

Creating a Business Analytics Course

Robert L. Andrews

Virginia Commonwealth University, Department of Management,
Richmond, VA. 23284-4000, 804-828-7101, randrews@vcu.edu

Christine M. McKenna

Virginia Commonwealth University, mckennacm@vcu.edu

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 be 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.

REFERENCES

- [1] Davenport, Thomas H. and Harris, Jeanne G., *Competing on Analytics: The Science of Winning*, Harvard Business School Press, Boston, MA, 2007
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- [3] Evans, James R., *Business Analytics: Methods, Models, and Decisions*, Prentice Hall, Upper Saddle River, New Jersey, 2013