INFORMATION SYSTEMS EDUCATION JOURNAL

In this issue:

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Using Business Analysis Software in a Business Intelligence Course

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Abstract

This paper presents an example of a project used in an undergraduate business intelligence class which integrates concepts from statistics, marketing, and information systems disciplines. SAS Enterprise Miner software is used as the foundation for predictive analysis and data mining. The course culminates with a competition and the project is used to enhance communication and presentation skills.

Keywords: business intelligence, data mining, data analysis, experiential learning

1. INTRODUCTION

Business intelligence is an umbrella term used to describe a variety of topics. Historically, business decision making depended upon the ability of an IT professional to develop reports based on internal information collected and stored in the transaction processing systems of a firm. These reports were not very flexible and could take a substantial amount of time from the initiation of the request by a decision maker until the appropriate information was available. As relational databases, ERP suites, and business analysis tools were developed, managers began to access and analyze data with greater speed and flexibility. The rapid growth of the internet also provided access to external market and business research databases. A new generation of software concepts and applications began to emerge. These activities included data warehouses, data mining, online analytical processing, online query, and online reporting. Analytical software packages were also developed to take advantage of these concepts to aid business decision making, cut costs, review processes for reengineering possibilities, and identify new business opportunities (Mulcahy, 2007; Stefan, 2009). These trends in industry have caused some universities to begin developing curriculum to support these concepts under the umbrella of business intelligence.

University approaches have varied. Some universities have created a specific major in business intelligence that includes course work

in ERP suites, data warehouses, data mining, and dimensional analysis. Other programs have defined the term more narrowly to the analytical tools associated with improving decision making. In either case, one of the problems facing curriculum design for business intelligence is the selection of analysis software to be used in the classes and the design of instructional projects that can effectively demonstrate the concepts. This paper describes one approach that was successful in an introductory level business intelligence class using SAS Enterprise Miner as a data modeling tool for predictive analysis. The instructional techniques and the project presented and described in this paper might be useful for designing a course using business intelligence analytical software packages.

2. BUSINESS INTELLIGENCE IMPACT

Industry is embracing recent trends in Business Intelligence applications and recognizing the benefits for adopting an integrated business intelligence strategy. Chickowski (2009) identified five important trends, one of them being predictive analytics. The other four are agile development, customization of BI information, visualization improvements, and operationalization of BI systems or the ability for operational level managers to see the predictive results of operational decisions in real time. In addition, Software as a Service (SaaS) and cloud computing are technological trends which enable firms to develop and deploy BI initiatives more efficiently (Henschen, 2009; Thompson 2009). A survey conducted by CIO Insight identified business intelligence/data mining as the technology most likely to make significant contributions to business strategy (Sircar, 2009).

The convergence of technology and applications that has occurred since 2000 has made business processes and data analysis a key differentiator for competitive advantage (Brannon, 2010). Integration provides even more advantages and opportunities. Benefits of adopting an integrated BI strategy include cost savings related to consolidation of data marts, time savings for data suppliers and users, higher quality data leading to better decisions, and improved business processes (Popovie, Turk & Jaklic, 2010; Watson & Wixsom, 2007). The types of data stored for analysis has also expanded. Baars and Kemper (2010) have stressed the importance of integrating both

structured and unstructured content within the BI framework.

Despite these technological trends and organizational benefits, there is a disconnect between industry needs and business school curriculum (Sircar, 2009). Sircar examined BI course offerings in the top 50 undergraduate business schools as ranked in Business Week and found that only 7 schools had specific courses in BI or Business Analysis. None of the schools offered a major in BI, and only one, Miami University of Ohio, offered a minor. Analytical competency and insufficient employee quantitative skills were found to be serious concerns of business executives yet universities have been slow to adopt BI into their curriculum (Sircar, 2009).

3. BI COURSE DESCRIPTION

In order to address the shortcomings of the business school curriculum in regards to Business Intelligence, a new course was introduced at both the undergraduate and graduate level. The catalog provides the following course description and is a required course for all undergraduate Information Systems Management majors: Development and application of the strategies, methods, and techniques used in data mining and other decision support systems. The course employs testing, documenting, and using software programs in functional areas of business such as finance, production, marketing, and accounting. The use of SAS software is employed for hands-on data mining experience. Students are required to have completed a business statistics course prior to enrollment in the BI course.

SAS software was chosen for multiple reasons. SAS has been a leader in business analytics software and is used by several of the potential employers of our student body. SAS also offers a certification in predictive analytics. Students are encouraged to consider certification for improving their personal job search opportunities. SAS also offers access to their business analysis software through the cloud. This carried a tremendous advantage for our university since we do not have computer labs. Students are required to have a laptop, therefore, it was very easy to approach this course using software as a service. SAS also provides free training to university instructors and extensive course material which can be used in the classroom, alleviating the necessity to purchase costly textbooks. SAS also provides

online support and quick response to user problems that can and will be encountered. Last but far from least, SAS was chosen for its policies toward its employees. SAS has been on Fortune's list of Best Companies to Work for the past 13 years, as long as the rankings have been published. In January 2010, SAS was named as the number one best employer (http://money.cnn.com/2010/01/21/technolog y/sas_best_companies.fortune/).

The course content closely follows the Trainer's Kit provided by SAS when the software agreement with the university was finalized. Because the university requires undergraduate students to have a laptop computer, the software was accessed as a cloud application. This environment is termed OnDemand for Academics by SAS. Regression analysis, decision trees, and neural networks are the three modeling tools upon which the course focuses. Students learn to build all three models and use tools to compare and identify the model with the best fit for the situation. SAS provides datasets which spotlight business decisions.

4. CLASS CHARACTERISTICS

Business Intelligence is a required, senior level class for all undergraduate IT majors under a newly implemented IT curriculum in the Bill Greehey School of Business. It is also available to any business major as an elective predicated upon completion of a basic statistics course. Seven students enrolled in the initial offering of the undergraduate course and participated in the project described below. The students were primarily IT majors although two of those were pursuing a double major, one in accounting, the other in marketing. Two other students were general business majors and a sole marketing major had enrolled. Students had varying viewpoints and skills when beginning the course which supported the interdisciplinary approach. While the course is currently taught by Information Technology faculty, it is possible for the course to be conducted within the domain of other business disciplines. Marketing, in particular, could benefit from the offering of such a course due not only to the survey aspects addressed but also the type of data SAS has incorporated into their examples and training materials. The statistical aspects of the course support upper level Finance decisions and SAS has included training data to assist students in decision-making in this field, too.

Table 1 below provides the list of topics covered in the undergraduate Business Intelligence class. The project provided the students the opportunity to integrate coursework and add to their portfolio of experiential learning activities.

Table 1 Topics Covered

Problem Formulation	Presentation Techniques
IRB Certification	Descriptive Statistics
Informed Consent Forms	Regression Analysis
Survey Development	Decision Trees
Data Collection	Neural Networks
Data Entry	Collaboration Software
Data Integrity	Cloud Computing
Graphs/Charts	Teamwork

5. THE PROJECT

Problem Identification
Students were asked to explore opportunities in and around the campus for a research project that could help management in a decision-making situation. After some brainstorming, the group chose a project that could aid on-campus bookstore sales. Students noted that online textbook purchasing had become easier and economically feasible. Thus students may be more apt to buy online rather than spending money at the bookstore. The goal of the project was to develop a predictive model for bookstore textbook purchases. By recognizing important variables, bookstore management could take action to manipulate those variables or offer enticements to individuals identified as most likely to buy online.

IRB Certification
While determining the problem to be researched, students became certified by the IRB (Internal Review Board) to perform human subject research. They also began preparation of the IRB application. Google Docs was one of the IT tools used extensively throughout the project. This collaboration tool was used not only for the IRB application, but also in the informed consent form, the survey development process, and later in data entry. Even when all of the students were located in the same room, they often

worked individually without discussion on the one copy of the document.

Survey Development

The items used on the survey were developed primarily through student discussion rather than literature review. Students speculated causes and characteristics which might influence textbook purchases on campus and those that could impact online purchases. The survey was comprised of 10 questions which students believed were independent of each other. It was decided that the target participation group would be students in the business and law schools due to easy accessibility and time constraints. The appendix includes the questions included in the survey.

Data Collection

All students were assigned to the process of data gathering by approaching target group representatives in a random manner. The instructor also distributed the survey in business classes. Each potential participant was verbally asked to assist in the class project but was also informed of his or her right to refuse without penalty. A total of 76 responses were used in the analysis.

Study participants were comprised of both business and law school students currently enrolled within the University. Participants were selected based on the courses in which they were enrolled and accessibility to individuals. Faculty were asked to assist with the distribution during class periods. The research project was depicted to participants as a study focusing on the purchasing patterns of individuals who purchase textbooks online or at the St. Mary's bookstore. Involvement in the study was voluntary and anonymous. A numeric code was utilized to manipulate and aggregate the data. Research participants were not compensated for their participation in this study.

Data Analysis

The foundation of this course is explored in the data analysis stage. Students used SAS Enterprise Miner to develop models that predict which business and/or law students are most likely to purchase their textbooks in the campus bookstore. Figure 1 in the Appendix is a picture of the SAS models and the nodes used in the comparison.

Presentation of Results

Students prepared a presentation using Microsoft PowerPoint to summarize results. This was used in the Computer Sciences' department

IT Symposium. Area IT professionals participated in the symposium as reviewers and judges. This added the opportunity to display our students' IT and communication skills as well as additional exposure to the school's IT curriculum. The students were awarded cords that can be worn during their graduation ceremony.

Descriptive statistics of the participants were presented. For example, the distribution of respondents living on campus and off campus is displayed in Figure 2 below.

Figure 2 Participant's Residency
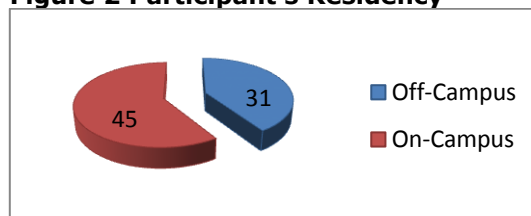
The results of the decision tree were presented. As can be seen from the diagram in Figure 3 below, the only significant factor was found to be whether or not the student had a charge account at the bookstore.

Figure 3. Decision Tree
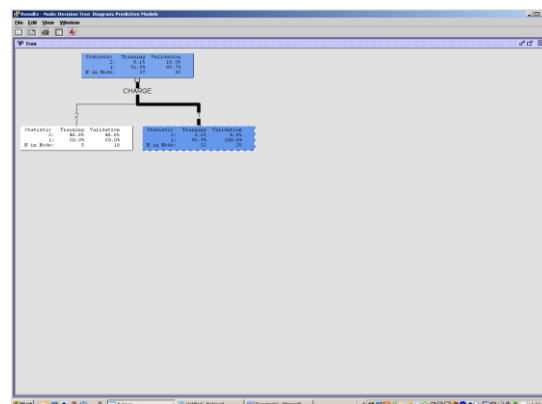
Various methods of regression were applied. Results of stepwise as well as forward regression analysis are shown in Figure 4 below. Both resulted in the imputed variable Charge to be the only significant factor determining if the student would likely buy online or at the bookstore. In addition, the neural network was trained immediately with the dataset entered.

Figure 4.   Regression and NN Results Examples
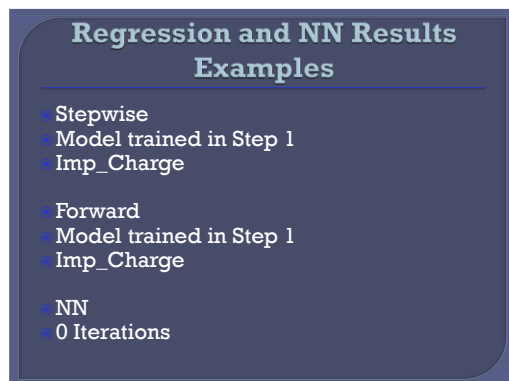
The Average Squared Error was used as the fit statistic to choose the appropriate model. As can be seen from the results in Table 2, the decision tree and regression equation produced similar model fits.

Table 2 Results

Model	ASE - Validation	# Misclassified
Tree	.062265	0
Reg	.062265	0
Reg2	.062265	0
NN2	.062268	4
NN3	.062268	4
NN4	.091663	4
Reg3	.091663	0
NN	.511218	35

The benefits of this study include enhancing theoretical concepts within the dynamic field of business intelligence and data mining. Using the SAS Enterprise Miner 5.3 statistical package will also aid the study in analyzing key elements influencing an individual's purchasing habits when it comes to purchasing course textbooks within a physical store or online. The research findings were expected to identify key predictors in an individual's behavior and also illustrate the efficiency and effectiveness of utilizing information technology applications to manipulate data into relevant information

6. BI COURSE BENEFITS

While empirical data depicting the learning outcomes was not obtained for this course, anecdotal evidence suggests that the content helps bridge the gap between the use of business intelligence software in the corporate environment and the neglect of this topic in business school curricula. The project approach helps students integrate the importance of data integrity and statistical analysis for decision-making in multiple arenas. The software exposes undergraduates to techniques such as decision trees and neural networks which are available in the business world to assist in problem-solving. The use of the software itself is simply a secondary benefit derived from the course. We hope that other faculty members can benefit from our approach to expanding student knowledge in the field of Business Intelligence.

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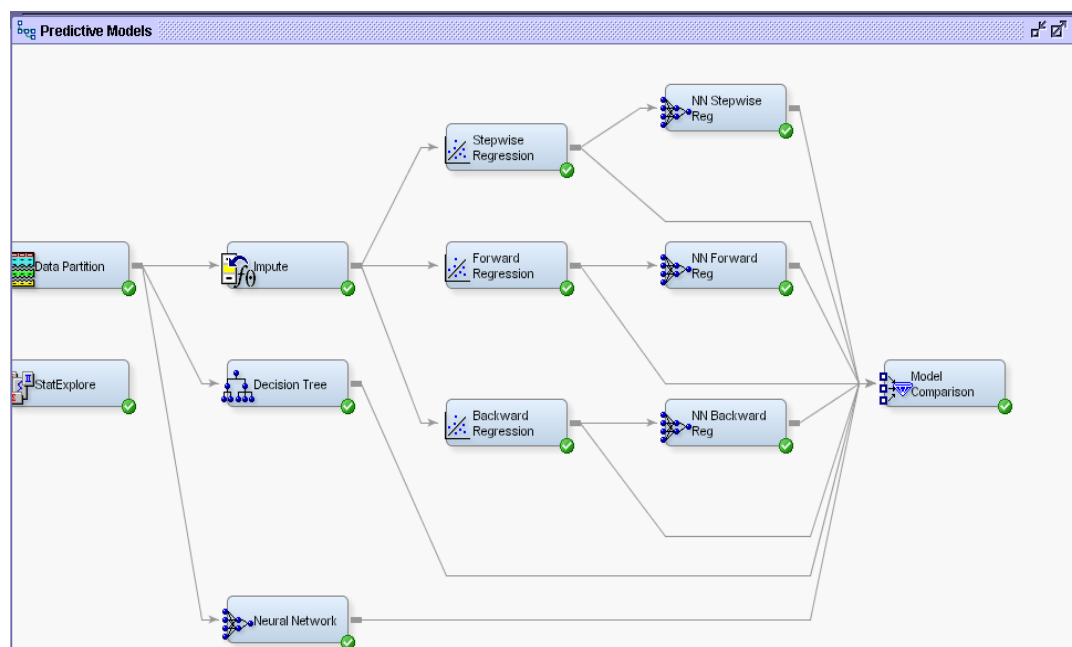
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APPENDIX

Figure 1. Example SAS Model

Business Intelligence Book Purchasing Survey

1. **Gender?** (Please Circle One)   Male   Female

2. **Where is your place of residence during the school semester?** (Please Circle One)
   on-campus / off-campus

3. **What is your academic classification?**

   Undergraduate: (Please Circle One) Fr. Soph. Jr. Sr.
   OR
   (Please Circle One) Graduate   Law Student

4. **Do you purchase textbooks in the St. Mary's bookstore?** (Yes / No)

   If no, do you purchase textbooks online, in another bookstore or from another student?
      Indicate here:

5. **Do you engage in online banking?** (Yes / No)

6. **How comfortable are you purchasing course-related textbooks online?** (Circle One)

   A.   Extremely Uncomfortable
   B.   Slightly Uncomfortable
   C.   Uncomfortable
   D.   Comfortable
   E.   Extremely Uncomfortable

7. **Do you currently use the school's bookstore charge account?** (Yes / No)
   (Circle **no** if you don't have access to one)

8. **Which factor deters you the most from purchasing books in the St. Mary's bookstore?** (Circle One)

   A.   Cost of new/used textbooks
   B.   Selection of used books
   C.   Selection of new books
   D.   Other
   (If other please specify):

9. **What is your current status of employment?** (Circle One)

   A.   Unemployed
   B.   Part-time
   C.   Full-time
   D.   Paid/non-paid internship

10. **Do you currently receive financial assistance (scholarships, grants,loans, etc.)?**   (Yes / No)

    If yes, do you use it towards the purchase of textbooks? (Yes / No)