AC 2011-1388: OAKLAND UNIVERSITY/ALTAIR ENGINEERING TECHNICAL BUSINESS INTELLIGENCE CORPORATE INTERNSHIP PROGRAM

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Lori Crose works in Strategic Programs through Academic Affairs at Oakland University. In this position she has administrative responsibility for educational programs including credit and non-credit certificates, re-licensure training, certification training and retooling programs at and above the post-bachelor level. She is responsible for developing high quality, innovative programming that will align with county, state, and federal employment trends and has been charged with connecting with government and with the business community through her work with the School of Business Administration. In addition to her 10 years of experience in administrating, counseling the adult student population and developing post-secondary programs, she has also had responsibility for writing and administrating educationally oriented grants at the K-12, secondary, and post-secondary levels. Previously she worked extensively in the health care industry, including work as a senior microbiologist for Pharmacia Upjohn and as a laboratory research assistant at a Southern Illinois University School of Medicine. She earned a Master's degree in Public Administration in 2002 from Oakland University and a Bachelor's degree from Illinois College in 1981. She is a current member of the Oakland County's Workforce Development Business Round table and serves

Oakland University/Altair Engineering Technical Business Intelligence Corporate Internship Program

Abstract

Organizations invest significant portions of their information technology (IT) budget to capture, store, and analyze data. The return on these investments will depend on how effectively organizations analyze the data and use it to support technical product development and managerial decision making. Business intelligence (BI) or business analytics are common terms used to describe the process of building models to support decision making. This paper describes the structure and implementation of a two-tier certificate program to give students a conceptual understanding of various BI modeling techniques with a focus on the application to technical decision making and solutions to business problems. The paper highlights student experiences from the initial certificate program that was completed during the March – July 2010 time frame at Oakland University in Rochester, Mi. Objectives and classroom examples from the Data Mining Tier (Tier I) are presented, along with two of the seven internship projects that were completed during the Student Internship Tier (Tier II). Program outcomes and assessment are discussed.

Introduction

The development and application of business intelligence (BI) or business analytics tools to support product development and guide managerial decision making has become a key strategic activity for companies competing in current globally-competitive markets. Organizations invest significant portions of their information technology budgets on the design, development, and implementation of decision support systems. Gartner, Inc. is one of the world's leading information technology research and advisory companies. A 2009 Gartner Group paper[1] predicted the following developments in the application of business intelligence tools.

- o Because of lack of information, processes, and tools, through 2012, more than 35 per cent of the top 5,000 global companies will regularly fail to make insightful decisions about significant changes in their business.

- o By 2009, collaborative decision making will emerge as a new product category that combines social software with business intelligence software capabilities.

- o By 2010, 20 per cent of organizations will have an industry-specific analytical application delivered via software as a service as a standard component of their business intelligence tool set.

In order to meet the pressing demand that companies have for employees skilled in BI modeling and data mining, the Oakland University School of Business Administration (Rochester, Mi) and Altair Engineering (Troy, Mi), collaborated in 2009 to develop a Business Intelligence and

Data Mining Certificate Course[2]. The course was structured to give students a conceptual understanding of various modeling techniques with a focus on real-world applications.

The course itself is a 160-hour post-baccalaureate non-credit certificate comprised of a two-tiered structure. Tier I of the course provides the students with a 60-hour theory overview of data mining and data-basing techniques. The application of software tools in decision making as well as detailed case studies demonstrating how BI can be used effectively in today's competitive product development environment are covered.. This includes the application of Altair Engineering Business Intelligence HiQube software using specific case studies involving applications in the product development, quality, warranty, and financial business environments.

Tier II is comprised of a 100-hour, unpaid internship whereby students demonstrate their knowledge in practice at business host site. Students who satisfactorily complete the Tier I portion of the course proceed with the Tier II Internship. The internship may be at a local sponsoring company within the Detroit, Michigan area, a distance company within the US, or a distance company internationally. The internship work is project focused to assure a finite conclusion.

Tier I is instructor-led since it involves practical software learning which necessitates a computer lab. This theory and application portion of the course meets for 10 hours per week over a six week period. Tier II may be instructor-facilitated, online, or in a web-conferencing environment. This internship portion of the course is conducted over a 5 week period for 20 hours per week.

Students and working professional that have achieved a technically-oriented Bachelor of Science or Master of Science degree are actively requited for the certificate program. Candidate students have degrees in the fields of engineering, information technology, computer science, operations management, marketing, or finance.

With regard to learning objectives, students are expected to apply business intelligence/data mining analysis tools to solve real world problems through a local or distance project-oriented work environment. At the end of the course, the student should be able to:

- o Frame a product development or business problem to build a decision support model

- o Assess data needs to build a decision support model

- o Prepare data for mining and decision support

- o Build classification and clustering based decision support models

- o Interpret and evaluate decision support models

- o Understand the advantages and pitfalls of different modeling techniques.

The following sections of the paper provide a detailed description of the Tier I (Data Mining) and Tier II (Student Internship) portions of the course. The paper concludes with a discussion of course assessment and outcomes.

Tier I: Data Mining & Data-Basing Methods

Tier I of the course provided the students with a 60-hour overview of data mining and data-basing techniques. This theory and application portion of the course was developed with the following principles in mind.

- o Multi-disciplinary perspective: The core of this portion of the course is to build decision support models with application to all functional areas of technology development and business. To accomplish this effectively, domain knowledge in a specific functional area is critical as the effectiveness of the decision support models are only as good as your understanding of the context to which it is to be applied.

- o Teamwork: Student collaboration on team projects is fundamental

- o Action learning approach: Tier I relies heavily on learning by doing. Students gain first-hand experience of building decision support models as part of an assignment and team projects.

- o Peer learning: Students played an active role by making proposal presentations and leading selected article discussions. As such, learning from peers through active participation in "in-class' discussions was an important element for learning.

Tier I was divided into two sequential parts, each having a different focus and taught by a different instructor. The first part was directed at the fundamental concepts of data mining and database development. Adjunct Professor Prakash Shrivastava of the Oakland University School of Business Administration taught this part. The textbook "Data Mining for Business Intelligence"[3] was used, along with the M.I.T. Lincoln Library XL Miner software tool[4]. The second portion of Tier I instruction was focused on the application of Altair HiQube business intelligence software[5] using specific case studies from application in product development, warranty, quality, and financial business environments. Instructor Charbil Saleh of Altair Engineering taught this portion of Tier I. The following summarizes selected student exercises from both parts of Tier I.

Tier I Classroom Examples

For the fundamental concepts portion of the classroom instruction, the students developed skills using exercises in the textbook[4]. In addition, they developed projects within their domain of

experience and expertise for which they brought their own datasets. A couple of examples are shown below.

- o <u>Increase Donations to an NGO Organization</u>: In this project, students applied clustering methods to identify 4 segments of the population of interest: Little or No donation potential, Low donation potential, Medium donation potential, and High donation Potential. Then they used "classification tree" technique to develop simple rules which would help them identify potential donors. In addition, they deployed Regression method to estimates of revenue potential.

- o <u>Admissions and Success in a University</u>: In this project, students worked on a dataset to identify characteristics of students that are likely to "accept" admission offer from a University. They also developed a model depicting successful graduations predicated on a set of variables using Logistic Regression method.

The main objective of the second portion of Tier I instruction was to teach the students how to apply Altair Engineering's HiQube software[5]. The students learned how to gather requirements, interpret and analyze relevant data, identify Key Performance Indicators (KPIs), and perform a complete process mapping needed to develop HiQube dashboards. A combination of classroom demonstrations and exercises were used to familiarize the students with the HiQube environment and various techniques needed to work on course projects. Two examples of classroom demonstrations are illustrated in the following.

<u>Design Validation</u>: Euro NCAP is an organization that executes vehicle crash tests and provides motoring consumers with realistic and independent assessment of safety performance of some of the most popular cars sold in Europe. Established in 1997, Euro NCAP is composed of seven European Governments as well as motoring and consumer organizations in every European country. Data was collected from the official EURO NCAP website and presented in an interactive dashboard were users can track KPIs at various vehicle development gates for multiple models.

Figure 1: HiQube Dashboard of Euro NCAP Vehicle Crashworthiness Data

Conditional Based Maintenance: Maintenance and repair data for helicopters was gathered and presented in a dashboard to help users keep track of repair time and cost.
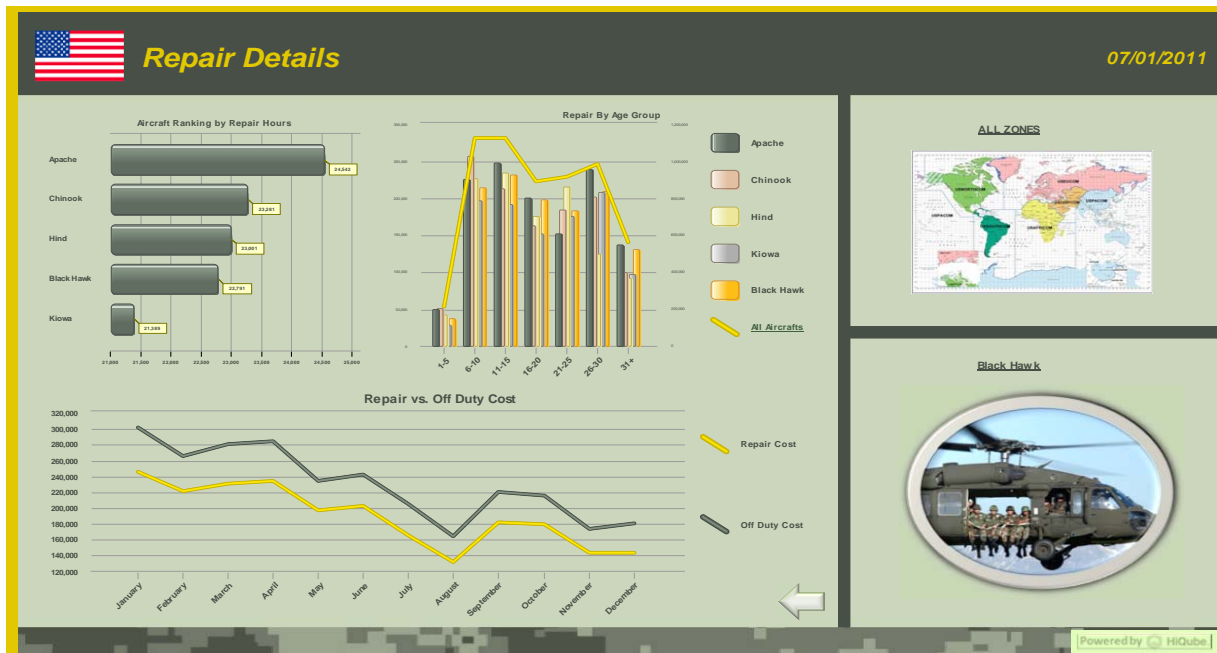

Figure 2: HiQube Dashboard for Helicopter Maintenance

Overall, the Tier I portion of the course helped students gain practical skills in unsupervised learning methods and predictive analytics – classification and prediction methods.

Tier II: Student Internships

Tier II of the course consists of a 100-hour unpaid internship whereby the students apply the database modeling skills from Tier I to a sponsoring business site. Students who satisfactorily complete the Tier I portion of the course proceed with the Tier II Internship. The internship must be completed within 9 months after finishing the Tier I coursework. The internship may be with a local Michigan sponsoring company, a distance company within Michigan, or a distance company within the US. During the internship, students worked closely with the sponsoring-company to apply BI modeling and analysis techniques to a technical business problem or need. At the conclusion of the internship, the students were responsible for completing a set of deliverables related to their internship project. These are: 1) a HiQube Database Model, 2) a Power Point Presentation, and 3) a Project Report.

The internship projects for the initial Oakland University/Altair Engineering Certificate Program were completed June 15-July 30, 2010. The students typically worked 20 hours per week on their projects. Of the eight students registered for the Certificate Program, seven completed internships. In addition, one student completed two internship projects. The Table listed below summarizes the internship projects.

Table I: Internship Project Summary

Student	Project Type (Individual, Partner or Combination Project)	Project Company Sponsor	Project Title	Project Description
1	Combination	Oakland University	Data Mining the Oakland University Alumni Database	This project employed the use of the M.I.T. Lincoln Library XLMiner software tool in an actual business situation. Specifically, it provided business insight into the Oakland University (OU) efforts for fundraising. The objective of this project was to identify high-potential opportunities available to the OU fundraising operation in the alumni donation area.
2	Combination	Oakland University	Data Mining the Oakland University Alumni	This project focused on overall data analysis of an active OU database, using a variety of analysis tools.

			Database	
3	Combination	Oakland University	Data Mining the Oakland University Alumni Database	This project focused on using the power of the HiQube tool for speculating future alumni targets.
4	Combination	Altair	Import Adventure Works Database	The goal of this project was to create a way to import Adventure Works database inside HiQube, focusing on one area (for example: sales) for reporting and analysis. This would allow one dashboard system through HiQube.
5	Combination	Altair	Import Adventure Works Database	The goal of this project was to create a way to import Adventure Works database inside HiQube, focusing on one area (for example: sales) for reporting and analysis. This would allow one dashboard system through HiQube.
6	Individual	Altair	Dashboard Solution for Issues Tracking	The project scope involved creating a model from transaction data pertaining to customer support and issues tracking databases for Altair products. As a part of deliverables, to create analytical output to target audience to manage, improve and balance resource requirement for bettering quality of customer support services.
7	Individual	Altair	Resource Analysis Altair, Int.	The aim of this project was to analyze Altair's resource utilization data across various business lines and cost center activities. In addition, it focused on providing historical and current views of business operations.
7	Individual	Great Place to Work	Competitor Market Analysis	Develop a regional business development strategy based on a matrix analysis of selected business metrics that will increase brand awareness and sales for Great Place to Work® Institute.

The following provides a summary of two of the internship projects.

Data Mining the Oakland University Alumni Database

This project employed the use of the M.I.T. Lincoln Library XLMiner software[4] and the Altair engineering HiQube software[5] to provide guidance to Oakland University (OU) efforts for fundraising for university educational support. The project objective was to identify high-potential opportunities available to the OU fundraising operation in their alumni center. Essentially, the project effort was to determine higher-value "low-hanging fruit" for donation contribution. For example, if a particular group of alumni was found to be contributing lower-than-average funds, additional strategies were identified to improve donations in a cost-effective manner. The following figures illustrate the HiQube modeling that was completed for this project.
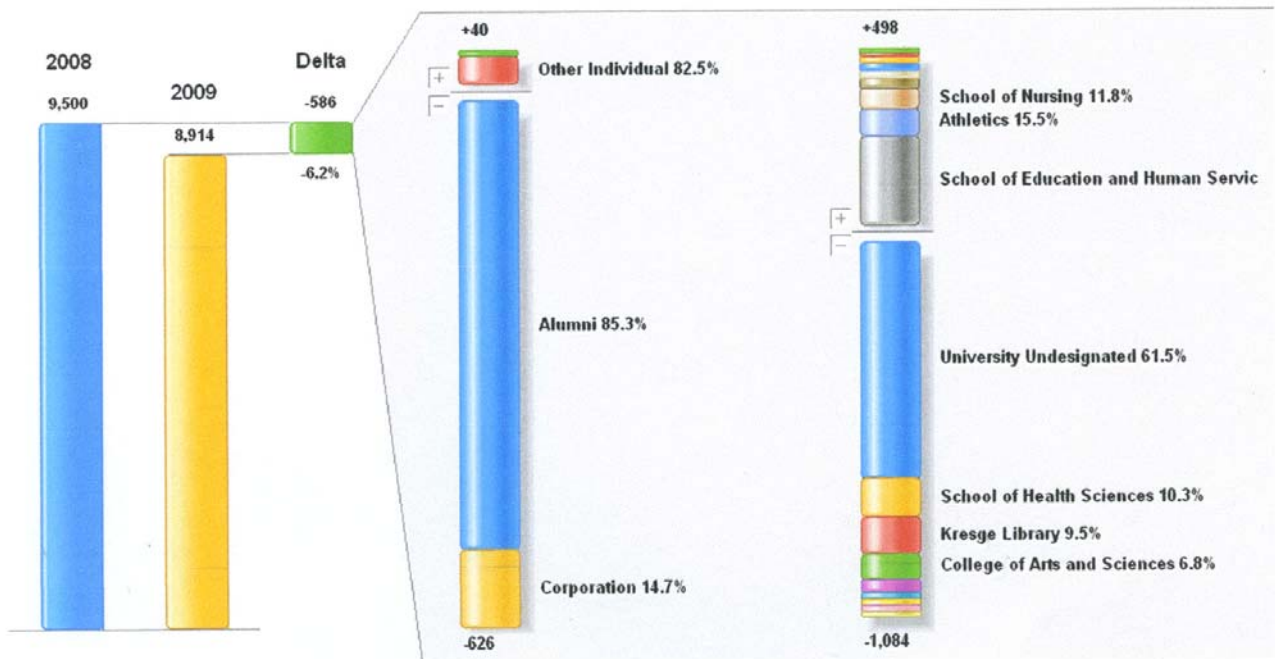

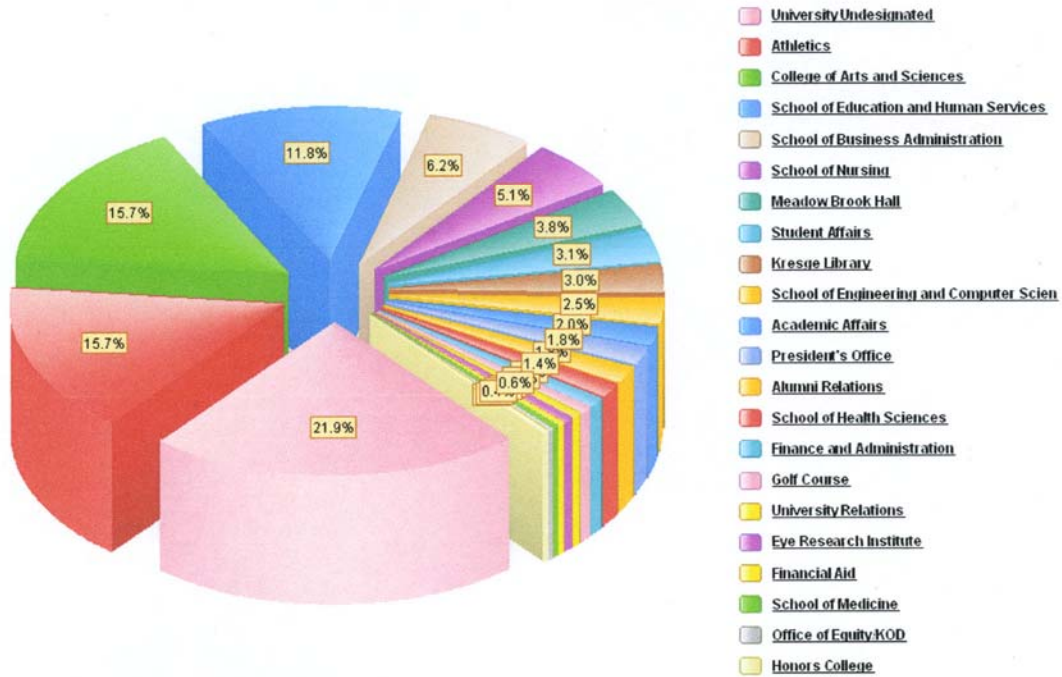Figure 3: Number of Donors Year-to-Year Comparison

Figure 4: Number of Donors by Division

Development of Dashboards for Altair Engineering Customer Support Services

This project was directed at creating a BI model from transaction data pertaining to customer support and issues tracking databases for Altair software products. The deliverable was the creation of an analytical output in the form of a dashboard that could be applied by management to improve quality and balance resource requirements for customer support services. During the project planning phase, frequent meetings with financial and software development managers were conducted to understand internal requirements and Key Performance Indicators (KPIs). After the necessary data was gathered and KPIs identified, a detailed dimensional analysis of the data was conducted. The data was then loaded into HiQube and the necessary reports, charts, and dashboards were created. An example chart and an example dashboard are shown in Figures 5 and 6, respectively.
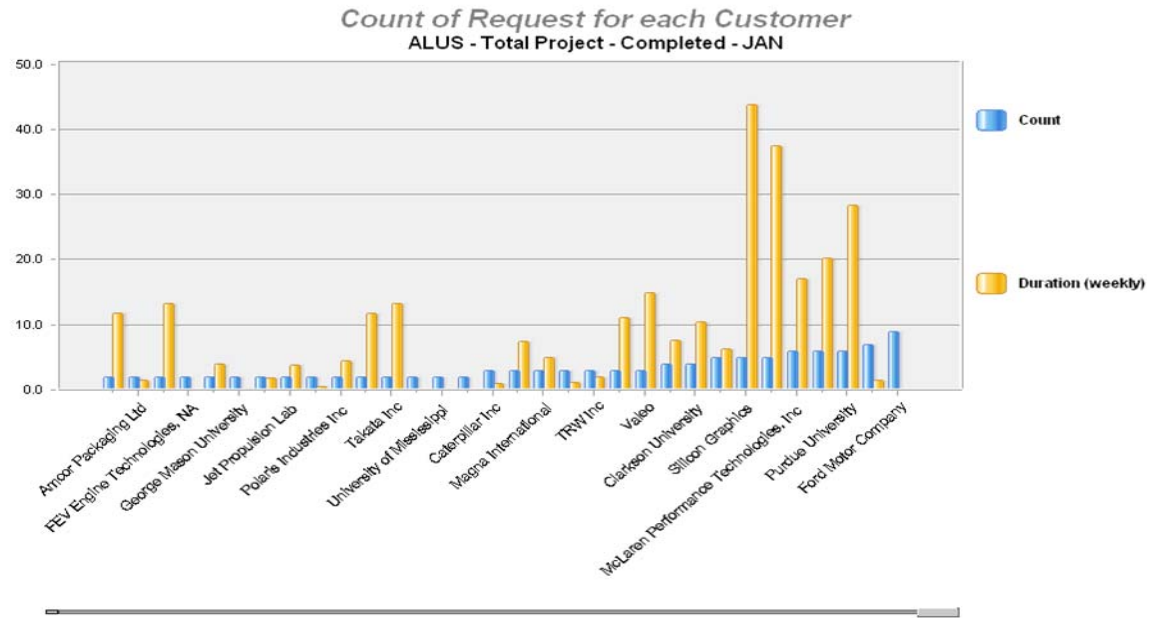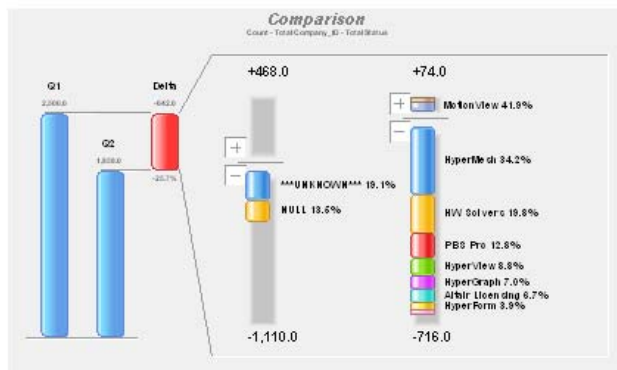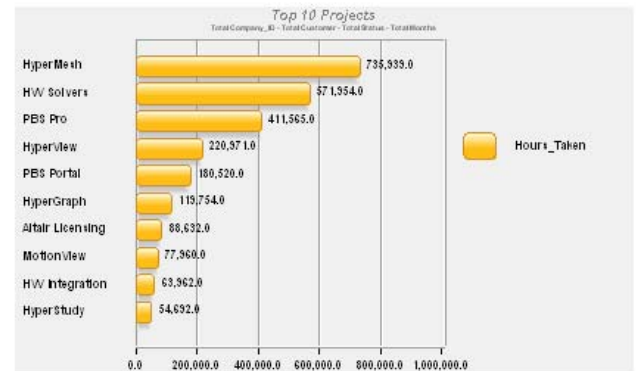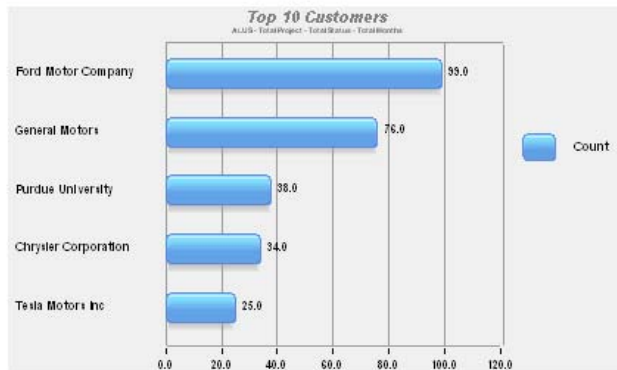
Charts

Figure 5: Chart-Request Count by Customer

Figure 6: Dashboard Examples

Course Assessment and Outcomes

At the conclusion of this course, participating students should be able to:

- o Frame a product development or business problem to build a decision support model

- o Assess data needs to build a decision support model

- o Prepare data for mining and decision support

- o Build classification and clustering based decision support models

- o Interpret and evaluate decision support models

The course was structured to meet these objectives by giving the students a conceptual understanding of various modeling techniques with a strong focus on application to technology development and business problems.

Course evaluations completed by the seven students who completed both tiers were used to evaluate the above objectives. Figure 7 shows the Intern Program Evaluation Form that was used for course assessment. Averaged scores from the seven students are summarized in Table 2.

Please answer the questions when asked, and rate the answers based on a scale of 1-5, with 1 being the least favorable and 5 being the best or strongest answer.

1=very negative, 2=somewhat negative, 3= neither positive nor negative, 4=positive, 5 = very positive

Please tell us about your experiences in the BI Certificate Program.

Overall, the BI Certificate Program was beneficial to my

professional development.   1   2   3   4   5

Did you feel the Tier I BI Course benefitted your project?   1   2   3   4   5

Did you feel Tier II BI Course benefitted your project?   1   2   3   4   5

Did you feel the internship was the most beneficial to your

professional development?   1   2   3   4   5

Do you think the faculty was knowledgeable about the subject matter? 1   2   3   4   5

How would you rate the quality of the education you received here?   1   2   3   4   5

How would you rate your ability to enter the professional field?   1   2   3   4   5

Figure 7: Intern Program Evaluation Form

Table 2: Summary of Course Evaluation

Evaluation Question	Ave. Score
Overall, the BI Certificate Program was beneficial to my professional development.	4.2
Did you feel the Tier I BI Course benefitted your project?	4.0
Did you feel Tier II BI Course benefitted your project?	3.7
Did you feel the internship was the most beneficial to your professional development?	3.8
Do you think the faculty was knowledgeable about the subject matter?	4.7
How would you rate the quality of the education you received here?	4.3
How would you rate your ability to enter the professional field?	4.0

While the student evaluation scores indicate that all of the Certificate Program objectives were met, several written comments from the evaluations have led to the following course modifications.

- As all of the students had not satisfied the prerequisite requirement for fundamental statistics, basic statistics concepts should be reviewed at the beginning of Tier I.

- The structure and content of each available internship project should be drafted by the beginning of Tier II.

- The Certificate Program should be taught as an e-learning course.

The incorporation of these changes will enhance what is already a unique course that combines the expertise of universities and employers to create a program that matches classroom curricula with the needs of commercial enterprises.

References

1. The Gartner Group, "Gartner's Hype Cycle Report for 2009", Gartner (August 2009).

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5. Altair Engineering HiQube Business Intelligence and Data Analytics Software, http://www.hiqube.com