



ISSN: 1545-679X

# Information Systems Education Journal

Volume 5, Number 24

<http://isedj.org/5/24/>

June 12, 2007

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## Incorporating Real World Projects and Emerging Technologies into One MIS Capstone Course

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**Abstract:** Developers of MIS (Management Information Systems) curriculum battle the need for additional courses offerings comprised of technical experience, management theory, IS strategy, communication skills all while living within a finite number of courses that may be required of MIS graduates. Many institutions offer a capstone experience in MIS combining knowledge from their previous courses. This capstone course varies from institution to institution. This paper discusses the experience of one public university's combination of a project management and emerging technology course into one capstone experience. It details the goals, course structure and results for this constantly evolving course. A key benefit is the implementation and merging of knowledge gained from previous MIS courses into one course where the students interact with real world clients. Students are able to enhance their technical, communication and management skills as a result of this course.

**Keywords:** MIS Curriculum, Capstone Experience, Project Management

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**Recommended Citation:** Janicki, Fischetti, and Burns (2007). Incorporating Real World Projects and Emerging Technologies into One MIS Capstone Course. *Information Systems Education Journal*, 5 (24). <http://isedj.org/5/24/>. ISSN: 1545-679X. (Also appears in *The Proceedings of ISECON 2006*: §2712. ISSN: 1542-7382.)

This issue is on the Internet at <http://isedj.org/5/24/>

The **Information Systems Education Journal** (ISEDJ) is a peer-reviewed academic journal published by the Education Special Interest Group (EDSIG) of the Association of Information Technology Professionals (AITP, Chicago, Illinois). • ISSN: 1545-679X. • First issue: 8 Sep 2003. • Title: Information Systems Education Journal. Variants: IS Education Journal; ISEDJ. • Physical format: online. • Publishing frequency: irregular; as each article is approved, it is published immediately and constitutes a complete separate issue of the current volume. • Single issue price: free. • Subscription address: [subscribe@isedj.org](mailto:subscribe@isedj.org). • Subscription price: free. • Electronic access: <http://isedj.org/> • Contact person: Don Colton ([editor@isedj.org](mailto:editor@isedj.org))

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# Incorporating Real World Projects and Emerging Technologies into one MIS Capstone Course

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## ABSTRACT

Developers of MIS (Management Information Systems) curriculum battle the need for additional courses offerings comprised of technical experience, management theory, IS strategy, communication skills all while living within a finite number of courses that may be required of MIS graduates. Many institutions offer a capstone experience in MIS combining knowledge from their previous courses. This capstone course varies from institution to institution. This paper discusses the experience of one public university's combination of a project management and emerging technology course into one capstone experience. It details the goals, course structure and results for this constantly evolving course. A key benefit is the implementation and merging of knowledge gained from previous MIS courses into one course where the students interact with real world clients. Students are able to enhance their technical, communication and management skills as a result of this course.

Keywords: MIS curriculum; capstone experience, project management

## 1. INTRODUCTION

Integrating theory and practice in the Information Systems (IS) curriculum is a challenge for any educator. To be successful, IS graduates must have a combination of technical, communication, business and IS strategy skills, and they must have the opportunity to practice those skills in a real world environment. This paper discusses the evolution of an emerging web development course with real world clients into the cap-

stone IS course for one public university. This evolution has taken place over the past five years.

This one course attempts to combine the recommendations of the 2002 Undergraduate MIS Model curriculum (Davis etc., 2002) for the project management course with the emerging technologies course. Other authors also site the combination of different model curriculum courses into one course. McGann and Cahill (2005) discuss the need

for an MIS capstone course to include applied skills, real world client projects and soft skills, which they state include communication skills. Scott (2006) discusses an approach of incorporating real world projects into a systems development course.

The combination of the two recommended 'model' curriculum courses into one course was driven by two factors. This public university is an AACSB (Association to Advance Collegiate Schools of Business) accredited school and the number of IS courses required is restricted due to the number of general business courses required. Currently the MIS department requires seven (versus the potential 10 in the model curriculum) MIS courses. The need to integrate strategy and policy into the MIS capstone course is reduced as the college offers a business capstone course that covers these topics, combining skills across the business curriculum. The MIS department desired to enhance students' emerging web development skills through a capstone project experience that required students to demonstrate and implement knowledge from previous courses while learning and developing new skills.

This IS capstone course involves student implementation of a three-tier web solution for a real world client. Specifically, students are required to use knowledge gained in the database design, systems analysis and system design courses, as well as their prior programming courses, to design and implement a database solution for an actual client problem. As the senior capstone experience for information systems (IS) majors, the course provides an opportunity for students to use what they have learned in their courses in a professional situation. The instructor provides mentoring through the process, but the students are responsible for the successful completion of the project.

## 2. BACKGROUND

The MIS capstone course described has evolved over five years from an advanced web development course. It initially began as a programming course (the emerging web technologies course as described in the model curriculum) in ASP with a database backend. Over the years, it has evolved to programming in ASP.Net 1.0 and then to the programming language of ASP.NET 2.0 using

a SQL 2005 database and incorporating XML and UML (Uniform Modeling Language) concepts. In the first years the course was offered, all students worked on identical projects provided by the instructor. The advantage to this was it gave the instructor the ability to monitor the progress of all students. The disadvantages were that the course was not integrated with other MIS courses offered by the host institution and that the projects were 'fake' and did not challenge the students to use their previously learned skills.

In 2003 the course began to evolve into one that combined web development skills with real world projects. At that time the business school needed to increase its database driven web applications, which provided ready access to real world projects. Students were divided into teams and each team was assigned a web / database project to complete. During the first semester, the instructor acted as the 'client', providing the student teams with information about the system and design needs. The student teams developed and tested potential solutions and the best designed solutions were implemented for the business school client.

## 3. CURRENT SITUATION

With the successful implementation of the initial four real world projects, the department and its students gained a reputation for providing competent, dependable assistance and workable solutions for other university colleges and departments. The course has evolved to designing and implementing solutions for numerous university clients as well as area non-profit organizations. The author no longer has to search for real world projects and keeps a backlog of 'client' requests.

Key learning goals for the course are:

1. Enhance systems analysis skills through actual interviews with real world clients and the development of solutions to meet client needs. This includes the development of user requirements and 'use cases' as well as a written system analysis report for the client.
2. Increase communication skills, both written and verbal, through presentations to the end client and the class.

3. Enhance database skills through the development of a relational database (SQL 2005) to support client needs.
4. Strengthen design skills and implement a system to meet user requirements in an n-tier application.
5. Build / implement a web-based solution using ASP.Net on a Microsoft.Net platform.
6. Develop project planning and management skills through the creation of an individual project plan for the systems development and implementation. Progress is assessed through bi-weekly checkpoints with the instructor.

The structure and management is divided into four separate modules to help support the learning goals above.

#### **Module One (analysis and design):**

In this module, students select a real world client, interview the sponsoring client to determine their needs, create sample use cases in UML (Uniform Markup Language) protocols and design the database to support user needs. Timeframe for this phase is approximately one month. Students may work in teams if the project is significantly complex. However, experience has shown that assigning more than two people to a team leads to reduced learning of web programming concepts by some team members.

The real world projects selected by the students come from two sources. The instructor posts a list of potential projects that have been requested from university departments or from local non-profit agencies. At first, this list was entirely university driven, but as the success of projects has expanded outside agencies are soliciting help. In addition, students may propose their own projects if they meet the criteria set by the instructor. Criteria for all projects include:

- a) Is project completion feasible within one semester?
- b) Does the project include a web solution utilizing a backend database for updating / deleting / inserting records?

- c) Is the end client willing to spend enough time with the students to make the project successful?
- d) If the student proposes the project, is there an outside client who will define the project scope and oversee student work?

Once a project is selected, students develop interview questions and interview the client. Following this interview, students prepare a detailed analysis of the client needs, potential solutions and alternative solutions. This document is sent to the client and a follow up appointment is scheduled to insure that the student and the client agree on what will be accomplished. This deliverables document helps to set reasonable client expectations, which may not include everything they initially requested. The interviewing and reporting activities follow the recommendations of Russell et al. (2005) who state the need for additional soft (communication) skills in all capstone courses.

Also as part of module one, students develop potential objects in the system and their 'use cases' and create the basic database structure. This supports the theory of Kovacs (2005), who argues for the use of increased systems analysis design tools in an advanced web design course. He states the need to provide 'structure' into the design of advanced web sites.

The last component of module one is the development of a project plan detailing the work anticipated and expected deliverables for each two-week period of the semester. Students build this project plan around which 'use cases' will be implemented by each two-week checkpoint.

#### **Module Two (learning ASP.Net basic skills)**

Module Two occurs simultaneously with Module One. Students are exposed to the basic concepts of web programming in ASP.Net 2.0 including CSS (cascading style sheets), skins, themes, master sheets, child web pages, user controls and simple database handling. These skills are taught and developed through two required projects that provide opportunities for students to practice their basic web programming skills. The use of cascading style sheets, validation controls in ASP.Net 2.0 and database con-

nections to update, insert and delete records through the use of stored procedures are particularly important. The timeframe for this module is the first month of the semester so students are learning these new skills at the same time as they are choosing their projects and doing the initial project plans with their clients. Use of XML (Extensible Markup Language) is also incorporated into this module.

### **Module Three (project design / programming / implementation)**

This module is the longest, comprising approximately 10 weeks of the semester. In this phase, students program their solutions based on the project plans they have submitted during Module One detailing the deliverables for the project. This work plan is broken into two-week segments with specific deliverables for each period (i.e. 'person use case' complete for insert / deleting / updating). At the end of each two-week period, the student submits an updated work (project) plan detailing what they had agreed to complete, what they actually completed and explaining any differences between the two.. They also submit an updated work plan for the next period, detailing any changes that have been made in the plan. The instructor grades each project individually, based on the student's individual work plan goals and target dates versus actual work completed. When necessary, the instructor assists the student or student team in modifying their projections based on difficulty level of the step(s) to be completed.

Each student or student team is required to have a 30- minute appointment with the instructor every two weeks to review progress, adjust the project plan and answer any specific questions that arise. The instructor acts as the student's supervisor and the students are required to treat this session as a meeting with their supervisor to update them on the progress of the project. A major goal of these meetings is communication. Since the instructor does not have detailed knowledge of the client's expectations, it is the role of the student(s) to communicate to the instructor (supervisor) those expectations and how they are meeting them.

This is the critical component of the project, as it requires individual monitoring by the

instructor, but it also puts the responsibility on the student to accomplish some portion of the project every two weeks. This reduces the problem of student procrastination, which results in all project work being completed the last three weeks of the semester. It also provides the opportunity for the instructor and the client to intervene early in the process if the project is not progressing well. Students receive a grade for each two-week checkpoint.

### **Module Four (implementation and presentation)**

At the end of the semester, the student writes a summary to the client, explaining the functionality of the system and what has been accomplished versus what was initially agreed to.. Students also invite their clients to attend their formal presentation of the project to the class for their final grade. Completed projects are then published to the appropriate web server.

## **4. RESULTS**

The best result measurement is the clients' level of use of the systems the students have developed for them. Approximately 60% of the final projects have been implemented for use by the end clients. As in any classroom, some projects do not measure up to 'production' quality for implementation. These projects are kept in the project pool for reassignment and re-design the next semester.

We have received significant anecdotal information from both clients and students about the success of the projects and the learning that takes place in this course.

Client comments include:

One client is the NC CPA Foundation, which awards scholarships in accounting to students at any North Carolina university. They credit the new online application system developed by an IS student team with enhancing award process by making it more objective and accessible to more students. The student team developed not only the online application process, but also a scoring system in which CPAs from across the state rank the applicants on five different point items to determine which applicants will receive awards. The organization was so impressed with the system they 'awarded' the

students involved in the design their own cash grants.

Another client was an assistant professor and director of the Athletic Training Education Program. The student built a database and web reporting system to track clinical hours logged by athletic training students. The athletic training certification process requires each student to complete 225 clinical hours each semester for six semesters. Those hours have to be accurately tracked both for each student's grade and for the program's national accreditation process.

Before the student developed the online tracking system, all clinical hours were tracked manually on paper. "The magnitude of the documentation was astronomical," said the director. "The paper-based system had no checks and balances, and I needed to be able to more efficiently generate reports and do quality control checks."

Another faculty member at the Center for Marine Science and former IT director of a research facility said he enjoyed working with the student but that it was different than what he had been used to in his former job at a major pharmaceutical company. "I had to change my approach to the whole working relationship because a student needs coaching and close supervision," he said. "We had to end up with a completed product, but overall this had to be more of a learning experience than a do-or-die business experience." This project involved building an inventory tracking tool to efficiently track small amounts of research chemicals that the center produces and provides to other research facilities.

Finally, most clients have stated that the student projects have saved them time in their operations and that they would welcome another student or student team. As a result, we have completed multiple projects for several clients over various semesters.

Student observations include:

"This experience taught me how to plan and manage a large project. It was a lot of work and very time-consuming because I was programming the back end of the database and designing the user interface at the same time. That's not easy but there's no better feeling than when it all comes together and works."

"This was the first real client project for me, and it was definitely a learning experience. The main thing was to figure out exactly what the client wanted and what the database needed to do. Also, I had to learn how to plan and schedule my time. I was a little overly optimistic in the beginning as far as what I could get done within a set amount of time."

"This class showed me how important the initial contact with the client is and also the ongoing follow-up. The client interaction was really good, and that's important for me because it's so different than the way things are done in the military."

Evaluations from the course included comments that this is the 'best course' and most demanding course of the program and that it ties everything together that they have previously learned. Very few negative comments are received in the course evaluations.

## 5. FUTURE ENHANCEMENTS

The course work required is more than a typical three-hour course. It is a heavy burden for students to do the project analysis, design and implementation as well as learn a new web application development language all in one semester. To solve this problem, the analysis component of the project is being moved to the system analysis course in the curriculum.

Both instructors (the system analysis instructor and the emerging technologies/capstone instructor) are working together so that real world potential projects are introduced approximately half way through the system analysis course. The students will select real client projects, interview the clients to determine their needs and complete the analysis portion prior to starting the capstone course. This will add a hands-on component to the system analysis course and provide the students with more time to develop their project plans and to complete the solutions. When this change is made in fall 2006, the projects will be completed over 1.5 semesters.

Class size can be a major issue for faculty as in any semester the instructor is managing approximately 15 different projects. Meeting with 15 students or teams for .30 minutes every two weeks is highly time intensive and

requires a high level of organization in the scheduling of appointments. However, this component is critical to insure that regular progress is made and project plans are begun followed.

Finally, it is important to insure that the project is feasible and that it can be completed within one semester before the student begins any work.. The instructor should offer only those projects that require a work load that the student can handle. Also, students should not be allowed to create projects for clubs or organizations in which they are involved. This can lead to unclear expectations and no real client to provide the necessary interaction with the student.

In summary, the use of real world projects in a capstone course brings together the textbook knowledge learned from prior MIS courses and provides students with the opportunity to demonstrate and apply that knowledge in a real world setting. Students learn skills that serve them well upon graduation, when they are able to enter a new job and immediately begin working directly with clients. In addition to their technical skills, they have mastered the 'soft skills' such as communication and project management that are necessary for success in the workplace. Because employers look for applicants who have developed these skills and who have experience working with actual clients, students who have participated in a capstone experience and completed a real world project have an advantage in the job market.

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