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 χ^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 χ^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 χ^2 test for pass/fail rates.

	Course Classification	**Semester of Course**	**Mode of Administering Course**	**Quantitative Status**
Test Statistic	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	H3
Test Statistic	-4.37	-7.78	-5.11
Sample size (n_1,n_2)	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-to-face 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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