Journal of Information Technology Education: Innovations in Practice **Volume 9, 2010**

Real World Project: Integrating the Classroom, External Business Partnerships and Professional Organizations

Donna M. Grant, Alisha D. Malloy, Marianne C. Murphy, Jovanna Foreman, and Rowena A. Robinson
North Carolina Central University, Durham, NC, USA

grantd@nccu.edu; amalloy@nccu.edu; mmurphy@nccu.edu

Executive Summary

A college degree is not what it used to be in respect to securing future employment. Constantly changing technologies in a struggling economy make it necessary for organizations to carefully balance recruitment staffing, particularly with regards to new hires. Organizations want to know that each new hire can add value immediately. In order to add value, Information Systems (IS) graduates must possess the necessary technical skills as well as "real world" work experience and soft skills. Additionally, these graduates will have more success if they have had applicable industry experience and a network of business professionals. In this paper, we describe a capstone experience model that goes beyond the reinforcement of the students' technical skills. The model extends the normal classroom to include students' putting into practice their skills and establishing professionals networks through their interaction with professional organizations and business partnerships. Our proposed capstone model integrates three learning environments: the classroom, a business organization and a professional organization. The model reinforces our students' technical, project management, team work, and communication skills through the implementation of a "real world" information system and the presentation of their system to their external client and at a professional conference. The expected benefits of this proposed model are to utilize various partnerships to prepare our students for employment Information Technology (IT) industry; allow our students to demonstrate their skills and talents; and establish networking opportunities with organizations and IT professionals.

The initial pilot of our model was conducted during the 2008-2009 academic year. Our capstone model classroom environment incorporates two courses: 1) Systems Analysis and Design and 2) Systems Implementation. The "real world" experience with the external business partner was a year-long project implementation of the City's Print Services information system. The professional organization environment was achieved by the additional requirement for the team to submit their project to a national conference. Consequently, the team submitted a paper, presentation, and poster to the BDPA 2009 National Conference IT Showcase.

The overall results of the initial pilot were very favorable. The students successful designed, developed and implemented the City's Print Service system. The students' paper and presentation received third place at the BDPA 2009 National Conference IT Showcase. Additionally, in order to evaluate the success of pilot from the stakeholders' perspective, two surveys were created: CIS Capstone Experience Project Team Survey

Editor: Anthony Scime

and CIS Capstone Experience Customer Satisfaction Survey. The students' responses to the survey showed that they valued the capstone experience and want to see it continued, improved, and expanded. The external customers, the City employees, were very satisfied with the student's performance as demonstrated on their survey responses. The City employees answered six of the ten survey questions with an average rating of 5.0 and three received an average rating between 4.0 and 4.75 (with 5 being strongly agree on questions regarding quality, performance, communication and process). Our future research will include developing quantitative measures to test the model's overall success and establishing measures to weigh the contributions of each component of the model.

Keywords: Capstone Course, Real World Projects, External Business Partnerships, Information Technology Professional Organizations

Introduction

The rapid changes in technology as well as the struggling economy demand that organizations efficiently utilize their resources in order to remain competitive. These constraints translate into an increasingly competitive and discriminating hiring process for recent college graduates (National Association of Colleges and Employers, 2009). A college graduate must possess more than the technical skills acquired through his or her degree program. "There is an increasing need for managerial and professional employees with a range of personal competencies that extend beyond the exhibition of technical expertise" (Brown & Scase, 1994, p. ix).

The literature strongly suggests that many graduates with IS degrees lack soft skills (Bullen, Abraham, Gallagher, Simon, & Zwieg, 2009; Russell, Russell, & Tastle, 2005). These soft skills generally include, but are not limited to project management, teamwork, presentation and communication. Some universities have attempted to make curriculum changes to strengthen these skills through adding new courses or programs (Hanna & Sullivan, 2005; Russell et al., 2005; Seethamraju, 2007). Since many IS departments may not have the flexibility to expand their programs, there is a need to address these issues within their current curriculum.

Education must go beyond the classroom in order to prepare students for today's job market. We introduce a pedagogical model that integrates "real" world projects with business partnerships and professional organizations in order to facilitate and reinforce technical, communication, presentation, teamwork and project management skills.

Background

IS Skills Gap

The IS model curriculum (Davis, Gorgone, Couger, Feinstein, & Longenecker, 1997; Gorgone, Davis, Valacich, Topi, Feinstein, & Longenecker, 2003; Topi et al., 2010) has evolved over the years to recognize the changing nature of information systems. The curricula guides acknowledge each university's responsibility to adjust the model curriculum to meet the needs of its target job market. Matching skills learned to employer needs is widely accepted as a means to review and adjust the IS curriculum.

In order to understand and properly align IS curriculum, researchers have studied the effect of the ever changing Information Technology (IT) industry and how it relates to the preparation of future IT workers. The concern that curriculums match industry needs has led to research that involves the in-depth study of business needs based on informal focus group discussions and follow up surveys of IT professionals (D. M. S. Lee, Trauth, & Farwell, 1995). D. M. S. Lee et al.'s (1995) study found that the lower-level IT jobs are rapidly disappearing and the requirements for IT professionals are becoming more demanding in multiple dimensions, particularly in the areas of business functional knowl-

edge and interpersonal/management skills. While new jobs require some technical competencies they also require the soft skills necessary to apply information technology to solve business problems.

Other studies have also surveyed IT professionals to determine job-hiring expectations for either specific IT occupations or within a specific region in order to better map the IS curriculum with employers needs (Banerjee & Lin 2006; Downey, McMurtrey, & Zeltmann, 2008; Janicki, Kline, Gowan, & Konopaske, 2004; Janicki, Lenox, Logan, & Woratschek, 2008). All of these studies confirmed the findings of D. M. S. Lee et al. (1995). The consistent theme in the studies is the need to hire IT professionals that possess a blend of technical and soft skills. These soft skills include, but are not limited to, the ability to communicate, solve business problems and have some project management expertise (S. M. Lee & Lee, 2006).

While many of these soft skills have been taught in the classroom, "learning techniques, beyond classroom activities, have been recognized as essential ingredients to enhance learning outcomes" (Kamoun & Selim, 2007, p. 81). Kamoun and Selim's (2007) study focused on a guest speaker program which exposed students to the IT professional environment. This exposure was found to be vital in not only conveying specific IT practical knowledge but also laying the groundwork for partnerships and student networking. Bullen et al. (2009) state that universities still lag in their responsiveness to the needs of organizations in the IT marketplace. Their study states that there is a shift in the mission of the information system function from delivering technology-based solutions to managing the process of delivering solutions. The study further states that critical skills needed by the IT industry have shifted to a mixture of technical, business and project management capabilities.

The Capstone Experience

In general the capstone experience is an opportunity for students to reinforce and/or test the skills they have learned throughout their academic program. "These important courses give students the opportunity to collaborate with their peers; practice their presentation and organizational skills; use their knowledge; and, ultimately, showcase what they have learned and achieved during their college experience. They are, in fact, an ideal way to ensure that graduates are prepared for life after college (Fanter, 2006)." This experience could consist of one or more courses.

Both the IS '97 and IS 2002: Model Curriculums and Guidelines for Undergraduate Degree Programs in Information Systems recommended a series of courses in the information systems development and information system deployment and management process areas (Davis et al., 1997; Gorgone et al., 2003). In the information systems development area the courses are: Analysis and Logical Design, Physical Design and Implementation with DBMS, and Physical Design and Implementation with a Programming Environment (IS '97)/ Physical Design and Implementation in Emerging (IS 2002) Environments. For the information systems deployment and management process area the course is Project Management and Practice.

The Analysis and Logical Design course addresses a systematic methodology for analyzing a business problem and articulating business requirements for the technology solution (Davis et al., 1997; Gorgone et al., 2003). The Project Management and Practice course incorporates many of the technical skills learned in the program and attempts to address soft skills in a semester and/or year long group project (Chen, 2006; Hashemi & Kellersberger, 2009; Malinowski & Noble, 2009; Russell & Russell, 2009).

Various methodologies for teaching the one or more course model have been introduced. These methodologies include the use of case studies (Guo, 2004; Harper, Lamb, & Buffington, 2008; Tetard & Patokorpi, 2005), reengineering (Matos & Grasser, 2007), comprehensive projects (Vliet & Pietron, 2006), multi-year projects (Cooper & Heinze, 2007; Hashemi & Kellersberger, 2009), simulation (Jih, 2003) and real world projects (Chen, 2006; Hashemi & Kellersberger, 2009; Malinowski & Noble,

2009). The latter, real world projects, has been given considerable attention as a way to provide practical experience, better prepare students for future employment, and build soft skills.

Real world projects

Real world projects attempt to integrate various technical and soft skills in order to solve real business problems. Since working successfully in groups/teams is a requirement in the IT industry many IS programs have incorporated group and project assignments into curriculum courses such as database, programming, networking, and systems analysis and design courses (Clyde & Crane, 2003; Dempsey, Anakwa, Huggins, & Irwin, 2003; Hamblen, Owen, Yalamanchili, & Dao, 1999; Hanna & Sullivan, 2005; Huizinga, 2002; Mason, 2008). The additional use of real world projects reportable to real clients has its unique potential benefits and challenges.

Table 1 provides some general findings of the use of real world projects in IS capstone courses. The benefits and challenges have not been empirically tested. However, there appears to be some consistent themes. The main benefit is that students feel proud of their projects and gain confidence in their practical abilities. It is not clear if this confidence translates to increased soft skills such as communication and interpersonal skills. The main challenge for educators is providing consistent projects across student groups and choosing appropriate projects.

Table 1: Real World Project Findings

SOURCE	COURSE NAME(S)	GENERAL FINDINGS	
		Benefits	***Challenges***
(Chen, 2006)	Systems Analysis and Design Systems Implementation	• Working for a real client motivated students • Effectively learned the material	• Student roles were not clearly defined and diminishes the ability of students to complete a feasibility analysis • Choosing appropriate projects is difficult particularly in providing consistency across student groups
(Scott, 2006)	Group Systems Development Project	• Competitive nature of the projects encouraged creative solutions and new technical skills • Deep learning of technical and interpersonal skills that translate to marketable skills	• Intellectual property issues with the project sponsor • Group selection process may not reflect a real world situation

SOURCE	COURSE NAME(S)	GENERAL FINDINGS	
		Benefits	***Challenges***
(Janicki, Fischetti, & Burns, 2007)	Project Management Emerging Technologies	• 60% of the final projects were implemented for use by the clients • Students expressed increased time management and communications skills	• Inconsistency and production quality across student groups • Projects selection is difficult particularly for completion in one semester
(Jones & McMaster, 2004)	Team Project Scheme	• Real world expands multiple years and classes • Ongoing business partnership builds confidence and increases initiative • Anecdotal information suggests students extensively discuss their project experience in job interviews	• Time frames and objectives do not always coincide with an academic semester • Students encounter unfamiliar technologies that may prove too challenging for some students • Perceived differences in project consistencies across various student groups • Managing client expectations
(Keogh, Sterling, & Venables, 2007)	Capstone Project	• Increased student confidence • Workshops provided opportunity for different student groups to describe their experiences	• Framework provides appropriate project selection
(Miles & Kelm, 2007)	Software Engineering Capstone Project	• Project success related to higher levels of communications between client and students • Developed trust among team members	• Time management of groups • Client expectations

SOURCE	COURSE NAME(S)	GENERAL FINDINGS	
		Benefits	***Challenges***
(Hashemi & Kellersberger, 2009)	Senior Project	• Long term projects that span multiple groups provide full Systems Analysis and Design experiences • Experience working with large, complex and in-place systems • Global understanding of a large, complex system • Experience mapping and working with components that have critical interrelationships • Increased collaboration skills by working with users, instructors and colleagues	• Coordination required of instructors across multiple semesters • Length of time required for user involvement before a completed project

External Business Partnerships

By its very definition "partnerships" indicate a mutual relationship. Many university program leaders recognize the need to build business partnerships as indicated by the development of advisory boards (Janicki, 2006; Koong, 2003). Organizational board members review and offer feedback to curriculum decisions in the hopes of programs that will produce the kinds of potential employees needed to support their industry. Academics understand that education is a vehicle to help ensure the economic future of its students. However, these partnerships have further reaching implications.

In today's economy, organizations will hire candidates who not only have the required education but who also possess some work experience. Therefore, academics cannot ignore the business relationship as a means to provide students with practical experience. This need for skilled workers can be met through growing partnerships between education and businesses (Hyslop, 2009).

What then is the main interest of these partnerships? Pawlowski (2007) took a close look at how to build solid and sustainable partnerships with the business community that benefits schools, students, and business partners. Most interesting is that the approach to these relationships is collaborative without a prepared agenda. The openness of these relationships provides many opportunities for academic and student involvement in business activities that can lead to internships and/or placements.

As with students exposed to practical experience through internships, membership in professional organizations have considerable advantages in the workplace. Using professional organizations' networks is another excellent way for faculty and students to garner internships and employment as well as project opportunities for students.

Professional Organizations

Professional organizations have a long history of providing a means of furthering the interests of a particular occupation. Members of these groups have the opportunity to network with others in their

chosen career as a means to investigate changes in their field, new technologies that may affect their job and potential job opportunities.

Various organizations support IT professionals including the Association for Computing Machinery (ACM), the Association of Information Technology Professionals (AITP) and the Black Data Processing Associates (BDPA) to name a few. The roles these organizations play varies, for instance the ACM is a valuable resource to academics as well as professionals providing "… the world's largest educational and scientific computing society, delivers resources that advance computing as a science and a profession. ACM provides the computing field's premier Digital Library and serves its members and the computing profession with leading-edge publications, conferences, and career resources" ("ACM Welcome Home page," 2009). AITP has a specific network that provides its members with the opportunity to share knowledge, career and educational opportunities and build lifelong relationships ("aitpNetwork," 2009). All of these organizations have student memberships and provide valuable resources to IT professionals; they may play an even more pivotal role for students who need to set themselves apart in the job market.

Student participation in these organizations can vary from educational opportunities to internships to skill development. Many professional organizations provide students with the opportunity not only to network but to also expand their knowledge and expertise through conference presentations and papers.

BDPA has thousands of members in 55 chapters across the United States. The organization is extensively involved with its student members from high school through graduate work. They are dedicated to not only providing opportunities to network but also providing positive role models committed to helping student members become the next generation of IT professionals and executives. Annual conferences provide student members with the opportunity to build business skills such as effective speaking and writing, delivering impressive presentations, setting and meeting goals, team building and time management ("You are the future. Are you ready?," n. d.).

The BDPA National Technology Conference provides students with many opportunities to participate in research in order to increase their business skills as well as develop their understanding of emerging technologies. High School and College students have an opportunity to participate in the IT Showcase, a two day event where students present and demonstrate their research through developing a paper, creating a poster presentation and giving an oral presentation. Their research is judged by a three (3) person panel and three awards are given. The audience consists of high school students, college students, IT professionals and academics who attend the national conference.

Enriching the Capstone Experience

Research indicates that in order to adequately prepare students, the capstone experience must include soft skills (S. M. Lee & Lee, 2006), real world projects through partnering with business organizations (Chen, 2006; Hashemi & Kellersberger, 2009; Janicki, Fischetti, & Burns, 2007; Jones & McMaster, 2004) and networking exposure to IT professionals (Basselier & Benbasat, 2004). To implement a more enriched capstone experience, we merged and deepened the students' experiences in three areas: classroom, business organization and IT professional organization.

Model

The proposed model for the CIS senior capstone experience is the integration of three distinct learning environments: the classroom, an external business organization and a professional organization (Figure 1). This model provides students with a richer capstone experience by combining the system development concepts with real world work experience. Additionally, we provided the students with a means to network with IT professionals as well the opportunity to develop communication, presentation, and project management skills.

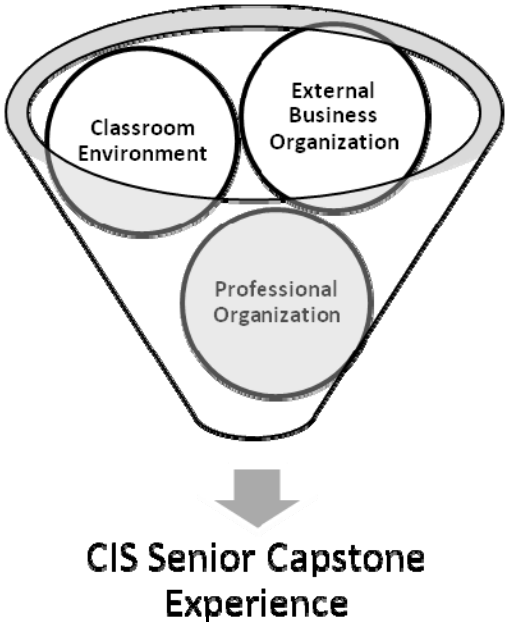

Figure 1: CIS Senior Capstone model

Classroom environment

The capstone experience can consist of one or more courses (Hashemi & Kellersberger, 2009; Jones & McMaster, 2004). Our senior capstone experience follows a two course series of: 1) Systems Analysis and Design and 2) Systems Implementation. The topics that are typically covered in our first course include analyzing the business case, modeling the requirements, and developing solution strategies with an increased focus on project management and communication. Mini cases are utilized in group and individual assignments in order to reinforce user input, interface, and data design techniques. The course typically has 15 – 25 students who are assigned to project teams consisting of four to five team members. Each project may have the same or different external business organization sponsors. While it is optimum to have several projects from the same external business organization, the class can effectively be executed with up to three different external business organizations without the need of an additional instructor.

The primary student learning outcome for this first course is an Information Systems project book. This book contains the deliverables for a real world IS project for the client. The deliverables include, but are not be limited to: the business problem, the project scope and constraints, the four feasibility studies for the project (i.e., financial, technical, operational, and schedule), the project development time and cost, the new business process model, the system requirements, the user interface design, the data design and the data dictionary.

The second course, Systems Implementation, incorporates many of the technical skills learned in the program and addresses many soft skills. Students learn the fundamental concepts and models of application development in order to understand the key processes related to building functioning applications and appreciate the complexity of application development. Students implement the basic concepts of program design, data structures, problem solving, programming logic, and fundamental design techniques for event‐driven programs. Within this course design, projects are continued, rotated, expanded, reverse engineered and re-engineered, as the implementation and support phases of the systems life cycle are also simulated. Project management is also continued and emphasized as teams must manage project sponsors expectations, project timelines, and deliverables.

There are three primary student learning outcomes for the Systems Implementation course. The first two are project management experience and enhanced team building skills. The third outcome is a well-documented, computer-based information system for the client. The performance metrics for these outcomes are not only the success of the project with regard to on time, within budget, meeting the client's requirements, etc but also formal peer, client, and faculty evaluations.

As in industry, there is no guarantee that projects will continue from the System Analysis & Design course to the System Implementation course. For each project, the project team is required to produce documentation that will be used for the go/no-go decision as well as serve as the knowledge repository for the project if it is continued. The project sponsor and faculty sponsor review the information gathered during the first course to analyze the feasibility of the project for the second course. The two courses were designed to be taken in lock-step. However, there have been students that either decide not to take the second course because they are CIS Minors or do not take the second course immediately after the first course. There is no requirement for the same faculty member to teach both courses, however there is the need for the faculty members to do a project knowledge transfer. Typically this is done during the last phase of the first course. In order to ensure that the proper knowledge transfer for the project between the two courses is achieved, it is essential for the faculty who will teach the second course to be at the final project presentations given at the end of the first course.

Partnership with the business organization

Partnering with the business community is recognized as a vital component of a student's education as well as a means to secure potential internships and future employment. The advisory board has been established at many universities and its benefits are widely recognized (Janicki, 2006; Koong, 2003).

In order to build formal business partnerships, the Dean of the School of Business at our university requested that each department establish a Board of Advisors for their discipline. Our Board was established in February 2009 and is comprised of representatives of national and international organizations that either require IS skills or are identified as stakeholders of the CIS Program. The Inaugural CIS Board of Advisors were selected by analyzing companies who already had a strong informal partnership with our program, had already hired our CIS students in internships or permanent positions, who regularly participated in our external speaker series, and/or who demonstrated a sincere interest in our CIS program and students. The Board also consists of three CIS Faculty members, one Staff Liaison who is the Director of Professional Development in the School of Business and two student representatives having ex-officio membership. Currently, our Board consists of the following corporations: Bank of America, BDPA, Blue Cross Blue Shield of North Carolina, Chubb and Son, Cisco Systems, and IBM. The purpose of our Board of Advisors is as follows:

1. to provide an opportunity for businesspersons and educators to become more familiar with the goals, opportunities, challenges, and responsibilities of our CIS Program;
2. to assist in identifying the skills required of businesses and the IT industry; and the CIS Program's present and future roles in preparing students to acquire those skills;
3. to identify future employment trends and employers' personnel needs and requirements
4. to raise funds and/or provide in-kind donations that can be used for student activities and travel ;
5. to assist the CIS Program in strengthening existing programs;
6. to assist in matters pertaining to professional development of students and faculty;
7. to participate as an external client for senior capstone projects;
8. to provide co-ops and internships to CIS students;
9. to actively recruit CIS students for permanent positions;
10. to provide support for the CIS program; and

11. to evaluate, periodically, the programs and processes, to provide input and offer advice and counsel where appropriate.

In our CIS Board of Advisors guidelines we documented a list of specific activities that indicates how Board members may ensure that they are fulfilling their commitment to the Board and adding value to the mission, vision and goals of the CIS program. The Board meets once per semester to discuss how each organization will fulfill their commitment. During this meeting, each Board member discusses how they will partner with the faculty and the CIS program. In this paper, we address the specific activity where the Board member has agreed to participate as an external client or solicit the support of another organization to provide viable senior capstone projects (# 7 in the list above).

In order to provide a viable capstone project, the external client (an IT professional in a business organization) must be willing to meet with the senior project team for a year (two semesters) to analyze, design and implement an information system. Furthermore, the information system must be small enough to be implemented in one year by a four to five person project team and usually originates from the client's desired, but not mandatory project priority list. The faculty who will teach the Systems Analysis and/or the Systems Implementation courses meet with the external client prior to the course to identify projects that are technically, schedule, and economically feasible. This meeting will ensure that the student teams can implement the project with technology available, within timeframes that coincide with the academic semesters, and that will be beneficial to the external client.

During the first semester, the team will select a student project manager who will guide them through the development of the written documentation necessary to plan and design the desired system. This team will collaborate with their client on a routine basis (i.e., bi-monthly) to complete the requirements for the system and a working prototype. These meetings will be conducted at the client's location. At the end of the first semester, the students will also plan, organize and conduct an oral presentation to present the results of their systems analysis and design recommendations to their clients, other CIS students, and faculty.

During the second semester a different student project manager is selected and the team builds, tests, and implements the system. Regularly scheduled client meetings are also held during the second semester. The routine meetings with the client throughout both semesters not only build a relationship between the CIS department and the business organization, but it also allows the students to observe the client's work environment. The semester ends with another oral presentation to the client, other CIS students, and faculty.

Professional organization

ACM and AITP identify membership as an important component of a professional career and encourage student participation as a way to increase professional knowledge as well as a networking tool. These organizations offer student scholarships as well as provide support for research and conference participation ("ACM Welcome Home Page", 2009; "aitpNetwork", 2009).

During the second semester, the implementation team must also submit a research paper about the project to a professional conference. If accepted to the conference, the students are required to attend the conference and present their paper. This opportunity allows the students to practice their oral and written communication skills. Additionally, conference attendance exposes the students to IT workshops on emerging technologies and provides network opportunities with IT professionals that may lead to valuable contacts for internships and career opportunities.

Benefit-cost analysis of the model

The expected benefits of this proposed model are to utilize various partnerships to prepare our students for employment; establish networking opportunities with organizations and IT professionals;

and for our student to gain the ability of demonstrate their skills and talents. In addition to co-ops and internships, the capstone project experience reinforces their technical, project management, team, and communication skills through the implementation of a real information system and the presentation of their project. Our CIS Board of Advisors includes members from all three components of our model. It includes the external business partners who work with our students as external clients and hire our students for internships and placement opportunities; CIS faculty who teach the capstone courses; and the professional organization where our students are members and have presented their projects. The convergence and synergies of this Board has enabled the implementation of the proposed model to the benefit of all stakeholders. The benefit to the business partner, in their role of external clients, is the ability to observe the senior project team for potential job candidates. Business partners are intimately involved in the deliverables and skills acquired in the capstone course; and are able to offload some of their small non-critical projects to student teams. Business partners have stated that the ability to receive a small information system and observe potential high performing job candidates is beneficial, especially considering the expense of hiring, training, and possibly losing the wrong candidate. Successful student projects lead business partners to conduct more student projects and develop more trust in their capability (Miles & Kelm 2007).

There are five primary benefits to the students:

- The capstone experience model allows students to demonstrate their skills and talents to a business partner who could be a potential employer.
- Students are motivated when working for a real client, gain confidence in their abilities and are proud of the project they have completed (Chen, 2006).
- Students can add these projects to their resumes to demonstrate relevant work experience, especially if they have no prior internship experience. The deep learning of technical and interpersonal skills (i.e. communication, time management, and project management) has shown to translate to marketable skills (Scott 2006; Janicki et al., 2007).
- The capstone experience allows students to network with IT professionals during the time that they are looking for future employment.
- The presentations of the projects at the professional organization's conference give students an additional avenue to network with IT professionals and showcase their project to other organizations.

This model provides immediate feedback to CIS faculty from the business partners and professional organization on the project team's deliverables, development methodology, and course curriculum. The benefit to the professional organization is the support of their mission to increase their student memberships and increase student participation at conferences. Additionally, IT professionals have an opportunity to network, meet and assist the next generation of IT professionals.

The benefits to the stakeholders of this model are not accomplished without cost and challenges. The business partners must agree to a significant time commitment as the role of the external client (Hashemi & Kellersberger, 2009). Our CIS Board members and their organizations have already committed to extensive co-op and internship programs as well as funding of student activities and travel. Based on the financial support given by our Board and conference sponsors, we have not needed to seek additional university resources in order for our students to present at conferences. However, our university does have a University Undergraduate Research Program that both supports and maintains as its mission the support of undergraduate research that could support student conference travel expenses if needed.

The costs to the student teams are time management and managing client expectations (Jones & McMaster 2004; Miles & Kelm 2007). The students must perform at a higher level and produce a higher quality product when the external client could be a future employer. In our model, a preliminary project charter which lists all of the deliverables is developed and approved by the CIS faculty

member and the external client. This charter helps to ensure that the project is feasible and the project team can produce a quality product within the allotted timeframe.

The additional time that the CIS faculty must commit in order to ensure the success of the project and the co-ordination of faculty across semesters is substantial (Hashemi & Kellersberger, 2009). However, the knowledge gained through feedback from the external clients makes the time well spent. This feedback has enabled faculty to identify significant changes needed to our CIS curriculum. For example, we have identified the need for a standard system development methodology to be used throughout all of our courses to produce repeatable processes for external development. In order to achieve the project knowledge transfer, project repositories and standardization of templates have become a more formalized process. The CIS Board of Advisors, faculty and students feel that the proposed model differentiates our students by providing a richer capstone experience, combining the system development concepts with real world work experience, providing numerous networking opportunities and providing the venue for students to enhance their communication, presentation and project management skills.

Initial Pilot of the Model

During the 2008-2009 academic year, the capstone courses undertook three concurrent projects. Two of the projects were internal projects for University clients and one was for the City, an external client. In Fall 2008, the Systems Analysis and Design course had 14 students enrolled. These students were assigned to one of the three concurrent projects with each project team consisting of four to five team members. Of the 14 students that took the first course, 13 students successful completed the course and 10 of those students continued on to the Spring 2009 Systems Implementation course. The three students that did not continue were CIS Minors and were not required to take the second capstone course for the completion of their degree program. During the second course only two of the project continued due to: 1) one of the internal University projects having a viable off-the-shelve solution, which was already deployed elsewhere in the University and 2) the decrease in the number of students between the courses. The initial pilot model presented in this paper only addresses the external project that was undertaken during the 2008-2009 academic year.

In order to identify and develop capstone projects, our CIS department collaborates with our CIS Board of Advisors, professional organizations and other external organizations. As a result, for the 2008-2009 academic year, one of the three projects was identified during a training event hosted by the Black Data Processing Associates (BDPA) with the Assistant Director of Information Technology of a local city organization. During that training event it was established that one of the projects would be for the City. Since initially the instructors for the two courses were different, both instructors were actively engaged in the final selection process of the project. The instructors had subsequent meetings with the City to determine the criteria and fit of the proposed projects. It was determined that the project undertaken would be the implementation of the City Print Services information system. Between the Fall and Spring semesters the second course instructor took on an administrative role and was therefore not able to teach the course. Consequently, the same instructor who taught the first course also taught the second course during the 2008-2009 academic year.

The City Print Services department relied on an Excel spreadsheet solution to track their print services orders and provide some minimum reporting requirements. However, this solution had an accounting discrepancy and did not meet the fiscal reporting requirements mandated by the City. Furthermore, only one person, the print service manager, had access to the complete workbook. Consequently, customers did not have the capability to check the status of their orders and employees could not update the status of received or completed orders. The City had an overall strategic plan to implement an Enterprise Resource Planning (ERP) system in order to streamline its operations and alleviate many of these problems. The Print Services department was scheduled for phased implementation beginning in 2010. However, due to flaws in the system, particularly the current financial dis-

crepancy, a more immediate solution was required. To this end, the City requested a team from the CIS capstone courses (i.e. System Analysis and Design - Fall 2008 and the System Implementation - Spring 2009) to investigate, plan, design, develop and implement a web-based information system for the print services operation.

During the Fall 2008 Systems Analysis and Design course, the Print Services project team consisted of five CIS students and two City employees (the City project manager and the Print Services manager). This team began meeting bi-monthly, many times at the City's main office. The Print Services project team agreed upon the following deliverables for the academic year: the Preliminary Investigation Report (i.e. Project Scope and Constraint Statement), feasibility reports, a risk management plan, system requirements, Data Flow Diagrams, Entity Relationship Diagrams, a structure chart, a project schedule, a test plan, user manuals, and a completed web-based Print Services system.

The project team successfully designed and developed a web-based system for the City's Print Services department. In addition to the presentation at the end of the first semester, the project team was asked by the Chief Information Officer of the City to present at an Information Resource Management meeting which included the City Manager, Assistant City Managers and their direct reports. At the end of the presentation, the City's CIO stated, "The level of work done by these students is higher than most consultants I have encountered".

By the end of the second semester, the project team successfully implemented this web-based system for the City's Print Services department. The system was immensely revered by the City as a "high quality product". The team's goal throughout this phase was ensuring that the system met all the basic features and functionality in order to maximize the benefits of the system during their transition period to the ERP system. The resultant system was accepted by the City, the external business organization, as having met their requirements.

An additional requirement of this capstone model is a team submission to a national conference. In this pilot project, the team submitted a paper, presentation, and poster to the BDPA 2009 National Conference IT Showcase. The team's paper was accepted by a review panel of IT professionals. The conference organizers of the IT Showcase paid all expenses (i.e., registration, hotel, food, and travel) for one team member to present the Print Services System. In order to provide opportunities for all team members, a grant received from one of our Board members was utilized to pay for additional attendees.

The Print Services team won second place in the BDPA 2009 National Conference IT Showcase. The team members also attended several conference workshops, interviewed for jobs, and attended a conference closing dinner where they received their award in front of all of the attendees. The team members received recognition at our university and updated their resumes with the project experience and award.

Finally, this project was also presented to our CIS Board of Advisors to ensure alignment with our curriculum goals. Involving our board provides demonstration of resulting courses of study and allows for feedback to ensure that the CIS faculty and board are in concert when discussing curriculum issues. Additionally, the presentations can encourage members to look for and provide projects for future student groups in the capstone model.

Survey Results and Discussion

In order to assess the impact and the value of the CIS Senior Capstone model, two surveys were created: CIS Capstone Experience Project Team Survey and CIS Capstone Experience Customer Satisfaction Survey (see Appendix A and C). The surveys were given at the end of the Spring 2009 semester. The sample size for these surveys is quite small as the participants are limited to only those involved in this pilot project with the external client. Consequently, the surveys were only given to

the project team that worked on the City Print Service Project. The surveys serve as a means to evaluate the pilot and discuss future changes as opposed to providing any scientific evidence of the success or failure of the model.

CIS Capstone Experience Project Team Survey

The purpose of the student survey is to determine the students' perception of the overall structure of the project, their capstone experience, and the outcomes of the project (see Appendix A for a copy of the survey and Appendix B for the results). This survey is composed of two distinct sections. The first section asks each project team member to rate their agreement/disagreement with 20 project related criteria using a Likert scale ranging from Strongly Disagree to Strongly Agree and N/A (Not Applicable). In evaluating the results, we used a Likert scale to assign a 1 for Strongly Disagree to a 5 for Strongly Agree. The second section is a series of open-ended questions that allow students to express their thoughts concerning the methodology used for the project, the value of the partnership with the City and provide suggestions for future partnership projects.

Four of the five project team members completed the survey. Of the 20 criteria questions, 13 questions received an average rating of 4.0 or higher. The other seven questions had an average rating of 3.0 to 3.9. None of the criteria questions received an average rating below 3.0. The students' comments to the open-ended questions showed that they valued the capstone experience and want to see it continued, improved, and expanded. Some select excerpts are:

> "System development partnerships are very beneficial to students in gaining hands on experience. It allows students to finding *[sic]* their strengths and weakness, which cultivates a better business professional. This partnership brings students to companies and creates a professional relationship that the students can continue throughout their career." ~ Student 2

> "I gained a great deal from the analysis phase of the project. I hope future projects are like ours, allowing for a complete analysis and design as part of the make-up rather than just an experience in coding software. Thank you to the City and XXU for this opportunity." ~ Student 4

CIS Capstone Experience Customer Satisfaction Survey

The second survey, CIS Capstone Experience Customer Satisfaction Survey (see Appendix C), is designed to capture the City's Stakeholders satisfaction with the process and outcomes of the project. This survey is composed of four sections. The first section asks the stakeholders for information regarding their job within the City (i.e. job title, time in position, years of experience, etc.). The second section gathers information regarding their roles within the project, benefits of the project and prior experience with similar university-based student projects. The third section asks the stakeholders to rate the Print Services System Project based on ten criteria from Strongly Disagree to Strongly Agree and N/A (Not Applicable). In evaluating the results, we used a Likert scale to assign a 1 for Strongly Disagree to a 5 for Strongly Agree. The final section of the survey allows the stakeholders to provide further feedback concerning the value and impact of the project using a series of open-ended questions. Appendix D contains the detailed results of the Stakeholder Satisfaction Survey.

All stakeholders who were directly involved in the project completed the survey. These stakeholders are all City employees and included the Assistant Director of Information Technology, the Project Manager, the Print Service Manager, the IT Oversight Manager, and the Business Application Support Analyst. These individuals provided major input and feedback during the project. The time in their current positions range from 1 to 2.5 years and their IT experience ranges from 0 to 26 years.

Six of the ten criteria questions received an average rating of 5.0, three received an average rating between 4.0 and 4.75 and only one received an average rating of 3.75. This last rating addresses whether the students' work is defect free. An explanation of the stakeholder's average rating of 3.75 on the system's defect rate could be the results of the user acceptance test. During the user acceptance test 43 errors were identified. The user prioritized all of the errors with 1 having the highest priority. Additionally, the user required that all level one errors must be corrected prior to the student participation ending. None of the errors in this pilot project were considered a level one. Five of the 43 found errors were given a priority number of two. These five errors were fixed before the team gave their final presentation to the client.

The overall success of the model is shown in the City employee comments to the open-ended questions. Some select excerpts are:

> "The students were very prepared to address the real –life issues that arose during the project. They did an excellent job in understanding the business requirements, and delivering the design specs that such a project requires." ~ Project Manager

> "The documentation was extensive, which is great to hand to somebody who has not worked on the project from the get go. I am also very impressed with the fact that you took the time to do high level documentation, document the code and a low level documentation. The bug report list has also been a great help to me in giving me ideas of items that need to be changed in the system." ~ Business Application Support Analyst

> "I think this partnership was of great value to the City in that we were able to get a developed solution to a persistent problem. We also we *[sic]* exposed to a group of very knowledgeable group of *[sic]* students who will make great employees in the future. Hopefully, some of these students will eventually become City employees." ~ Assistant Director of Information Technology

Conclusion

In the ever changing technological environment that universities send their graduates to work, the playing field is increasingly competitive. For the IS graduates this fact means not only possessing a wide range of technical skills, but also having a set of soft skills such as project management, teamwork, presentation, and communication.

Numerous CIS programs have a capstone course or experience that includes a project (Chen, 2006; Hashemi & Kellersberger, 2009; Janicki et al., 2007; Keogh et al., 2007; Miles & Kelm, 2007; Scott, 2006). It is imperative that academics strengthen this experience to maximize its potential benefit to the students and their preparation for successful careers. An essential element to strengthening this experience is providing students with adequate opportunities to practice and develop their soft skills as well as reinforce their technical skills.

In this paper, we presented an enhanced capstone model and the results of the pilot program. This model is unique in that it integrates three important components (i.e. the classroom, external business partnerships, and professional organizations) into one succinct model. Research identifies these areas as important aspects of student's ongoing success in the workplace. Combining these components in a structured capstone experience uniquely qualifies our students for success following graduation. The skills reinforced are necessary for students to adequately compete for today's IT jobs. Although research clearly states that organizations need workers who have some development of a soft skill set, most capstone models do not specifically address a wide range of these skills. Our model directly

addresses technical skills as well as the relationships and soft skills that are necessary to see a project through to implementation.

In order to meet all these needs, this model incorporates not only the classroom experience with a real world project from a business partner but also includes a third component, professional organization, which enhances and deepens students soft skills. Exposure to professional organizations through membership and networking as well as research and conference participation provides students with additional opportunities to practice and hone their communication and presentation skills, as well as, provide exposure to a wide range of IT professionals. This exposure helps students better understand their career opportunities and what roles best match their skills and interests.

Benefits that cannot be easily measured but are no less important are enhanced by the interaction of the three components (classroom, business organization, and professional organization). The communication that must exist between student project members is enhanced by their communication with the external client and vice versa. These communication skills are further enhanced by participation in the profession conference. By the time the team reaches the conference they are more confident and quite skilled at communicating their project goals and outcomes. This confidence is demonstrated through ease with which the project team makes this final professional presentation.

Our model integrates three components that distinctively address technical and soft skills. This model has evolved over time consisting of the following phases. First, the CIS faculty who teach the capstone courses sought out real world projects. Second, our advisory board was established. Our board members, some of whom were also members of professional organizations began to sponsor these projects. Third, our faculty members encouraged students to join professional organizations. Finally, as our students became more involved with the activities of the professional organizations, it became clear that submissions of their work at various conferences would afford more opportunities for growth and development of their soft skill set. At the end of this phased integration, our CIS faculty realized that the combination of these components uniquely enhanced the capstone experience in a way that each alone did not.

Universities are familiar with these components and to some degree try to incorporate them in their programs. If implementing the entire model is not feasible, we recommend the following phased implementation:

1. Use simulated classroom projects to incorporate real world projects.
2. Establish an advisory board.
3. Join professional organizations and network with local IT professionals.
4. Encourage students to join professional organizations and attend conferences.

What is unique about our model is that it is directly tied to the project development and the external client. This unique combination works in such a way that at the end of the experience, the students have become adept at speaking about their project (they own it) and are comfortable with IT professionals in a variety of settings.

Future research will include developing quantitative measures to test the model's success including internships and job opportunities that can be directly tied to the project. Additionally, we plan to develop quantitative measures to weigh the contributions of each part of the model.

References

ACM welcome home page. (2009). Retrieved July 21, 2009, from http://www.acm.org/

aitpNetwork.(2009). Retrieved July 21, 2009, from http://www.aitpnetwork.org/

Banerjee, S., & Lin, W. (2006). Essential entry-level skills for systems analysts. *Journal of Education for Business*, *81*(5), 282-286.

Basselier, G., & Benbasat, I. (2004). Business competence of information technology professionals: Conceptual development and Influence on IT-business partnerships. *MIS Quarterly*, *28*(4), 673-694.

Brown, P., & Scase, R. (1994). *Higher education and corporate realities: Class, culture and the decline of the graduate careers.* Abingdon, Oxon: University College London Press.

Bullen, C. V., Abraham, T., Gallagher, K., Simon, J. C., & Zwieg, P. (2009). IT workforce trends: Implications for curriculum and hiring. *Communications of the Association for Information Systems*, *24*(9), 129-140.

Chen, B. (2006). Teaching systems analysis and design: Bringing the real world into the classroom. *Information Systems Education Journal*, *4*(84).

Clyde, S. W., & Crane, A. E. (2003). "Design-n-code fests" as capstone projects for an object-oriented software development course. *Computer Science Education*, *13*(4), 289-303.

Cooper, G., & Heinze, A. (2007). Centralisation of assessment: Meeting the challenges of multi-year team projects in information systems education, *Journal of Information Systems Education*, *18*(3), 345-355.

Davis, G. B., Gorgone, J. T., Couger, J. D., Feinstein, D. L., & Longenecker, H. (1997). IS '97: Model curriculum and guidelines for undergraduate degree programs in information systems. *ACM SIGMIS Database*, *28*(1), 101-194.

Dempsey, G., Anakwa, W. K. N., Huggins, B. D., & Irwin, J. H. (2003). Electrical and computer engineering curriculum assessment via senior miniproject. *IEEE Transactions on Education*, *46*(3), 350-358.

Downey, J. P., McMurtrey, M. E., & Zeltmann, S. M. (2008). Mapping the MIS curriculum based on critical skills of new graduates: An empirical examination of IT professionals. *Journal of Information Systems Education, 19*(3), 351-364.

Fanter, A. (2006). *Preparing for post-college life: Capstone and keystone courses*. Retrieved July 22, 2009, from http://www.worldwidelearn.com/education-articles/capstone-keystone-courses.htm

Gorgone, J., Davis, G. B., Valacich, J. S., Topi, H., Feinstein, D. L., & Longenecker, H. E. (2003). IS 2002 model curriculum and guidelines for undergraduate degree programs in information systems. *Communications of the Association for Information Systems*, *11*(1).

Guo, W. (2004). Guiding students learning project team management from their own practice. *Issues in Informing Science and Information Technology*, *1*, 267-277.

Hamblen, J. O., & Owen, H. L., Yalamanchili, S. & Dao, B. (1999). An undergraduate computer engineering rapid systems prototyping design laboratory. *IEEE Transactions on Education*, *42*(1), 8-14.

Hanna, A., & Sullivan, K. (2005). Bridging the gap between academics and practice: A capstone design experience. *Journal of Professional Issues in Engineering Education and Practice*, *131*(1), 59-62.

Harper, J. S., Lamb, S. W., & Buffington, J. R. (2008). Effective use of case studies in the MIS capstone course through semi-formal collaborative teaching. *Journal of Information Systems Education*, *19*(4), 411-418.

Hashemi, S., & Kellersberger, G. (2009). The pedagogy of utilizing lengthy and multifaceted projects in capstone experiences. *Information Systems Education Journal*, *7*(17).

Huizinga, D. M. (2002). Four implementations of disconnected operation: A framework for a capstone project in operating systems. *IEEE Transactions on Education*, *45*(1), 86-94.

Hyslop, A. (2009). Fostering partnerships between education, business and industry. *Techniques: Connecting Education and Careers*, 84(5), 42-43.

Janicki, T. N. (2006). A guide for establishing an advisory board for an information systems department: Benefits and lessons learned. *Information Systems Education Journal*, *4*(10).

Janicki, T. N., Fischetti, D., & Burns, A. T. (2007). Incorporating real world projects and emerging technologies into one MIS capstone course. *Information Systems Education Journal*, *5*(24).

Janicki, T. N., Kline, D., Gowan, J. A., & Konopaske, R. (2004). Matching employee needs with IS curriculum: An exploratory study. *Information Systems Education Journal*, *2*(21).

Janicki, T. N., Lenox, T. L., Logan, R., & Woratschek, C. R. (2008). Information systems/technology employer needs survey: Analysis by curriculum topic. *Information Systems Education Journal*, *6*(18).

Jih, W-J. (2003). Simulating real world experience using accumulative system development projects. *Journal of Information Systems Education*, *14*(1), 181-191.

Jones, M. C., & McMaster, T. (2004). Addressing commercial realism and academic issues in group-based IS undergraduate project work. *Journal of Information Systems Education*, *15*(4), 375-381.

Kamoun, F., & Selim, S. (2007). A framework towards assessing the merits of inviting IT professionals to the classroom. *Journal of Information Technology Education*, *6*, 81-103. Retrieved from http://www.jite.org/documents/Vol6/JITEv6p081-103Kamoun223.pdf

Keogh, K., Sterling, L., & Venables, A. (2007). A scalable and portable structure for conducting successful year-long undergraduate software team projects. *Journal of Information Technology Education*, *6*, 515-540. Retrieved from http://www.jite.org/documents/Vol6/JITEv6p515-540Keogh288.pdf

Koong, K. S. (2003). Forming an effective information systems advisory board. *Journal of Information Systems Education*, *14*(2), 133-136.

Lee, D. M. S., Trauth, E. M., & Farwell, D. (1995). Critical skills and knowledge requirements of professionals: A joint academic/industry investigation. *MIS Quarterly*, *19*(3), 313-340.

Lee, S. M., & Lee, C. K. (2006). IT managers' requisite skills. *Communications of the ACM*, *49*(4), 111-114.

Malinowski, C., & Noble, R. E. (2009). Capstone projects: Putting the pieces together. *Information Systems Education Journal*, *7*(24).

Mason, S. G. (2008). Client-oriented projects: GIS course design with the potential to serve multiple constituents. *Journal of Public Affairs Education*, *14*(2), 241-252.

Matos, V., & Grasser, R. (2007). Using Reengineering as an Integrating Capstone Experience. *Journal of Information Systems Education, 18*(1), 85-101.

Miles, G., & Kelm, K. M. (2007). Capstone project experiences: Integrating computer science and the liberal arts. *Information Systems Education Journal*, *5*(30).

National Association of Colleges and Employers. (2009, March). *NACE Research: Job Outlook 2009 Spring Update*. Retrieved May 26, 2010, from the Stony Brook University Web site: http://www.career.sunysb.edu/files/Spring_Outlook.pdf

Pawlowski, B. (2007). Partnering with business coalitions. *Techniques, 82*(8), 16-19.

Russell, J., & Russell, B. (2009). A survey analysis of the perceptions of IS educators and IS professionals appertaining to the course content of an undergraduate information systems capstone course. *Information Systems Education Journal*, *7*(30).

Russell, J., Russell, B., & Tastle, W. J. (2005). Teaching soft skills in a systems development capstone class. *Information Systems Education Journal*, *3*(19).

Scott, E. (2006). Systems development group project: A real-world experience. *Information Systems Education Journal*, *4*(23).

Seethamraju, R. (2007). Enterprise systems (ES) software in business school curriculum - Evaluation of design and delivery. *Journal of Information Systems Education*, *18*(1), 69-83.

Tetard, F., & Patokorpi, E. (2005). A constructivist approach to information systems teaching: A case study on a design course for advanced-level university students. *Journal of Information Systems Education*, *16*(2), 167-176.

Topi, H., Valacich, J. S., Wright, R.T., Kaiser, K., Nunamaker, J.F. Jr, Sipior, J. C., et al. (2010). IS 2010 curriculum guidelines for undergraduate degree programs in information systems. *Communications of the Association for Information Systems*, *26*(18).

You are the future. Are you ready? (n.d.). Black Data Processing Associates. Retrieved July 21, 2009, from http://www.bdpa.org/students.php

Vliet, P., & Pietron, L. (2006). Information systems development education in the real world – A project methodology and assessment. *Journal of Information Systems Education*, *17*(3), 285-293.

Biographies

Donna M. Grant is an Assistant Professor of Computer Information Systems at North Carolina Central University. Dr. Grant received her PhD in Computer Science from DePaul University, where she also earned a M.S. in Information Systems and an M.B.A. in Finance. Additionally, she earned a B.S. in Mathematics at Northwestern University. To date, Dr. Grant has published her work in numerous conferences, the Encyclopedia of Gender and Information Technology, the Informing Science Journal and the Journal of Information Technology Education. Prior to receiving her doctorate, Dr. Grant spent 22 years in the IT industry where she worked as a Director of Information Technology at Ameritech.

Alisha D. Malloy is an Assistant Professor of Computer Information Systems at North Carolina Central University. She holds a PhD in Computer Information Systems from Georgia State University. She also holds a Masters in Engineering Management from Old Dominion University and a Bachelor of Science in Engineering from the United States Naval Academy. Dr. Malloy has published in ACM/Kluwer Journal on Mobile Networks and Applications (MONET), Computers, Encyclopedia of Information Systems, and several others. Dr. Malloy is a member of the PhD Project, Association of Computing Machinery, Association for Information Systems, and Institute of Electrical and Electronics Engineers.

Marianne C. Murphy is an Associate Professor of Computer Information Systems at North Carolina Central University. She earned her PhD at Arizona State University in 1997 and an MBA from Kent University in 1994. Her primary teaching interests are computer applications, data management and mainframe systems. In addition to her teaching experience, her industry experience includes audit, accounting, bank mergers/acquisitions and network consulting. Her primary research interests include teaching methodologies, system security and database management.

Jovanna Foreman is currently a contractor for FYI Tech, doing data migration for Glaxo Smith Kline. She received her BS in Computer Information Systems (CIS) from North Carolina Central University in 2010. She has also received an AA from Queensborough Community College. Jovanna served as an active member of the CIS Club as Fundraiser committee chair, Events committee chair, and Vice President. Jovanna interned at Shodor Education Foundation, a non-profit organization specializing in computational math and science for three years, where she was taught and assisted computer workshops, and developed her skills as a Java programmer. Jovanna received many awards and recognition such as Who's Who Among American College Students, The National Dean's List, and North Carolina Central University School of Business Academic Achievement certificate and scholarship.

Rowena A. Robinson is currently a Support Specialist at Credit Suisse. She received her B.S in Computer Information Systems (CIS) from North Carolina Central University in 2009. Along with her college career she gained experience in Information Technology by interning at IBM and Shodor Education Foundation, Inc. Rowena participated in Phi Beta Lambda Business Organization and during her college career she has achieved honorable recognitions such as the Deans List, graduating Magna Cum Laude, and receiving the North Carolina Central University's School of Business Award for Academic Achievement.

Appendices

Appendix A: CIS Capstone Experience Project Team Survey

Criteria	Rating					
	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**	**N/A**
I worked a reasonable amount of hours per week on this project.						
Team members came to the meeting prepared to discuss the project.						
Team members completed their assigned duties for the project in the time frame required.						
Team members communicated their ideas to each other.						
I had a clear idea of what was expected of me on this project.						
I learned new skills and/or gained valuable experience through this project.						
I felt I was a member of a well-functioning, co-operative team.						
I was free to say what I thought, even if I disagreed with other team members.						
Feedback on my performance was accurate, timely, and helpful.						
The productivity of the team was at an optimum level and was not handicapped by lack of organization or planning.						
The project communication methods, frequency and content, met my needs.						
Project meeting times were properly managed and project meetings were run effectively.						
Unnecessary procedures were kept to a minimum.						
The project work plan was reasonable and sound.						
I clearly understood the operational needs of the customer.						
The work that I was responsible for met the operational needs of the users.						
The schedule contained achievable milestones.						

The project goals were achievable.						
I am proud to tell people I worked on this project.						
The assigned tasks/deliverables allowed me to balance my classes, work and/or personal life.						

Do you have any comments on the system development methodology you used in the City of Raleigh project team?

Do you have any comments on the value of the partnership with the City of Raleigh?

Are there any additional suggestions you would like to provide on the process/approach with future system development partnerships?

Appendix B: CIS Capstone Experience Project Team Survey Statistical Results

SURVEY QUESTIONS	AVERAGE RATING	STANDARD DEVIATION
I worked a reasonable amount of hours per week on this project.	4.4	0.5
Team members came to the meeting prepared to discuss the project.	4.2	0.8
Team members completed their assigned duties for the project in the time frame required.	3.0	1.0
Team members communicated their ideas to each other.	4.2	0.4
I had a clear idea of what was expected of me on this project.	3.4	0.5
I learned new skills and/or gained valuable experience throughout this project.	4.2	0.4
I felt I was a member of a well-functioning, co-operative team.	4.0	0.0
I was free to say what I thought, even if I disagreed with other team members.	4.2	0.4
Feedback on my performance was accurate, timely, and helpful.	4.2	0.8
The productivity of the team was at an optimum level and was not handicapped by lack of organization or planning.	3.0	0.7
The project communication methods, frequency and content, met my needs.	3.6	0.5
Project meeting times were properly managed and project meetings were run effectively.	4.0	0.7
Unnecessary procedures were kept to a minimum.	3.8	0.4
The project work plan was reasonable and sound.	3.8	0.4
I clearly understood the operational needs of the customer.	4.0	0.7
The work that I was responsible for met the operational needs of the users.	4.0	0.0
The schedule contained achievable milestones.	4.0	0.0
The project goals were achievable.	4.0	0.7
I am proud to tell people I worked on this project.	4.2	0.4
The assigned tasks/deliverables allowed me to balance my classes, work and/or personal life.	3.8	0.4

Do you have any comments on the value of the partnership with the City?	
Our development process worked great, when it worked. More frequent examination of the modules working together may have allowed the project to mesh tighter when it was rolled out.	Student 4
Do you have any comments on the value of the partnership with the City?	
I hope City of X can provide the XXU CIS department with future projects.	Student 1
System development partnerships are very beneficial to students in gaining hands on experience. It allows students to finding their strengths and weakness, which cultivates a better business professional. This partnership brings students to companies and creates a professional relationship that the students can continue throughout their career.	Student 2
The partnership with the city was an excellent opportunity, taking a real project from start to finish. Ms. XYZ almost singlehandedly made the partnership work, and I hope there is someone at the City to carry on her efforts.	Student 4
Are there any additional suggestions you would like to provide on the process/approach with future system development partnerships?	
I would hope that future system development partnerships will provide a more clear understanding of the scope and deliverables for future projects. I would also like to see more interaction between students and the clients.	Student 1
I gained a great deal from the analysis phase of the project. I hope future projects are like ours, allowing for a complete analysis and design as part of the make-up rather than just an experience in coding software. Thank you to the City and XXU for this opportunity.	Student 4

Appendix C: CIS Capstone Experience Customer Satisfaction Survey

We value your opinion. We recently completed and implemented the Print Services System Project for you. Please let us know how well we met your needs.

1. Job Information

Job Title:	
Time in position:	
Years of experience in IT Industry:	

2. Information Concerning your role with the Print Services System Project

Role with the project:	
Benefits of project to the City:	

3. Rating of Print Services System Project

Criteria	**Rating**					
	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**	**N/A**
Quality of work: Did our work meet your requirements?						
On-Time Delivery: Did we resolve the problem/question when we promised we would?						
Defects: Was our work defect free?						
Performance to the Budget: Was our work completed within budget?						
Issue Resolution: If problems occurred, we resolve them in a timely manner?						
Personnel Assigned: Staff assigned to your project were adequate?						
Communication: Project team kept you adequately informed about our progress?						
Communication: Project results were effectively represented during the final presentation?						

Process: We effectively represented the project results during the final presentation?						
Overall Satisfaction: The project was one of quality that will be an asset to the organization?						
Do you have any comments on the system development methodology used by the CIS project team?						
Do you have any comments on the documentation created by the CIS project team?						
Do you have any comments on the value of the partnership with the university?						
Are there any additional suggestions you would like to provide on the process/approach with future system development partnerships?						
Would you like a follow-up call to discuss your rating: _____ Yes _____ No						
If yes, please complete the following: Name: Phone: Preferred day and time to be called:						

Appendix D: CIS Capstone Experience Customer Satisfaction Survey Results

Stakeholder's Project Roles					
Job Title:	Assistant Director, Information Technology	Project Manager	Print Services Manager	Assistant IT Director, Strategy & Planning	Business Applications Support
Time in position:	2 years	1 year	1 ½ years	1 ½ years	1 year
Years of IT experience:	26	20 +	N/A	20+	4

Benefits of project to the organization:
"Implemented a much needed work order system." ~ Maintenance Support
"Allows management and tracking of print resources and requests." ~ Project Initiator
"Went from off-line paper procedure to on-line order form with tracking capabilities for reporting." ~ Project Manager
"The project resulted in an automated tool for our Print Services Division (Public Affairs Department) to receive and track work orders." ~ IT Oversight Manager

Survey Questions Results	**Average Rating**	**Standard Deviation**
Quality of work: Did our work meet your requirements?	4.60	0.89
On-Time Delivery: Did we resolve the problem/question when we promised we would?	5.00	0.00
Defects: Was our work defect free?	3.75	1.26
Performance to the Budget: Was our work completed within budget?	5.00	0.00
Issue Resolution: If problems occurred, we resolve them in a timely manner?	4.40	0.89
Personnel Assigned: Staff assigned to your project were appropriately prepared, conversant in technology?	5.00	0.00
Communication: Project team keep you adequately informed about our progress?	5.00	0.00
Communication: Project results were effectively represented during the final presentation?	5.00	0.00
Process: We effectively represented the project results during the final presentation?	5.00	0.00
Overall Satisfaction: The project was one of quality that will be an asset to the organization?	4.75	0.50

Do you have any comments on the system development methodology used by the CIS project team?	
Well, nothing is ever defect free. I have been programming for 3 years and I can guarantee that nothing I have ever developed has been defect free. The methodology used by the team to put this project together was very sound. All of the PHP code is very coherent and I do not even code in PHP. The mysql database was also good overall; however there were some practices that are generally avoided when using mysql. A couple of those being to avoid using command names as the name of a column or table, and the other being that in php code you should not reference the columns as DB_NAME.TBL_NAME. You only need the latter of the two (unless you use a reserved name like "order" for the name of your table). Again though, organization of the MySql database was great. The two items listed above were the only two flaws worth mentioning.	Maintenance Support
The students were very prepared to address the real –life issues that arose during the project. They did an excellent job in understanding the business requirements, and delivering the design specs that such a project requires.	Project Manager
No	Print Services Manager
I thought the methodology was compatible with the City's methodology.	Project Initiator
The methodology was straightforward and highly effective.	IT Oversight Manager
Do you have any comments on the documentation created by the CIS project team?	
The documentation was extensive, which is great to hand to somebody who has not worked on the project from the get go. I am also very impressed with the fact that you took the time to do high level documentation, document the code and a low level documentation. The bug report list has also been a great help to me in giving me ideas of items that need to be changed in the system.	Maintenance Support
The documentation for the first semester design phase was exceptional and caught the attention of the CIO for its quality, detail and professionalism.	Project Manager
Have not seen it	Print Services Manager
The documentation was complete, informative, and accurately explained the issues and design considerations that went into the solution.	Project Initiator
The documentations was as professional as any I have ever received from high-priced consultants. Excellent!	IT Oversight Manager

Do you have any comments on the value of the partnership with the university?	
I believe this partnership should definitely continue for future projects. I look forward to your next product, and as a matter of fact I would very much like to help with the next project that we partner with your college to work on. This program is one of the best things that you can do for your students: Placing them in an environment where they are working for a customer from start to finish. It is this kind of situation that I did not have the pleasure of experiencing in my college courses that I feel I could have benefitted greatly from.	Maintenance Support
The city benefited by acquiring a real product to help in a real-life situation (going from no-tech to a web form solution with backend reporting capabilities. This was a very needed project for the city. I think the students also benefited from seeing some of the real-life details and obstacles that arise outside of the classroom setting (scheduling, departmental priorities, communication). On a personal level, I thoroughly enjoyed working with these dedicated and talented students.	Project Manager
I think this is a great Value to the city I can't wait to have the time to implement its use	Print Services Manager
I think this partnership was of great value to the City in that we were able to get a developed solution to a persistent problem. We also we exposed to a group of very knowledgeable group of students who will make great employees in the future. Hopefully, some of these students will eventually become City employees.	Project Initiator
The partnership not only provided the City with an end-product at no cost, but as a manager I liked demonstrating to my staff who have been here for a while that excellence can be achieved by workers new to the field, so there is no reason why we old-timers are not delivering top-quality products. It was inspiring to me to see these young, talented people entering the workplace who have a 'can-do' attitude and are ready, willing and able to be top performers.	IT Oversight Manager
Are there any additional suggestions you would like to provide on the process/approach with future system development partnerships?	
This was the pilot project for this program, and as many pilot projects, it can always be improved but I am very impressed with how smoothly it went. One thing I would suggest would be to bring one of our business applications people in to work with the students as well as the department head or whoever the next project is being built for. I'd have liked to be involved in this project sooner so that I could have made some suggestions for the application that the students may have benefit from. If we have the resources to give, I believe the knowledge the students receive and the quality of product that we receive could both increase with this change.	Maintenance Support

I think one thing that would be valuable would be for the 'partners' to have more buy-in on a departmental level (IT at the City). This was a fault on the communication side of the city – and resulted in some unnecessary delays. The school can perhaps communicate this to the partner as a 'lesson learned' to make sure the students are working on the 'inside' of the entire processes of the partner.	Project Manager
I think the team did a great job, unfortunately I can't answer the technical sides of these questions.	Print Services Manager
We are still gathering requirements, but I am confident that we will have future partnership opportunities.	Project Initiator
None	IT Oversight Manager