals:

- #1 and #2 spellers are entering finals, or
- #1 and #3 spellers are entering finals.

Therefore

$$p_1 = p * p * (1 - p) + p * (1 - p) = (1 - p)(p + p^2).$$

For the #2 seat speller, there are also two cases of entering finals:

- #1 and #2 spellers are entering finals, or
- #2 and #3 spellers are entering finals.

We have

$$p_2 = p * p * (1 - p) + (1 - p) = (1 - p)(1 + p^2).$$

Similarly, for the #3 seat speller, the two cases are:

- #1 and #3 spellers are entering finals, or
- #2 and #3 spellers are entering finals.

The probability is

$$p_3 = p * (1 - p) + (1 - p) = (1 - p)(1 + p).$$

For a simple algebraic comparison, we have,

$$p_1 < p_2 < p_3$$
.

This result also confirms the same seat order advantage: the #3 speller has the highest probability of entering finals while the #1 speller has the lowest. Detailed probabilities at different levels of preparation are listed in the following table.

**Table 2**: The probabilities of entering finals

p	$p_1$	$p_2$	$p_3$	Range
0.10	0.099	0.909	0.990	0.891
0.30	0.273	0.763	0.910	0.637
0.50	0.375	0.625	0.750	0.375
0.70	0.357	0.447	0.510	0.153
0.90	0.171	0.181	0.190	0.019

This table shows that all probabilities of entering finals are increasing as the seat number increases at any levels of preparation. Based on the last column, the current system is very sensitive when the level of preparation is low. Table 2 also shows an important result. When the word level of difficulty is very high, there is a large gap in probability of entering finals between #1 speller and the group of #2 and #3 spellers. From the first row of Table 2, the passing rate for a given word is 10%. The chance of entering finals for #1 is about 10%. However, the chance for #2 is about 91%, and for #3 is about 99%. There is a huge seat advantage for the last two spellers.

### SIMULATION MODELS AND OUTPUT ANALYSIS

Due to the complexity of the Phase II model, theoretical results are difficult to derive. We use computer simulation, a powerful tool, to simulate the Georgia Spelling Bee system. Simulation output analysis is performed to evaluate the fairness of the current system.

The overall simulation model contains both phases. We carry all notations and assumptions from previous sections. Java is used here for programming. There are 4 parameters in the input modeling part: the level of preparation p, the total number of speller n, the total number of simulation iterations m, and the repassing rate  $p^*$ . The re-passing rate is only defined for the Phase II part. From the official rule #13, if one speller misspells a word, the other speller shall be given an opportunity to spell that same word. It is reasonable to assume that the "other" speller has a higher chance to pass the same word, because she or he at least can eliminate one wrong spelling combination. This chance or probability is called the re-passing rate. Obviously, it is higher than the normal passing rate p.

First of all, we generate the overall Georgia Spelling Bee system. There are 5 spellers in this system. The total number of iterations is 10,000,000. This implies that all 4 digits after decimal point of the simulation output are significant in accuracy [8] [9]. We will perform the simulation output analysis to check if the current system is fair to all spellers. Do they have the equal chance to become the champion at the same level of preparation? The answer is no. The simulation output data is listed in the following table:

**Table 3**: The probabilities to be the champion

	Tubic	e. The pro	oud miles	to oc the c	mampron		
p	$p^*$	$p_1$	$p_2$	$p_3$	$p_4$	$p_5$	Range
0.10	0.19	0.0461	0.0473	0.0483	0.3672	0.4911	0.4450
0.30	0.37	0.1048	0.1166	0.1285	0.2524	0.3977	0.2929
0.50	0.55	0.1330	0.1519	0.1741	0.2278	0.3132	0.1802
0.70	0.73	0.1551	0.1724	0.1927	0.2206	0.2592	0.1041
0.90	0.91	0.1823	0.1904	0.1991	0.2088	0.2194	0.0371

We have the following results, which are consistent with the results from the previous section.

- Probability to be the champion increases as the seat number increases.
- The system becomes more and more unfair (sensitive) as the level of preparation goes down. This result is based the range value in the last column of Table 3.
- The last two spellers have huge seat advantage to become the champion.

From row 1 of Table 3, for a close look, the chances of becoming the champion for #1, #2, and #3 spellers are about 4.61%, 4.73%, and 4.83%. But the chances for the last two spellers are 36.72% and 49.11%. The gap is huge and significant.

Furthermore, we simulate the Phase II part of the current system separately. Phase II is designed for the last two winners to compete for the champion, and is determined by official rules #13 - #15. Our simulation output also shows that Phase II is not fair. The output is listed in the following table.

**Table 4**: The probabilities to be the champion

p	$p^*$	$p_1$	$p_2$	Range
0.70	0.75	0.4598	0.5402	0.0804

The #2 speller has the seat advantage too. The probability of the #2 speller to win is about 17% higher than the probability of #1 speller due to the seat order.

#### CONCLUSIONS

In conclusion, the Georgia Spelling Bee system provides an unfair competition. This system is determined by the Georgia Official Spelling Bee Rules [4]. The chance for all spellers to win the championship is not equally likely even if they have the same level of preparation. The major reason to cause this problem is the random seat assignment. Spellers with higher seat label numbers have a higher chance of becoming the champion. The unfairness of this system becomes more and more serious as the level of spelling words becomes harder and harder. The last two spellers with the largest seat label numbers have a significant (huge) seat advantage (chance) for entering the finals.

Every year, many students across the State of Georgia participate in such competitions. The fairness of the current Georgia Spelling Bee system is an important issue. Therefore, it is imperative that the problem pointed out in this study be fixed.

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# **Creating a Business Analytics Course**

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#### **ABSTRACT**

Analytics has become a hot topic in the business world. To adequately prepare students for a future with more analytics and data driven decision making, our business curriculum should have course work in business analytics. Most of our courses are supported by one or more textbooks but business analytics is not an academic discipline with a selection of established textbooks. This paper examines the new Business Analytics textbook by James Evans and its appropriateness for such a business analytics course that would focus on analytics methods, models and decisions.

# **INTRODUCTION**

The driving force behind this paper is the desire to create an introductory course in business analytics for graduate students in business. An Internet search yields few options for an academic textbook for business analytics. The "classic" in the analytics area is *Competing on Analytics: The New Science of Winning* by Thomas H. Davenport and Jeanne G. Harris [1] and they followed up with another book *Analytics at Work: Smarter Decisions Better Results* [2]. However these books make the case for analytics and look at the bigger picture of how analytics can add value to the business enterprise rather than on the analytical tools used in analytics. Neither of these books was written as a textbook for a university level course.

Pearson Education has published a book *Business Analytics: Methods, Models, and Decisions* by James R. Evans [3] that was written as a textbook for upper level business undergraduates or as an introductory course for business graduate students. Pearson is also preparing a website and supporting materials for such a course. This paper will give an overview of the book and present a plan for using it as the text for a master's level course for MBA and other business students during the fall semester. "In 2011, the U.S. Bureau of Labor Statistics predicted a 24% increase in demand for professionals with analytics expertise." With this one statement, James Evans provides the necessary justification for the inclusion of a basic business analytics course in the graduate offerings for business students. The proposed plan for utilizing the book assumes that students enrolling in this course will have the basic understanding of business statistics

#### OVERVIEW OF THE BOOK

The stated purpose of the book is to provide "undergraduate business students and introductory graduate students with the fundamental concepts and tools needed to understand the emerging role of business analytics in organizations, apply basic business analytics tools in a spreadsheet environment, and to communicate with analytics professionals to effectively use and interpret analytic models and results for making better business decisions." "The book is uniquely designed to present the emerging discipline of business analytics in a unified fashion consistent with the contemporary definition of the field." Business analytics covers a variety of academic disciplines ranging from the area of application in a standard business functional area, to technology and software for data acquisition and storage, to analysis of the data, and finally the determining of tactical strategies to leverage the acquired knowledge to improve enterprise based on a defined metric(s). This text focuses mainly on the analysis of data, but within a business context.

The book has learning objectives at the beginning and homework problems at the end of each chapter with total of 415 exercises and an average of 23 per chapter. A database for a fictitious company, Performance Lawn Equipment, is provided and for each chapter a case exercise is given "for applying the tools and techniques introduced in the chapter." The current edition of the text does not have support from Pearson's MyLab course management system that provides online grading of homework but the senior acquisitions editor indicated that the plan is to make it part of the package for a second edition of the text.

The Business Analytics textbook is divided into five parts and eighteen chapters:

- Part 1: Foundations of Business Analytics (2 chapters)
- Part 2: Descriptive Analytics (5 chapters)
- Part 3: Predictive Analytics (5 chapters)
- Part 4: Prescriptive Analytics (5 chapters)
- Part 5: Making Decisions (1 chapter)

Pearson provides online instructor resources to accompany the text. To obtain access to these the instructor must request and register for an "IRC access code." At the time of writing this proposed paper the following resources are not yet available but should be available at some time in July 2012. These include:

- Companion Website for Business Analytics
- Instructor's Solutions Manual (Download only) for Business Analytics
- Test Bank (Download only) for Business Analytics
- TestGen® Computerized Test Bank for Business Analytics

The text uses Excel as the platform for data, but several topics require using additional software. The text provides images of the dialogue boxes so illustrate how perform the prescribed analysis in Excel or other software. A purchase of a new text provides the buyer with a code to provide access to "Subscription Content." This content includes the Risk Solver Platform for Education and Oracle Crystal Ball Trial. Almost all of Part 1 and Part 2 can be done with Excel alone. In following chapter by chapter course outline we indicate approximate portion (based number of pages in the text) of each chapter that can be covered using only Excel 2010.

## CHAPTER BY CHAPTER COURSE OUTLINE

This course outline does not include Chapter 14: Applications of Linear Optimization, Chapter 15: Integer Optimization or Chapter 16: Nonlinear and Non-Smooth Optimization. These chapters are available for those who would like to cover these topics, however we currently offer a management science class where these topics best fit and our recommendation is to not try to cram too much content into a course. Hence chapters 14, 15 & 16 are omitted from the course outline. This decision favors allowing adequate time for students to digest and use the material presented in the course, otherwise students do not have time to truly obtain a working grasp of all that was thrown at them. The rough allocation of lectures assumes that the course will be taught twice a week for 16 weeks.

# **Part 1: Chapter 1 – Introduction to Business Analytics**

This chapter provides a good overview of the general subject of business analytics, including a thorough definition, as well as the evolution and scope of the subject. According to Evans, "business analytics is the use of data, information technology, statistical analysis, quantitative methods, and mathematical or computer-based models to help managers gain improved insight about their business operations and make better, fact-based decisions." The information in this chapter could be quickly covered in the first lecture of the semester. Areas that should be stressed include data types and classifications, decision model types (descriptive, predictive, and prescriptive) and problem solving methodology. This chapter can be covered using only Excel 2010.

# Part 1: Chapter 2 – Analytics on Spreadsheets

This chapter explains the basic Microsoft Excel functions that business students need to know in order to perform spreadsheet calculations and analyses. The textbook utilizes Microsoft Excel 2010 for Windows, as well as the add-on feature Risk Solver (student access code found on the front cover of the text; downloading information is found on the textbook's Companion Website). Students should already have a basic understanding of the basic functions of Excel through MGMT524, but several functions may be new and are worth going over. These include NPV, logical functions and lookup functions (index, match). The material in this chapter could also be covered in the first lecture. This chapter can be covered using only Excel 2010.

# Part 2: Chapter 3 – Visualizing and Exploring Data

Evan's states, "Making sense of large quantities of disparate data is necessary not only for gaining competitive advantage in today's business environment but also for surviving in it." This chapter deals with the Excel functions that can be used to create charts and graphs, filter records, construct a frequency distribution table and histogram, cross tabs (or contingency table) and pivot tables. Students will most likely have had some exposure to many of these functions. Time, however, should be devoted to scatter charts and pivot tables, as they are extremely valuable tools. This chapter can be covered using only Excel 2010.

## Part 2: Chapter 4 – Descriptive Statistical Measures

This chapter provides an overview of fundamental statistical terms and concepts. Because of the statistics prerequisite requirements, students should have familiarity with much of the material in this chapter and it can be covered in one lecture. New concepts, such as the process capability

index and return to risk should be introduced. In addition, Excel's Descriptive Statistic tool and Data Analysis Correlation tool are utilized in this chapter. This chapter can be covered using only Excel 2010.

# Part 2: Chapter 5 – Probability Distribution and Data Modeling

"Characterizing the nature of distributions of data and specifying uncertain assumptions in decision models relies on fundamental knowledge of probability concepts and probability distributions." Many of the probability basic concepts and definitions should have been covered in the prerequisite class so a review, covered in one lecture is all that should be necessary. However, understanding that random samples can come from different distributions (normal, uniform, Bernoulli, exponential, etc.) and their impact on modeling are important concepts. Time should be spent going over how to use the Risk Solver Platform Distribution Function and how to apply the goodness of fit test to distributions (chi-square, Kolmogorov-Smirnov and Anderson-Darling). About 95% of this chapter can be covered using only Excel 2010.

## Part 2: Chapter 6 – Sampling and Estimation

"Sampling is the foundation of statistical analysis." However, like the previous chapters that pertained to statistics, much of this chapter is really prerequisite knowledge, and therefore, can be covered in one lecture. Important concepts that should be emphasized include sampling methods, sampling error, sampling distributions, and confidence and prediction intervals. This chapter can be covered using only Excel 2010.

# **Part 2: Chapter 7 – Statistical Inference**

This is the last chapter that should be considered as review material. A key component of the chapter is the important concept of hypothesis testing. "Hypothesis testing is a technique that allows you to draw valid statistical conclusions about the value of population parameters or differences among them." T-tests, ANOVA and the Chi Squared Test for Independence are also included in this chapter. This chapter can be covered using only Excel 2010.

# Part 3: Chapter 8 – Predictive Modeling

According to Evans, "Predictive modeling is the heart and soul of business analytics." This chapter focuses on the fundamentals of modeling building, beginning with several simple examples, such as those that incorporate linear trends, and then moving into more complex ones involving uncertainty and what-if analysis. These concepts can be demonstrated through the use of Excel's data tables, Scenario Manager and Goal Seek, all of which can be found within the What-If Analysis menu in the Data tab. Parametric sensitivity analysis, a systematic method of what-if analysis, can be achieved through the Risk Solver Platform, which can easily create one-and two-way data tables and tornado charts. This chapter is the first that introduces material that will most likely be new to the students; two class periods should be devoted to it. About 75% of this chapter can be covered using only Excel 2010.

# Part 3: Chapter 9 – Regression Analysis

This chapter focuses on two broad categories of Regression Analysis: cross-sectional data and time-series data. "Regression analysis is tool for building statistical models that characterize relationships among a dependent variable and one or more independent variables, all of which are numerical." Even though linear regression is a topic that students should have seen in a

prerequisite course, its importance justifies spending time reviewing it in class. A review of assumptions, residual output and Excel functions would be beneficial to students. Other topics that should be covered include hypothesis testing, confidence intervals, building good models, correlations and multicollinearity. Finally, a review of the use of dummy variables, in order to incorporate categorical variables, should also be included. This chapter can be covered using only Excel 2010.

# **Part 3: Chapter 10 – Forecasting Techniques**

This chapter introduces three categories of forecasting methods: qualitative and judgmental techniques, statistical time-series models and explanatory/causal methods. "Managers require good forecasts of future events in order to make good decisions." Three class lectures should be devoted to this important topic. During the first, qualitative and judgmental forecasting methods, such as the Delphi method and indicators/indexes, should be discussed. The bulk to the class period should be devoted to the statistical time-series approach of simple moving averages and how it is implemented in XLMiner. In the second lecture, the concept of error metrics and forecasting accuracy should be explored. In addition, the sections on simple exponential smoothing and regression forecasting can be covered. Finally, in the third lecture, trends with seasonality (Holt-Winters) and forecasting with causal variables (econometrics) can be addressed. About 50% of this chapter can be covered using only Excel 2010.

# Part 3: Chapter 11 – Simulation and Risk Analysis

Businesses spend a large amount of time analyzing their exposure to risk, or "the probability of an undesirable outcome," and searching for ways to reduce it. One of the best ways to do so is to build models and run simulations. For this reason, several lecture periods should be devoted to this chapter. In the first lecture, the concept of a Monte Carlo simulation should be introduced. "Monte Carlo simulation is the process of generating random values for uncertain inputs in a model, computing the output variables of interest, and repeating this process for many trials in order to understand the distribution of the output results." These simulations can be performed using the Risk Solver Platform. During the second lecture, the various charts and reports associated with risk analysis (sensitivity, overlay, trend, box-whisker) can be introduced. And lastly, the concepts of fitted and custom distributions and correlating uncertain variables can be addressed. In the second and third lectures, models illustrating the various techniques can be employed. This chapter virtually requires additional software beyond Excel 2010.

# Part 3: Chapter 12 – Data Mining

"Data mining is a rapidly growing field of business analytics that is focused on better understanding characteristics and patterns among variables in large databases using a variety of statistical and analytical tools." Four approaches to data mining are illustrated in this chapter: data exploration and reduction, classification, association and cause-and-effect modeling. Because of the volume of material in this chapter, several lectures should be reserved for the topic. The issue of data exploration and reduction, through the use of cluster analysis, can be addressed in the first class period. The concept of classification, the largest of the topics, may be able to be introduced then, but continued during the second, along with discriminant analysis and logistic regression. Association rules and cause-and-effect modeling should be covered in the third lecture. This chapter virtually requires additional software beyond Excel 2010.

# Part 4: Chapter 13 – Linear Optimization

"Optimization is the process of selecting values of decision variables that minimize or maximize some quantity of interest and is the most important tool for prescriptive analytics." For this reason, four or five lecture periods should be reserved for the topic. In the first lecture, the process of building an optimization model should be identified. The translation to the spreadsheet environment and the use of Excel Solver can also be covered. Interpreting the optimization reports (sensitivity, shadow price) can be discussed in the second lecture. The graphical interpretation of linear optimization (feasible regions, etc) can reserved for the third lecture. Note: If time becomes short, the graphical section can be eliminated. About 85% of this chapter can be covered using only Excel 2010.

# **Part 4: Chapter 17 – Optimization Models with Uncertainty**

The final two lectures on this topic should be devoted to Chapter 17, which introduces uncertainty into linear optimization models. One lecture can address optimizing risk analysis and the other, optimizing Monte Carlo simulations. This chapter virtually requires additional software beyond Excel 2010.

# Part 5: Chapter 18 – Decision Analysis

This chapter, which should encompass the last lecture, addresses "the philosophy associated with making decisions and provide[s] techniques for incorporating uncertainty and risk in making decisions." The main concept is that of a decision tree. The fundamentals of a decision tree and how to implement one in Risk Solver should be covered. About 25% of this chapter can be covered using only Excel 2010.

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# Simulation Visualization Rhetoric and Its Practical Implications

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#### **ABSTRACT**

Modeling and simulation has moved far beyond simple data representation into the world of visual communication over the past 15 years; ultimately, the acceptance of M&S within mainstream science and society will depend on the results that are produced visually. A simulation's function is of primary importance to its end result, but it cannot be denied that the discipline of M&S now prizes fancy graphics to communicate. Rhetorical methodological decisions have the greatest impact on the end user, and considerations that bring visual rhetoric to modeling and simulation should be examined as a necessity to application. This paper will expose the community to existing research on the rhetoric of visualization, highlights and addresses current problems with simulation visualization, and bring visualization's inherent rhetoric to the forefront of consideration and utilization.

## INTRODUCTION

The considerations of the philosophical underpinnings of visualization have been left on the sidelines while researchers chase the latest technological visualization applications for modeling and simulation (M&S). Visual rhetoric in M&S is also an effect of the latest technology that deserves closer observation into its uses. Our focus in this paper is to develop the view, both now and in the future, of rhetoric's importance to simulation visualization. Visualization creates and uses images, diagrams, and/or animations to explain models, display simulations and their realtime results, and even, in some cases, for validation. When we study the epistemology of visualization, the means by which we represent data and communicate it to others is not only a matter of how relevant data is displayed but why the producer of the simulation chooses particular means of visual communication. It is rhetorical methodological decisions that have the greatest impact on the end user and there is a necessity to examine closer the considerations that bring visual rhetoric to modeling and simulation. Visualization is a serious design activity that demands deeper conceptual investigation, trumping software and programming as the initial act of the visualization process. As foundations of M&S are currently being addressed, the importance of how and why M&S is presented cannot be overlooked. A wealth of philosophical investigations exists in both arenas but joint consideration needs to be applied for a deeper understanding of current and future uses of visualization (Collins and Knowles-Ball, 2012)

M&S has moved far beyond simple data representation into the world of visual communication over the past 15 years. The advancement of technology available for conducting visualization has been expanding at the same rate as the changes of methodologies available for conducting M&S. M&S practitioners are immersed in data, algorithms, and validation, and yet these are not the impressive gaming level high definition realistic quality graphics that dazzle M&S customers; thus rhetoric emerges in the means of visual communication. Effective simulation visualization is a thing of true value, not simply eye candy or media fodder. The visual argument of data displays and statistics has been examined in the past, but the rhetorical appeals at play in M&S is uncharted territory, ripe for examination.

The need for a simulation to visually appeal and argue a directive clearly comes into play in the modern era. Consider Figure 1 for example, a red square is no longer an adequate representation of battle tank when compared to a highly rendered graphic, even though they both represent the same data. The function of simulation is of primary importance to its end result but it cannot be denied that the discipline of M&S now prizes fancy graphics to communicate. The underpinnings of visualization are deeply rooted in the power of an image to convey both quantitative and qualitative narrative structures as effectively as alphanumeric language systems. Is the visual clarity, organization, and visual understanding still secondary to the data? Are the form and the function so far removed from one another? It will be argued that the visualized form creates the narrative structure of the simulation, creating expectation and leading to bias.

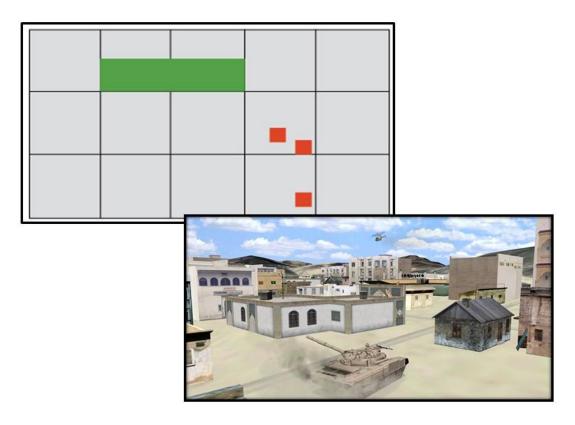


Figure 1: Comparing old and new representation of a tank

This paper is designed to give a brief overview of the simulation visualization rhetoric. The following three sections give a brief overview of visualization, visual rhetoric and how they are related; this includes a discussion on some of the current problems with simulation visualization. The final sections of the paper discuss some possible solutions and conclusions are given.

# VISUALIZATION BACKGROUND

Computer simulations are a construction of mathematical algorithms and data; this statement is not meant to trivialize simulation, as many modern simulation are incredibly complex and involve tens of thousands of lines of code, it is meant to explicitly point out what they are. However, most people, with the exception of the simulation developers, will see a simulation though its visualization, the graphics used to represent the inner workings of the simulation. Simulation visualizations has been defined as "a process that generates visual representation such as imagery,

graphs, and animations, of information that is otherwise more difficult to understand though other forms of representation, such as text and audio" (Sokolowski and Banks, 2010). Though this definition is not necessarily universally accepted, it acts as a working definition for the purposes of this paper.

A computer simulation could simply be presented as a series of equations and tables but, even to those trained to read such things, this can be cumbersome and difficult to follow. By representing the different elements of simulation using visualization, we are able to gain a concise clarity of the simulation's purpose and function; this clarity can thus organized in our minds to give an understanding of the simulation's purpose and results. Achieving this clarity for the viewer is no simple task and the art of visualization is discussed at length by Edward Tufte (Tufte, 2001) and William Cleveland (Cleveland, 1993).



Figure 2: Screen-shots from the computer game Doom which show the advancement of computer graphics over the last 15 years  $\frac{1}{2}$ 

Over fifteen years ago, the film *Jurassic Park* and the computer game *Wolfenstein 3-D* were released. The graphics used in *Jurassic Park* were so revolutionary that people in cinemas all-round the country stood up and clapped at its finish. *Wolfenstein 3-D* impressed gamers with its fast-paced 3-D gaming, the like of which had not been seen before, and it has become known as the grandfather of 3-D shooters (1UP Games, 2010). If Jurassic Park was released today, it would seem heavily dated and unlikely to receive positive reviews; similarly, *Wolfenstein 3-D* would be seen as retro gaming and would be placed in a genre of gaming where 3-D graphics are now the accepted, and expected, standard. Fifteen years has seen a dramatic change in our acceptance and expectations of visualization.

As visualization becomes more realistic and easy to integrate within a simulation, its role within the simulation process is increased. Thus what started as a simple add-on to many simulations is now an integral part of it. This means that the influence of visualization on a simulation's design and output has grown over the years to a point where people are now starting to questions its role.

Paul Roman highlighted the impact of visualization's influence in his paper: "Garbage In, Hollywood Out" (Roman, 2005). The title of the paper is a metamorphosis of the George Fuechsel's adage "Garbage In, Garbage Out" (Bulter et al, 2010), implying that bad data and design going into a simulation will result in unusable, and invalid, results being produced. Roman's play on the phase comes from the tendency of some commercial simulation vendors to mask the inadequate simulation designs behind advanced graphics. The use of visualization to express a simulation's output can be considered to be a rhetorical process.

#### **Statistical Relationships with Visualization**

The problems of information rhetoric are not M&S alone and they have been discussed extensively in other subjects, especially statistics. Statisticians have wrestled with problems of visualizations rhetoric for years. The seminal work of Darrell Huff, entitled "How to lie with Statistics," highlighted many misleading practices that are used with the graphical representations of statistics (Huff, 1954). It was suggested within the book that the cause of these misrepresentations where rhetorically, e.g., the use of cut-off graphs to exacerbate gradient changes within the data.

## VISUAL RHETORIC

Many would be pleased to place rhetoric firmly in the realm of lawyers and politicians. Others may go as far as to posit it in the world of linguistics. In the past decade, rhetoric has branched out and taken a multidisciplinary approach to be applied to many aspects of the world around us. It now extends far beyond the path of verbal arguments and persuasion. As Zelizer states, "Visual *representation* gives way to visual *rhetoric* through subjectivity, voice, and contingency" (Zelizer, 2004). Meaning is visual and any visual representation is subject to having its meaning parsed for analysis and questioning.

Foss, Foss and Trapp define rhetoric quite broadly as "the unique human ability to use symbols to communicate with one another" (Foss, Foss, and Trapp, 1985). Blair opens the realm even further by stating, "Arguments in the traditional sense consists of supplying grounds for beliefs, attitudes or actions...pictures can equally be the medium for such communication" (Blair, 2004). Visual rhetoric used in visualizations does not force us to have certain interpretations as much as it creates the context for interpretive frameworks and, more importantly, shared expectations.

The basis of visual rhetoric can be found in the traditional methodologies of semiotics, or the study of signs. Semiotics is not only necessary for visual understanding, but it seeks to reveal the constructed character of meanings we use every day. As a philosophy and method of critique, it questions and investigates the coded structure and meaning of *anything* that stands for something else – what is simulation visualization if not just that? Visual systems are signs existing in semantic space. The meaning is not on the surface but arises from collaboration between signs and interpreters. Semiotics allows for a more complex, subtle, and sophisticated mode of interpreting visual rhetoric present in simulation visualization.

As rhetoric relates to the arguments and appeals found within visualization's imagery, we turn once again to Blair who provides a modern definition of rhetoric as "the best means available to make the logic of the argument persuasive to the audience." We must be open to asking how rhetorical "constraints" and "opportunities" come into play in a particular visualization, because the developers are asking "what visual imagery will the audience understand and respond to" (Blair, 2004).

A visualization simulation has both a social rhetoric factor and an aesthetic component that must be deconstructed. The social aspect asks "what does it do?" (function) while the aesthetic requirements address "how does it look" (form). As for the appeals of social rhetoric, you find the end user falling prey to the concept that a visualization must be a good simulation simply because the graphics are so impressive. The aesthetic component falls on the designer in charge of massaging rhetorical implications visually. Both have equal roles to play in regards to rhetoric being introduced into a visualization. One must suspend the idea of function of all things to understand their meaning, how they function as signs and symbols to produce layered veiled meanings, why narratives are produced and how narrative alters the meaning of the images "informing" the interpretation.

# HOW RHETORIC RELATES TO M&S

M&S has been used extensively to support decision-making by giving the decision-maker new information, a different view-point or even a paradigm for framing the problem under consideration. It would be completely inappropriate to suggest that any simulation gives the "correct" answer to the problem under consideration but it does give insights into understanding some of the factors of problem. This idea is summarized by the famous quote of George Box: "All models are wrong but some are useful" (Box, 1979). Thus, as a simulation does not supply the absolute correct answer, its results are there to support the decision-maker in their decision.

Without an absolute answer to give, the M&S practitioners must decide which information, from the simulations results, to provide the decision-maker and what format this information should take: tables, dialogue or graphics. A skilled M&S practitioner will be able to select the right information and format in such a way as to increase the creditability of the simulation; this selection will be affected by the same biases that the practitioners had when developing the simulation in the first place. Thus the M&S practitioner has an opportunity to influence the decision-maker and the art of doing so is the rhetoric of M&S.

Visualization is just a small part of the M&S process; a generic overview of the whole process is given in Figure 4. Given that any visualization of the simulation results are the only thing most decision-makers will see of the simulation, there is a temptation to want to concentrate your efforts on developing the best visuals. This is not helped by the effect that visualization has on decision-makers, as highlighted by Banks and Chwif "[G]raphics can aid sales. Animated graphics seem to have a mesmerizing effect on the simulation novices" (Banks and Chwif, 2011).

This mesmerizing of simulation novices might initially seems innocent enough but it leads to a charlatan aspect of the M&S industry. Simulations, with fancy graphics, are being sold as tools for problems they are not equipped to solve. Analysis simulations with pretty front-ends but no substantial back-end are being peddled to unwary decision-maker. The results of such charlatanism might make a quick buck for some businesses but what is the effect on the industry as a whole? That decision-maker will most likely obtain bad results from the simulation and thus look unfavorably at the simulation and M&S as a whole. Is that decision-maker likely to recommend M&S to others? Quite the contrary, for a new and fledgling subject like M&S, the bad press could be devastating to its growth and, ultimately, survival.

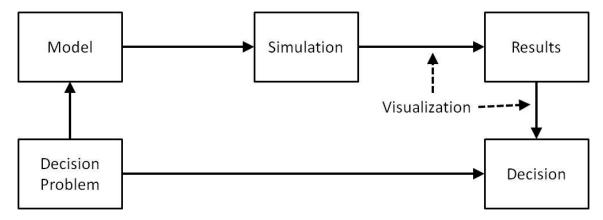


Figure 3: Generic decision-making process involving M&S

The authors would like to say that, in most cases, the addition of extra graphics within a simulation is due to an innocent wish, by the simulation developers, to make the visualizations more life-like; however, from personal and anecdotal evidence, the authors believe that there are cases of commercial simulations whose visualization is purposely designed to mislead the potential user/buyer which we have defined as the charlatan aspect of our industry. No direct examples are given here to avoid any law-suit but by walking around any large industrial M&S conferences, any M&S expert should be able to spot these charlatanism practices.

## RHETORICAL VISUALIZATION – SOLUTIONS

One must ask if anything can be done to counteract bad visualization. There are different schools of thought on how this might be achieved:

Verification and Validation (V&V): Paul Roman says that the rhetorical issues with visualizations can be overcome with good V&V in his statement that "[t]he primary defen[s]e against undue influence by impressive looking outputs is validation and verification" (Roman, 2005). However, V&V is a very subjective process and there is no agreed upon standard. The process of V&V is not an instant one and it might not just be possible to apply to the simulation, this is especially true for simulation platform purchases. A simulation firm might release a limited version of the simulation platform for evaluations purposes but inadequate, or misleading, documentation of the simulations capabilities make it difficult for the simulation expert to evaluate the propriety components. Those that hold the purse-strings for purchasing simulation-platforms are not necessarily M&S experts.

<u>Transparency</u>: The perceptual cognitive-based school of thought argues that all data displays should be as simple, thus transparent, as possible (Kostelnick, 2008). Given the complexity of the data outputs, this is just not always feasible. To follow this school of thought would require the analyst to present the results in graphs and diagrams as simply as possible; such a display would look dated and passé to the decision-maker and ultimately affect the simulation's creditability.

Neither of the solutions presented above really give an adequate solution to the problem of misleading visualization rhetoric and the rise of simulation charlatans so what about trying to educate the populous about rhetoric instead?

Requirements may differ between the analyst and the customer, or metaphorically speaking, the car builders and the car buyers respectively. A first step towards preventing bad or unnecessary visualization would certainly be awareness of visual rhetoric's impact on visualization by both

the builder and the buyer. Primary use and clarity of form must be brought to the forefront while agendas and subjectivity take a back seat once they become apparent. With newfound awareness, the analyst must place importance once again on creditability and acceptability of a simulation to move us closer to objective communication in visualizations for analysis and training.

## CONCLUSIONS

Researchers and scholars are looking into the depths of M&S but what really matters is what those outside of the M&S community see, including customers & decision-makers that "use" M&S. The considerations of visualization's rhetorical underpinnings must be brought to the forefront of M&S study in order to effect change in the application of simulation visualization. Realizing that visual rhetoric is at play in many visualizations marketed today is a first step toward requiring greater validation and transparency practices at the inception of the visualization process. Visual rhetoric in M&S, as an effect of the latest technology, deserves closer observation into its teleological uses.

To overcome the problems relating to visualization's rhetoric are non-trivial and thus could linger for a long time like those rhetorical problems of statistics. The problems cannot be ignored either, as there is a growth of charlatanism within our M&S industry which is especially due to the availability of fancy graphic for simulation purposes. Only time will tell if these problems are overcome but as the American engineered Charles F. Kettering stated "A problem well stated is a problem half solved."

Our focus in this paper was to develop the view, both now and in the future, of rhetoric's importance to simulation visualization. The importance of these epistemological investigations lies not only in thinking about visualization in a new way but also in exposing audiences to the rhetorical nature of visualization. These new connections therein expose existing problems in modeling and simulation by way of the application and the philosophy of visualization. Both facets must be examined at once for a true understanding of visual rhetoric's place in this field of study.

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#### WORKPLACE CYBERBULLYING

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#### **ABSTRACT**

The purpose of this paper is to highlight the lack of literature on cyber bullying in the workplace and to develop research propositions for further development based on several existing streams of research related to bullying, aggression, and decision-making. The constructs of trait anger, narcissism, approval of aggression, job dissatisfaction, and the demographic construct of gender are posited as areas for future research.

#### BULLYING IN THE WORKPLACE

Workplace bullying is slowly gaining the attention of companies and academic researchers. In part, this recognition is due to the negative consequences to organizations such as absenteeism and employee turnover (Raynor and Hoel, 1997). Li (2007) defines workplace bullying as a form of aggression. This aggression may include both verbal and physical harassment. Li (2007) further notes bullies intentionally inflict injury or discomfort and includes hitting, pushing, hostile gesturing, threatening humiliating, degrading, teasing, name calling, put downs, sarcasm, taunting, staring, silent treatment manipulating friendship and ostracizing.

Workplace bullying is more prevalent than many think. In a 1997 study by Raynor and Cooper, 53% of respondents reported being bullied. However, official reported incidences are much lower. Why? The reason may be that a stigma exists against reporting in an official manner (Raynor and Hoel 1997). This stigma is partially explained by Namie (2010) who suggests several possible interrelated explanations. One explanation is low reporting is due to cultural bias against appearing weak. A second possibility is the economic conditions in which employees find themselves where people feel lucky just to have job and may be embarrassed/ashamed to complain about work issues. Further, to expose being bullied at work requires independence, pride, and self-assurance as suggested by Namie (2010) which are the very psychological constructs most damaged in bullying!

Organizations should care about bullying among their employees. Workplace bullying impacts victims, but also impacts witnesses (Namie, 2010). Bullying therefore has a greater impact for organizations including impact on morale, culture, and productivity beyond the aggressor- aggressed dyad.

## **Literature Review**

There is very little academic research in the area of cyber bullying in the workplace. However, the work done demonstrates the practice is not trivial. In a study of workplace bullying, 40% of union workers experienced bullying, 10% of those 40% experienced cyber-bullying. Of those who experienced cyber bullying at work, 100% also experienced face-to-face bullying (Privatera and Campbell, 2009). The increase in cyber bullying in the workplace should not be a surprise since the adolescents who grew up with the practice are entering the workforce and bringing their norms and behaviors with them. In addition, those that bully face-to-face certainly have no compunction taking a less direct tact. Furthermore, no work environment is safe from cyber bullying including academe (Gupta, 2008).

There is increased attention on cyber bullying in the workplace in the popular press which highlights what cyber bullying practices are and ways to avoid them (Duram, 2010; Jensen, 2011). These articles also highlight corporate risks which include litigation for the company. Currently, 21 states are debating laws that make workplace bullying an unlawful practice (<a href="http://www.healthyworkplacebill.org">http://www.healthyworkplacebill.org</a>). These

regulations extend beyond current US laws addressing hostile work environments.

The impact of cyber bullying at work is noted by Privatera and Campbell (2009) on several levels. The immediate impact on the individual is diminished physical health and well being. Further personal relationships and self esteem are impacted. These in turn affect future career advancements and long-term or recurring sick leave.

To date, research on cyber bullying in the workplace has been descriptive and focuses on describing the actions and consequences. The following sections provide a more theoretically based series of propositions to explore cyber-bullying in the workplace as well as its underlying causes. The constructs of trait anger, narcissism, approval of aggression, behavioral ethics, job dissatisfaction, interpersonal conflict, and the demographic construct of gender are presented as possible areas for a robust more theoretically grounded stream of research to pursue in explaining the underlying roots of cyber bullying in the workplace. The first construct explored is trait anger.

## **Propositions**

Trait anger -Trait anger refers to an individual's anger proneness as a personality trait (Deffenbacher, 1992). Persons with high trait anger have higher predispositions to respond in a hostile manner and perceive situations as frustrating (Hershcovis, Turner, Barling, Arnold, Dupre, Inness, LeBlanc, and Sivanathan, 2007). Trait anger is shown to be related to workplace aggression. Fox and Spector (1999) demonstrate a relationship between trait anger and both work frustration and work place aggression exists and is directed at both the individual and the organization. Douglas and Martinko (2001) found a strong link between workplace aggression and trait anger. The importance of trait anger (and other individual difference variables such as self-control and negative affectivity) is demonstrated by Hempworth and Towler (2004) who found these constructs to account for 27% of the variance in workplace aggression. Given the strength of the relationship between workplace aggression, future researchers should examine the relationship between trait anger and workplace cyber bullying. Thus the following research proposition:

P1: Perpetrators of workplace cyber bullying will have higher levels of trait anger than non-perpetrators.

Narcissism - Narcissism is a multidimensional construct and includes a sense of grandiosity and superiority, a sense of entitlement, exploitation of others for personal gain, lack of empathy for others, and an excessive need for admiration from others (Ang, Ong, Lim and Lim, 2009). Lubit (2004) notes narcissistic managers devalue others, feel exempt from normal rules of society, lack empathy and have little, if any, conscious. Narcissism is related to relational aggression in adolescents, which can carry over into adulthood (Kerig and Stellwagen, 2010). Narcissism is shown to be related to aggression specifically in the form of a reprisal. Ang, et al. (2009) note greater aggressive behavior is directed at the person or persons who were perceived to have insulted them. Further, in the workplace, if a negative evaluation or provocation is perceived as threatening, it is likely that narcissists will perceive bullying behavior as legitimate and justifiable (Ang, et al., 2009). Challenges to a narcissist's grandiose self-image can lead to a rage that is destructive to themselves and their victims. Thus, even constructive feedback can result in inappropriate retaliation that harms both parties (Lubit, 2004) leading to the following proposition:

P2: Narcissism is positively related to cyber bullying behavior. Approval of Aggression - Normative beliefs are shown to influence behavioral intentions and behaviors, see research on the theory of planned behavior or the theory of reasoned action for examples. Normative approval of aggression is a construct that is shown to be directly related to aggressive behaviors and to mediate the relationship between other constructs that are positively related to aggression. Research indicates that children and adolescents who approve of the use of aggression are

considered more aggressive by their parents, teachers, and peers than individuals who do not approve of the use of aggression (Ang, et al., 2009).

Huesmann and Guerra (1997) longitudinally studied normative beliefs that are supportive of aggression and eventually aggressive, bullying behavior resulted. Their results indicate that normative beliefs become stable by fourth and fifth grade and, once stable, these beliefs predict aggressive, bullying behavior through adolescence and beyond. In a similar finding, Bellmore, Witkow, Graham, and Juvonen (2005) demonstrate that adolescents who believe in the appropriateness of aggression chose hostile/aggressive response options that result in subsequent physical, verbal, and indirect bullying behavior. Thus, the following proposition:

P3: Approval of aggression is positively related to cyber bullying in the workplace. Gender - As an individual difference, gender is related to aggression.

Some studies indicate that men are more aggressive than women (McFarlin, Fals-Stewart, Major, and Justice, 2001; Green, 1990). However, in specific situations, women can be more aggressive than men (Namie and Namie, 2000). In the instance of cyber-bullying, females are more likely to be both the victim and perpetrator (Tokunaga, 2010). Gender differences also exist in who is doing the bullying at work. Men are more likely to be bullied by their superiors, while women are just as likely to be bullied by a superior or their peer (Salin, 2005). For women, workplace bullying affects their beliefs about the world, people, and themselves. Additionally, women have greater symptoms of post-traumatic stress disorder than males (Rodríguez-Muñoz, Moreno-Jiménez, Sanz Vergel, and Hernández, 2011). Within the acts of cyber-bullying, gender differences also exist. In males, gender visual cues can be considered good indicators of severe cyber bullies and cyber victims (Menesini, Nocentini, & Calussi, 2011). The impact of workplace bullying is also different based on gender. Researchers should examine the relationship between gender and workplace cyber-bullying.

P4: Gender and cyber bullying in the workplace are positively related.

P5: Gender plays a mediating or moderating role in cyber bullying in the workplace.

Job Dissatisfaction - Job dissatisfaction is a function of how much people dislike their job (Spector, 1997). Several studies have linked job dissatisfaction and frustration to bullying behavior at work. Stress is shown to increase job dissatisfaction and to lower aggression thresholds for the concerned individuals—partly due to the fact it does not allow for time-consuming conflict solving (Salin, 2005). For example, bullying may result from inefficient coping with frustration (Baillien, Neyens, De Witte, and De Cuyper, 2009). Einarsen, Rankes, and Matthiessen (1994) and Vartia (1996) found a significant correlation between bullying and low satisfaction with the social climate at work. Dissatisfied employees are more likely to act in destructive ways and act out through workplace aggression (Herscovits, et al., 2007). This aggression may be an effort to assert or regain some level of control over their job (Judge, Scott, and Ilies, 2006). Interestingly, Rodríguez-Muñoz, et al., (2009) demonstrate that bullying may also be a cause (and not a result) of job dissatisfaction. Thus, the following research propositions are suggested:

P6: Job dissatisfaction will be positively related to cyber bullying in the workplace.

P7: Job dissatisfaction may be both a cause and result of cyber bullying in the workplace.

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# Teaching Statistics: Its not about Procedures, Its about Understanding Relationships

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#### **ABSTRACT**

The typical course description for a statistics class lists a set of covered analysis procedures. What most business students will need in their future is to understand relationships between variables and how to measure the nature of these relationships. Focus on procedures gets students mired in calculations without getting the big picture and leaves them inadequately prepared to analyze data to answer real business questions.

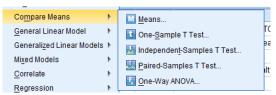
## INTRODUCTION

Most of us want to do well when we do something, like teach a class, and doing well can easily take precedent over other objectives, like helping prepare students for their future. We can do best by focusing on the things we know best. Hence when it comes to teaching class, what we most often know best are the things and ways we were taught or the things we are currently doing in our research. Also textbook authors and publishers produce materials that match the way faculty teach their courses. The above logic and reasons support teaching statistics in the same way as we have been for years. But that does not mean that it is the best way to do it, certainly if determining best uses preparing students for the future as a major criterion.

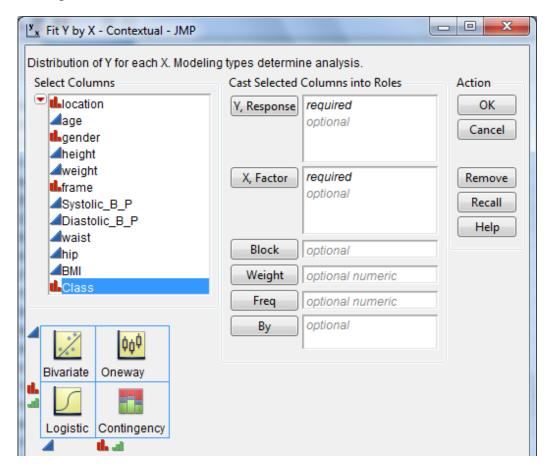
Since the publication of *Competing on Analytics* by Davenport and Harris in 2007, analytics has received increased focus and use in the business world. Businesses are using analytics to enhance company competitiveness by using data to improve decision making. These businesses need employees with business and analytical knowledge to interpret findings and develop relevant advice to guide their business decisions. In March 2010 IBM published *The New Value Integrator: Insights from the Global Chief Financial Officer Study* which found that the CFOs felt that a significant gap existed between skills required for today's business environment and the skills currently available in the workforce. This indicates that our present educational process is deficient for their perceived needs. For business students the business statistics class is one that has a clear focus on analysis of data. Historically this has included a set of analysis procedures listed in the course description with a primary focus on descriptive statistics, confidence interval estimation and testing for the statistical significance of hypotheses. Testing

of statistical hypotheses may match well with the analysis a faculty member is doing to get his/her research published but does not match well with the analysis that is part of analytics.

If the goal is to help prepare business students for their future then major consideration needs to be given to what they are most likely to be doing in the future. The chances are slim that they will be collecting data to test hypotheses so that they can get an article published in a refereed journal. We need to look at trends in business and the current focus on analytics is one clear trend. Looking at statistical software can also be helpful. SPSS is a software package that has been in existence since the days of computer punch cards. It has evolved into the point and click era of computing but the menu still has a list of classical procedures as shown in the SPSS image below which remains the same in SPSS 20.



JMP, a SAS statistical software product, is more recently developed. It tends to be more oriented to providing service to businesses with an analytics focus than what SPSS has done historically. Of course with IBM purchasing SPSS and its "Smart Planet" initiative, the look of SPSS may change. The JMP menu below focuses on the relationship between variables and automatically selects an appropriate procedure based on the type of variable for the response Y and the type of variable for the predictor or factor variable X.



Once the variables have been selected then JMP creates a graphical display corresponding to the appropriate one of the four quadrants in the box at the lower left in the above diagram based on the type of variables for X and Y. It may also provide some appropriate descriptive statistics and possibly hypothesis testing results. If the user wants output for a specific procedure then that can be requested in a second phase.

As can be seen, this approach to analysis focuses first on relationships between variables and the measurement scales of the variables. The type of variable for both X and Y defines or determines how one looks at the relationships relative to the type of graphical pictures used to describe the relationship and the mathematical models built to evaluate the relationship. The testing procedures also depend on assumptions associated with the particular type of mathematical model. Using this focus on the types of variables as a first step in analysis helps guide students in the selection of appropriate graphical representation and analysis procedures.

Webster West in a keynote talk for the 2012 Electronic Conference on Teaching Statistics emphasized that a primary goal in a statistics class should be to "get students excited about data." His point agrees with our point that the statistics class should start with data. We need to get students to think about potential or anticipated relationships between variables. Then we can teach them techniques for painting pictures of the relationships between the variables and the type of picture will depend on the type of variables. Next we can move to measuring the strength or magnitude of the relationship as indicated by the data. As with painting the picture, the type of procedure for obtaining strength of relationship measurements depends on the type of variables and how the data are recorded. To obtain the proper analysis the software user must know how the data have been recorded and how the software procedure requires that the data be recorded.

Table 1 contains a guide created to assist the data analyst (student) in selecting the proper testing procedure based on variable type and how data were gathered and recorded. This guide is laid out to be similar to and used like the matrix JMP has in the Fit Y by X menu. The user of the guide can find the appropriate located in the table corresponding to the types of the variables the user wants to use and how the data were obtained and recorded. Students have found this guide to be useful when they were given a scenario and asked to select the appropriate testing procedure for the situation described in the scenario. This type of problem is often found to be very challenging when students have only focused on the individual procedures in the typical text. Merely spending time on each of the individual procedures does not provide the student with the big picture and fails to truly enable the student to be able to use the learned individual procedures when faced with a real situation requiring analysis. It should be noted that Table 1 does include logistic regression, which is not covered in many business statistics texts. However, some do, such as *Business Statistics* by Sharpe, De Veaux and Velleman.

The classic statistics course focuses on determining statistical significance of an appropriate test that essentially tests  $H_0$ : There is no relationship between the variables versus  $H_A$ : there is a relationship between the variables. In the business arena the amount of data that may be available for analysis may make determining statistical significance of no real practical value because an extremely large sample size may identify statistically significant effects for effects that would not provide any real improvement on the business side of the operation. Hence

students need to learn to think about assessing the practical significance of a result in addition to the statistical significance.

**Table 1: Guide for Selecting the Appropriate Testing Procedure** 

Type of variable for Y {Response}	Type of variable(s) for X {Predictor(s)}			
	Categorical (2 categories)	Categorical (3 or more categories)	Quantitative (1 variable)	Quantitative (2 or more variables)
Quantitative (1 variable)	Difference in 2 Means 2 sample Pooled t (= variances assumption) (2 Independent Samples) [Fit Y by X; Means/Anova/Pooled t] Difference in 2 Means 2 sample Welch's t (≠ variances assumption) (2 Independent Samples) [Fit Y by X; t Test]	Equality of k Means ANOVA (k Independent Samples) [Fit Y by X; means/anova]	Linear relation between Y and X Simple Linear Regression (1 Y and 1 X for each data case) [Fit Y by X; Fit Line] or [Fit Model]	Linear relation between Y and Xs Multiple Linear Regression (1 Y and k Xs for each data case) [Fit Model]
	Difference in 2 Means (Paired Sampling) [Matched Pairs]		V2 [2 W 12 W W ]	
Categorical (3 or more categories)	Independence of 2 Categorical Variables Chi-square test of Independence [Fit Y by X]	Independence of 2 Categorical Variables Chi-square test of Independence [Fit Y by X]	Multinomial Logistic Regression Not Covered in this Class	Multinomial Logistic Regression Not Covered in this Class
Categorical - Dichotomous (2 categories)	Equality of 2 Proportions (2 Independent Samples) [No JMP procedure]	Independence of 2 Categorical Variables Chi-square test of Independence [Fit Y by X]	Prob(category) = f(X) Logistic	Prob(category) = f(X)
	Independence of 2 Categorical Variables Chi-square test of Independence [Fit Y by X]		Regression (Dichotomous Y and 1 X for each data case) [Fit Y by X] or {Fit Model]	Logistic Regression (Dichotomous Y and k Xs for each data case) [Fit Model]
	Categorical (2 categories)	Categorical (3 or more categories)	Quantitative (1 variable)	Quantitative (2 or more variables)
		Type of X or [predictor		г
	hading denote that Data are in enote that Data are in matched		or each category	
Shaueu Cens u	enote that Data are in matched	pair s/ blocks		

#### **SUMMARY**

The panelists, with varied levels of experience and from business schools at four different universities, will present their views on these articulated issues relative to teaching statistics in a business school. In addition to their presentations, time will be provided for those attending the session to also enter into the dialogue.

The main focus on the session will be on what is being taught in a class and how it is taught. But the session title also allows for discussion of how establishing a relationship with the students in the class can help them be more engaged in the learning activities. The panelists will have the opportunity to share what they consider to be the type of relationship with their students that they try to develop and why.

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# **Toward More Effective Presentations**

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In this workshop, presenters will engage the audience in demonstration and discussion regarding the preparation and delivery of a variety of presentations. The session will provide insight, both first-hand and referential, from award-winning teaching professionals, presentation experts, and neuroscientists. Attendees can expect thoughts on:

- Content versus Concept: Delivering different formats for different outcomes
- Targeting your message: Tailoring to the background of the audience
- Creating measurable objectives: Ensuring the appropriate take-aways
- Not only for the ADD generation: Facilitating audience engagement and participation, active learning styles
- Pacing and Pausing: Utilizing verbal and nonverbal communication
- Setting the stage: Generating titles, abstracts, and advertisements that grab attention, convey the message, and draw the correct audience
- Not just decorating: Using appropriate color, font, and other aesthetics in every facet of your presentation
- When a speech isn't a speech: Preparing posters and static presentations
- Pros and Cons of PowerPoint: Exploring how technology has changed speech-making
- Using PowerPoint effectively: Applying best practices on PowerPoint
- Perfecting the elevator pitch: Giving a presentation without charts and graphs

# RESETTING COLLEGE MISSION AND VISION WITH ENHANCED STRATEGIC THINKING

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## **ABSTRACT**

Well-run Colleges of Business generally make value proposition statements about their rigidity in adherence to mission and established strategy, yet also appear willing to engage in the flexibility required to accommodate the changing student needs over time. This paper reviews the role of formalized strategy in Business Schools and sets it next to today's student, revealing an increasing gap in goal congruence. When mission and strategy ideas are not synchronous among the various players in the academic market, dysfunctional decision making, apathy, and blurred vision occurs.

The environment external to the academy cannot be ignored, and those events cannot be controlled. However, we can use that information to help develop appropriate strategy, minimizing threats, and maximizing potential gains in not only course and curriculum development, but in overall institutional advancement. The authors examine factors and trends that may identify areas where strategic shift occurs, including the economic, political, legal, global, technological and socio-cultural. The paper concludes with a summary listing of action plans that could be used by institutions to address those critical areas.

## THE SUPPLY SIDE: THE BUSINESS SCHOOL DILEMMA

For those faculty with the luxury of teaching MBA students, the quantity of areas needing fixing are far less pronounced than in undergraduate curriculums, where student inputs vary significantly. Strand [2011] observes that the more common fabric of sustainability in business and education is generally understood by MBA students and that contributes to desire and stronger outcomes in learning. Many undergraduates acquire their first exposure to business in the survey setting of principles of accounting and principles of economics courses.

David and David [2011] find the major disconnect between the training rendered to students and the needs of practicing managers hurting not only business students, but B-Schools, business firms, and American society as a whole. College rankings are another hotly debated area. Some prestigious schools invest resources in benchmarking their success in attracting new students with high admission test scores and other criteria. Institutions may find some of these strategies harmful in the event of backlash created by the discovery of fraudulent numbers reported [Diamond and Schneider, 2012].

Trends on the part of universities to supply quality education at a reasonable cost have been recently documented by the business press [Banchero, 2012 and Wessel, 2012]. Wessel points to studies that face-to-face learning and totally online learning can provide similar individual outcome achievement, but suggests that totally online is deficient if the objective is to lower the attrition on those students who lack the discipline to complete the online requirements. A hybrid model may well assist in getting the additional face time needed. Banchero lists key institutions such as California Institute of Technology, Georgia Institute of Technology, Duke University, Johns Hopkins University, Rice University, and others, providing free online classes through *Coursera*, developed by Stanford University computer-science professors, and having 111 introductory courses already converted, with more planned [Banchero, 2012].

Such movements could easily sway B-School mission writers to promote language of "broad access" and "diverse curricula." The successes being measured at secondary level on "flipped learning" where the lecture and didactic tools are used without live teacher present, either in homework or through laboratory sittings, to allow live teacher presence is a subsequent session to focus on practical aspects of the material could see a ripple in higher education.

Enrollment management by many colleges targets growth in a student body. In the University System of Georgia, Complete College Georgia advocated by Governor Nathan Deal is already strongly on course, and consistent with the drives in many other states and Complete College USA [Complete College Georgia, 2012].

An institution which separates mission statement from vision statement may be better able to design strategy – provide the limited resources in such a way to meet the needs of stakeholders. Difficulties must be managed to main operational excellence while executing business fundamentals and going to the next step a strategy plan. May [2012] distinguishes between vision—a long-term perspective and the reason for being, the answer to the "why you are in business?" and mission—a current, operating focus, the answer to the "what you do?" question.

#### THE DEMAND SIDE: STUDENTS AND OTHER STAKEHOLDERS

Individual students have much less bargaining power than institutions. Those students gaining entrance with relatively weak high school GPAs and standardized test results could be at special peril. Are students seeking a school that will impose less rigor, or simply providing better value? Is value in the student mind the long-run gains from quality education in the college setting, or simply getting sufficient financial aid this academic term? Nelson [2012] addresses these issues and raises the undesirable outcome where students switch institutions quickly in response to the next avenue of financial aid.

Not all students are financial aid hoppers. Some are interested in base knowledge within B-School curriculum and some even thirst for answers beyond memorizing procedures, and

actually seek reasons "why," not just the "what" and "how.". Strategic thinking by administrators and faculty would respond to these student needs by providing forums for integrated case studies providing wide perspectives to students, yet still unobtrusively throwing in the seeds of accounting, economics, marketing, and the other traditional disciplines. Singh, Bisht, and Rastogi [2011] find that faculty members face serious challenges when they do not deal appropriately with conflicts between monetary and sustainability issues in the courses. The denial of the existence of social costs and determinants of quality of life contributes little to lifelong learning for our students.

The next wave of leaders will come from the new breed of students. Symonds [2011] concludes that students will demand more involvement with growth markets, flexibility in workspace, embracing of social media, new destinations for study, distance and blended learning, greater classroom diversity, and options for executive MBA and other alternative programs. Demand conditions change with economic conditions over time. With the plethora of accounting scandals in the first decade of the 21<sup>st</sup> century, perceived needs increase for greater involvement in business ethics and corporate social responsibility. Liederkeke and Demuijnk [2012] imply that if B-Schools do not adapt, they will flounder.

Institutions must understand their student body and determine the composition of its salient parts. Sargent and Matheson [1996] report that Beard found two major types of business students—either the Octopus, or the Star Fleet Captain. The former are those individuals who want to be in control and seek concepts that maintain that position. The latter are individuals who seek self-fulfillment and wish to become effective leaders, to "boldly go where no one has gone before." Sargent and Matheson charge that it is the unintended emphasis by the business schools to develop octopi rather than star fleet captains that is the cause of much deterioration in the learning.

Who are the students and does their chemistry matter? Zhao and Qiu [2009] found that cultural rather than biological factors play a greater role in Asian-American student development. Loh, Smith, and Restubog [2010] found that in comparing the cultural background of 120 Australian university students with 120 Singaporean students, both with control groups, that trust and cooperation were more strongly influenced by the workgroup membership and far less by cultural factors. Haynes and Gebreyesus [1992] concluded that sociocultural basis is important and that collaborative learning can be a strong driver in learning among African-American children. Other studies suggest that minority groups may actually develop a culture in opposition to schooling, or develop a further resistance to be creative if the college does not challenge them [Downey, 2008 and Lim, 2010]. These studies collectively suggest appropriate team play may be important for the future of education. Perhaps an analysis of trends in corporate America, the employer base, where team performance is required, would provide guidance on resetting the academic strategy.

#### OTHER TRENDS—INFLUENCE OF ORGANIZATIONAL SUSTAINABILITY

A positive trend within corporate America is developing greater concern for human welfare, and enterprise success is measured on the basis of qualitative and non-financial factors as well as the financial [Kan, 2011]. Many of these atypical performance measures arise at the business level, or though the auspices of key executives. Microsoft founder, Bill Gates, and wife have invested heavily in the Bill and Melinda Gates Foundation. Another leader in these endeavors is P&G, a company that proposes to fund other organizations for sustainability and social responsibility [P&G, 2012]. The increasing roles that large entities are playing either directly, or indirectly through their foundations, in philanthropy and social causes, may demonstrate a shift away from individual contributors to larger entity donors. Grants and other incentives are used to spur social investments.

Should the moves by corporate America and its various constituencies be emulated by colleges and its stakeholders? A 2007 white paper discusses the concept of a "Wholly Sustainable Enterprise," where value is derived overall by all parties through the value orientation of products and services, workforce, workplace and the management and governance [Deloitte, 2007]. Using this concept, a holistic strategy may emerge that transcends departments and curriculum, that looks to both the short-run and the long-run (student perhaps as both product and customer), and provides synergy in higher education that is not evident today.

An increasing number of companies are moving toward improving the overall sociocultural framework of their organizations, through implementation of best practices, and with an eye toward success in bottom line profitability, not just doing good things for society [Heffes, 2010; Burnett, Skousen and Wright, 2011; and Gupta and Benson, 2011]. The problem of "buy-in" exists in the education market. Companies can add or delete non-performing workers as they see fit, and on a timely basis. The education market is not so neat, and uses such tools as slow grading feedback to distinguish between success and failure for students, and commits the Type II error where other faculty and administrators award undeserving tenure on unproductive faculty.

With today's students having an ever-increasing short-sighted time run of taking one course or box of knowledge at a time, and arriving at a satisfactory grade, the parallels are limited when making comparisons to the employees who want to "get up the organization chart" or "make partner" soon as possible. On the other side, faculty are notorious for not buying into paradigm shifts when the expected rewards are based upon research and other measures extremely far removed from the student and other stakeholders. Faculty may strive for "points" on annual review and promotion and tenure forms. Perhaps fixing the student and faculty evaluation processes would do much to promote an environment where good strategy can be planned, and more importantly, where efficient and effective learning occurs.

Recent studies find that academic research is important to the higher education system, careers of individuals, and the publishers involved with rewarding the fruits of that research, but leave open the question of whether such heavy duty research has any significant positive impact on teaching or professional practice [Parker, Guthrie, and Linacre, 2011]. Other research suggests specifically that business undergraduates have much to gain by having courses developed around the concept of sustainability, green issues, and qualitative factors in measuring enterprise performance [Rudell, 2012]. Kinder, gentler type of research by professors could be conducted that has direct value and classroom application for the students.

David and David [2011] present 14 changes that business schools could implement to improve their service to both their students and local businesses:

- 1. Revise mission to become more practitioner-oriented.
- 2. Revise curriculum to provide more training on specific skills graduates need on the job.
- 3. Develop specific tracks within majors to tailor courses to business needs.
- 4. Revise specific courses to encourage licensure or certification.
- 5. Design new courses for employers in the university's market.
- 6. Offer meaningful internship experiences.
- 7. Work toward reduced class size to involve more practitioner-oriented pedagogy.
- 8. Expand "professionally qualified" (PQ) faculty in areas where their expertise is a plus.
- 9. Encourage AACSB and other organizations to look at standards in light of above.
- 10. Alter promotion and tenure guidelines to reward practitioner-based research/consulting.
- 11. Include a section on "Implications for Practitioners" in every journal article published.
- 12. Adopt a practitioner theme in text and resource selection.
- 13. Establish and revolve executive-in-residency and faculty-in-residence programs.
- 14. Focus on real-world practice as does medicine, law, architecture, not general A&S.

Those of us interested in the relevancy of our profession would do well to try to influence the Dean's suite and strategic planning committees to consider making more changes along these lines. David and David [2011] also cite that Dickinson, Herbst, and O'Shaughnessy in 1983 noted that "Professors routinely suggest that corporations should be responsible to society, but few prestigious academics have suggested that business schools should be more responsive to their environments." The gap can be and should be narrowed.

## RECOMMENDATIONS

- Operate the B-School with a dedicated strategic planning committee, breaking down individual and department silos of interest in favor of addressing vision and mission that address the desired outcomes.
- Build on prior successes, but discard old baggage, and use zero-base planning when needed.

- Ignore the pleas of those who voice "we tried that before and it did not work" and other excuses that stand in the way of innovation; consider appointing those with objective views to working committees.
- Build a student body that is collegially oriented—instill a specific and positive culture, that your institution is better than the cross-town rival, but all of us have to work harder to maintain the results.
- Inspire students with challenging assessments; discard the trite and trivial; good practical experience trumps many standardized testbank questions.
- Provide the students with what they many times do not obtain from the media, their softer courses, and sometimes, even their parents; instill the concept of exceptionalism regardless of sociocultural background, and the notion that we can all win if we work at it.
- Reward faculty on what matters; design systems that correspond with institutional needs and the markets for the graduates, rather than narrowly considering what we did last year, what the College of Arts & Sciences is doing, what the cross-town rival institution is doing, and what might be thought to be the expectations of accrediting agencies.
- Encourage outplacement for those who are not of like-mind in creating winning solutions; use a post-tenure review process to assist faculty; recruit and collaborate with others both inside and outside the institution; surround ourselves with great deans, department chairs, faculty, and staff.

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