Critical Issues in the Administration of an Integrating Capstone Course

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Abstract

This paper discusses an MIS Capstone course in a graduate information technology program. The course provides an environment that allows students to apply the information and skills that they have obtained in the program. Teams of students work with organizations and deal with actual IS issues in a real world environment. This paper describes elements of the course, the tasks required to ensure course completion, basic operation of the course, and problems encountered in its administration. As the course has run serious problems have been encountered which required effective resolution if the course was to serve its stated goals. In spite of these problems, the results certainly outweigh the problems encountered.

Keywords: Capstone, MIS, Applied Project

Introduction

The effectiveness of communicating global MIS and business concerns to technical students has on the whole been poor. A survey of academic journals and popular literature reveals numerous articles describing various education programs and their efforts to better prepare MIS students to function in the corporate business world after they graduate.   The use of an integrating capstone course is one way that many schools have used to address this problem, but their use can lead to other problems. This paper looks at the problems one school has encountered in the operation of the capstone course and how it has addressed these issues.

Background

Student exit surveys indicate that many students, especially those changing careers although technically competent, do not feel confident about their abilities to function in an IS role. Chow and Edmundson (1994) and others (Alexander, 1996; Coffee, 1998) discussed what IS employees lack from the employers' standpoint. In Information Week an

article by Marianne McGee (1998) discussed the disconnect common in MIS programs between what industry wants and needs, and what is typically provided. The article notes the apparent inability of many MIS programs to produce graduates who are ready and able to meet the demands of dealing with a highly technical integrated infrastructure supporting multiple functional departments in organizations across our information society. This is not a new complaint. Buckingham (1987) discussed many of these same issues over a decade ago.

Novitzki (1998) conducted interviews of IS professionals and identified skills sets that an effective IS program must give its students and compared this to what most schools were providing. The most consistent shortcomings were the ability of students to work with functional managers to develop systems that provide the information needed, group skills, and communication skills. It is obvious that one course can not cover all of these issues, but it can expose students to the environment and provide practice in developing these skills.

There is extensive recent literature which discusses the application of capstone courses to various curricula (Rains et al., 1999; Andreasen and Trede, 1998; Perlman and McCann, 1999), but their focus seems to be largely on the results of such a course rather than a discussion of actual implementation issues. Articles that present a more general view of the value of capstone courses are by Collier and Driscoll (1999) and a summary collection published in the journal Teaching Sociology (1993). The one thing that

seems to be lacking is a detailed discussion of any administrative problems encountered in these courses with a discussion of how these problems were or could be resolved.

Course Development

Novitzki (1998) presented a detailed discussion of the rationale for developing an MIS capstone course and the logic behind developing learning objectives and outcomes. Most of the material focused on how the course was developed and delivered. This paper summarizes some of the points made in that article and then expands into issues encountered in the administration of the course that are unique to the applied project type of course. It then presents methods to deal with the problems noted.

The course being discussed is an applied project class, which was developed to provide students the experience of working on an IS related undertaking with a real organization. Depending on the number of students enrolled in the various sections of the capstone course offered, anywhere from seven to fifteen projects are needed each term. Since the course is focused on the completion of actual applied projects, no specific technology topics or issues are taught. It is a group activity, as most MIS projects are done in groups. Since almost all of our students are working with full time jobs, it also ensures that the project can continue even if a team member is called out of town on business trips. Lastly, a group allows a larger project scope to be accomplished. The class projects are significant undertakings, which could not normally be accomplished by a single person in a one semester time frame. For example, no project is as simple as, 'design and implement a web page'. Appendix A is a listing of some completed projects.

The following description was developed based on these ideas: This course is intended as the culminating experience in the MIS program. As such, it is taken in the student's last semester. This course provides a guided experience, which will allow the students to manage information or telecommunication system projects in the future. It provides students an opportunity to participate in actual technology projects within a real work environment with all its processes and challenges. Under the supervision of a faculty advisor, student teams of three to four students develop a project proposal. Utilizing the skills and knowledge gained in the program, project teams then design, develop, and/or implement a telecommunications or information system solution for the organization.

Course Procedures

Prior to the term students take the course, department staff contact organizations and companies in the local area for any IS type projects or tasks which these firms might have. On the first night of class, the list of participating organizations and companies with the types of projects available for the term is given to the students. The instructor discusses the various projects and the participating firms with the class. Students then are given time to discuss projects and possible teams. At the end of the evening, students select their top three choices for projects based on interest, experience, and skills.

Team Assignments

The instructor assigns students to projects, using their choices as a starting point. He/she must make sure that all projects get a balanced team to work on them, and that proper-sized teams (3-4 students) are formed. Team makeup is critical for project success. If the team is made up of individuals with a limited mix of skills, the process is often less successful than it could have been. Projects and companies often vary widely in their appeal; as a result there is usually at least one project chosen by few students, and one that is chosen by most students. Final team assignments are based on student skills and competencies as recorded on their Skill and Preference Form(Appendix B). As a result of all these constraints, only about 70% of students get their first or second choice for a project.

There is some flexibility with team assignments. If after initial assignments have been made, students wish to be on different teams, they can switch, but someone must replace them on their original team. After students have their final assignments, they meet as a group with their faculty advisor and identify a team leader who serves as the team point of contact for both the corporate sponsor and the course instructor. One of the purposes of this meeting is to show students that while individually there may be some gaps in their technical knowledge or experience, as a group their knowledge and experience level is quite high.

Course Requirements

Team members compose a list of questions that they want answered about the company, project, industry, etc. The team leader schedules a meeting with a representative from the company who becomes the team's corporate sponsor. The team meets at the company with the faculty advisor and the corporate sponsor. The response to the questions developed by the team often shows that the corporate spon-

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sor does not have a firm understanding of the requirements, time required, and general work issues that are necessary to complete what they want. After the meeting with the sponsor, the team assembles again to develop an initial scope statement which outlines in some detail the work involved, timing, deliverables, etc.

Teams rewrite their scope statements based on input and recommendations from their instructor, faculty advisor, and their corporate sponsor. They meet again with their corporate sponsor to get the final scope statement approved. This document then becomes their contract with the corporate sponsor. If either the sponsor or the team wants to modify the project after it is signed, a new or modified scope statement must be prepared, and both groups must sign it.

Based on their meetings with the corporate sponsor, knowledge learned in the program, their own research, and the scope statement, the student teams then work with the corporate sponsor as required to complete the project in the fifteen week semester time frame. Their goal is to develop the best IS solution, given their knowledge of the organization and its problems.

The last night of class students make a thirty minute presentations to senior corporate sponsor IS and management staff, IT faculty, the rest of the class, relatives, and interested guests. This presentation is expected to be highly professional, providing discussion of the problem, relevant research, alternative analysis, and a recommended solution. Project teams also prepare a written academic report that discusses the entire project from problem statement to solution.

Required Support

This course is very labor intensive and requires several faculty to serve as faculty advisors in addition to the course instructor who serves as faculty advisor for one team, and corporate sponsors who also have a role in the course. Some of their main responsibilities are described below.

Course instructor:
1. Facilitates the in class sessions, encourages interaction of teams, and uses class resources to help project teams.
2. Provides project management oversight direction and works with faculty advisors to ensure that all class projects progress.

3. Works with corporate sponsors to ensure that required information is provided to teams in a timely manner.
4. Identifies and assigns topics for the individual research papers.
5. Acts as faculty advisor for at least one project.
6. Evaluates individual research papers, scope statements, interim and final reports.

Faculty Advisors:
1. Provide guidance to team members on (a) technical issues that arise in discussion with corporate sponsor and (b) process issues that arise during all phases of project design and implementation.
2. Communicate with course instructor on any unusual challenges or project implementation issues.
3. Evaluate student projects from technical and process perspective.
4. Meet with teams as appropriate, particularly during project scope of services development and the final meeting with the corporate sponsor.
5. Attend interim and final team presentations and the formal presentation to the corporate sponsor.

Corporate Sponsors:
1. Act as corporate project liaison for the team.
2. Provide access to users and data that the team needs to deliver services agreed upon in the scope of service statement.
3. Respond to team questions and follow up communications in a timely manner.
4. Attend final corporate presentation.

Initial course evaluations were extremely positive with students commenting on the usefulness of the experience, and corporate sponsors uniformly impressed with the quality and amount of work accomplished by the capstone teams. Most students rated the course as one of the highlights of the program.

Course Administration Issues

Initial course sections were completed with only minor problems. There has, however, been a steady increase in administrative problems that were not noted initially and were not anticipated, but which threaten continued successful operation of the course, the more times that the course is run. The problems are in two categories. The first are tied to the projects themselves. These relate to the number

of projects required, the type of projects used in the course, and the workload required to complete some of the projects. The second relate to team and individual student performance.

Project Problems

The following problems were not originally envisioned when the course was created, but except for the first are becoming much more prevalent.

Projects Required

The program has continued to grow rapidly, far exceeding original estimates. We now use on the average between 15 and 18 projects each term, so in the last two years, we have completed over 150 different projects. The sheer volume of projects required is almost a magnitude above what was originally planned.

Project Numbers

It has been a continuing problem to find the required number of appropriate projects every term. This problem has been reduced somewhat by the reputation that students are developing in performing their projects. As more projects are completed, many companies have heard about the projects and are contacting us to submit a proposed project. Other firms have recognized the quality and amount of work done in the various projects; as a result, we are starting to have requests for follow-on projects. In the case of large companies we are getting requests for multiple teams to work on more than one project in a semester. While still somewhat of a problem the continued high quality of projects completed is reducing it to reasonable levels.

Project Type

A more difficult problem is the type of project provided by the corporate sponsors. Some obvious constraints are that the projects can not be mission critical, involve highly proprietary information, be time critical, involve extended time frames, involve travel to distant locations, or be merely an implementation of some technology at the technical level. Obviously all students want a project that is appropriate to their interests and fits with their concentration. For example, students in the Telecommunications Concentration do not feel that they should have to work on an IS project with little or no telecommunications component.

Despite continuing efforts of both faculty and administrative staff it is more and more difficult to find projects that match student expectations as the number of students in the programs continues to increase. With the move of companies from legacy systems to web-based and B2B models, many previous types of projects such as consider appropriate upgrades, modifications, and other technically focussed, or incremental step projects are fewer in number.

The majority of firms in our area are start-up, service, or consulting firms. With the continuing influence of the Web on business operations, corporate sponsors are asking for a different kind of project. These require students to look at issues, products, and technologies to determine if they would be suitable, cost effective, or have scalability for use by the corporate sponsor.

Other projects look at a new technology or its use, and analyze it to determine the suitability for the corporate sponsor to pursue it, or at least describe potential uses of the technology. These projects are partly market research and partly technology based, have no hands-on component, and are considerably different than most of the initial projects sponsors submitted. Few students feel that a project that requires them to research a technology or an area that a company may be moving into is a meaningful technology project. Most students want projects that have significant hands-on components.

The problem here is one of both perception and communication. We had obviously not done an adequate job communicating to students the role that they would be playing in organizations. At the Masters level the IS professional is not normally the hands-on running the cable techie. Corporate sponsors point out that senior IT personnel do expend considerable time doing this sort of research.

We have addressed this problem in several ways. First, we have extensively revised the introductory materials for the degree program. They highlight that the IS person should be looking at the system and its components and determining what changes need to be done to make the systems more efficient and effective. This means that the IT person does not merely look at information systems, telecommunication problems, or technical issues. They must look at the whole enterprise to determine what the IT organization should be doing to help the whole organization achieve its goals, what IT can do to help, and how IT should get there. The IT person must bridge the cap between the engineers, technical experts, and the functional managers. From that standpoint looking at new technologies and trying to determine future directions are critical functions in their jobs.

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Second, in the student orientation for the capstone course we now present examples of previous projects highlighting those that are NOT tied to a technical issue or problem and explaining their importance to the IT role in the organization. Third, the faculty advisor and instructor reinforce this approach and have started requesting a look at more global issues even in those projects where there is only a tightly defined technical focus.

Initial response from students indicates that while many students still don't like not having technical projects, they do understand the importance of what they are doing.

Project Workload

The workload varies between projects and there is usually no way to predict this completely in advance. All require significant amounts of work outside of class and meetings on site with the corporate sponsors. Typically a company who has sponsored a project before has a better feel for what a team can do and what the company needs to provide. As a result students may only need to meet with the sponsor on site three or four times during the term. For others it may require weekly meetings to make sure the team and sponsor keep in tune with what is going on. If there are some extensive technical deliverables or survey required, it may take multiple meetings per week to resolve and complete the project.

Meetings with corporate sponsors and faculty have not fully resolved this problem. All agree that it is a typical real world occurrence, and that it is important for students to realize that IT projects can not generally be neatly boxed and that some will require significantly more effort to complete than others. Instructors use the workload issues as a way of reinforcing the need for a carefully specified scope statement. They point out the need to use this agreement to keep the project within manageable bounds and not let the project creep to impossibility. Lastly, we have started to describe the significant amounts of time that can be required to complete projects in the capstone orientation. This makes students aware of the potential for extensive work before the class starts. Students are encouraged to take no other courses or a significantly reduced course load the semester that they take the capstone.

Team Performance

The second problem category and the one that threatens to severely damage the program has been the change in attitude of many students when they reach the capstone. Initially students came to the course expecting to be challenged and doing whatever was necessary to complete the projects. Recently some students have arrived who seem to feel that they are finished with the program and they merely have to put in time to complete the project. As stated earlier, this course is not designed as a technical course, and some students view the projects as busy work that does not require significant involvement. As a result the quality and amount of work performed by a few project teams has decreased in recent semesters. Some students feel that if the project does not interest them in their technical area, they put out little effort to be involved in the projects assigned. While previously there had been occasional problems with individual students not performing at acceptable levels, this year is the first time that some whole student teams have done little for the corporate sponsor. When asked to produce something more substantial, the teams responded that this is all that they felt that they had time for. This action, if it continued, could damage the school's credibility with corporate sponsors and would seriously reduce the development of new projects.

Process Changes

Several processes have been changed to convey the importance of the project as well as team and individual performance. While it was not required previously, efforts to evaluate and receive feedback on student and team performance in the early stages of the course have intensified. One change that has really attracted student attention is the fact that a student can be fired from a team, if the team feels that a member is not meeting deadlines, doing required research, or attending meetings, and discussions with the faculty advisor and instructor do not correct the situation. In these cases students can try to get hired by another team, can attempt to complete a project on their own, or can take an incomplete grade and repeat the course the following term.

The decline in team performance is a tougher problem to resolve. Just giving the team a low grade does not solve the underlying problem of a lack of adequate project completion. Also since it is a group project, if one or two students are working hard they are punished by the poor performance of others on the team.

One way to deal with this problem has been to obtain early feedback from the corporate sponsor and the faculty advisor. Is the team moving on the project, are they delivering, is the project on track? Do they see problems with the team? In one case the corporate sponsor had to edit the team's deliverables for spelling and English before submitting them to corporate management. Student teams can

then be advised that they are not meeting expectations. If the verbal warnings do not change behavior, the team is officially notified of failure to perform at expected levels and the fact that the team may be fired from the project which would result in a failing grade for the course.

A final element is the right of the corporate sponsor to reject a project if it fails to meet their standards for depth and breadth of analysis and presentation. These steps have done much to make students recognize that the project is not just an academic exercise, and that they will be expected to perform at a professional level. This combined with a detailed explanation of expectations and definition of interim and final deliverables has done much to reduce this problem.

Grading Changes

Many of the changes described are manifested from the student perspective in how their performance will be evaluated. To minimize student issues and concerns about grading a group project, several elements have been added. First, an individual paper worth 20% of the course grade has been added which allows the instructor to evaluate student effort on a paper that is usually a significant part of project research. Second, the course instructor, faculty advisors, and corporate sponsor all evaluate both team and individual member performance. These evaluations account for another 20% of the course grade. They consider how the individuals perform with the group, which ones do the work, who does the best work, who is divisive, who doesn't show up, as well as how the team is working toward project completion.

As a result of these changes even though the overall project is group based, 40% of the grade is now dependent on individual performance. The remaining 60% of the course grade is composed of group grades for the scope statement and interim written report, an interim oral presentation, the final written report, and the final oral presentation. These deliverables provide feedback to students of their progress through the course.

These changes have added to the duties for the instructor, faculty advisors, and the corporate sponsors. The duties for the instructor now include: rate performance of all teams and team members and give feedback for improved performance. For the faculty advisor the duties now include: observe students in team meetings, record observations, and submit interim and final evaluations of team and individual contribution. For the corporate sponsor duties now include: evaluate interim and final team and individual member performance.

Conclusions

It appears that, at least for our student population, the capstone group applied project course improves the learning experience. The changes in the capstone orientation for students, evaluation procedures, and new interim requirements have done much to solve the problems highlighted here and have also made the project much more real world to students. They recognize that there are severe consequences for failure to perform at adequate levels. At the course's completion, students definitely feel that this is not a book exercise, and see that the real world is not as clean and neat as many texts say it is. Most recognize the role that IS personnel have in working with functional managers in the development of new effective MIS solutions and the varied assignments in which IS personnel can be involved. Most comment that one of the biggest benefits of the course was exposing them to the problems involved in working in IS and satisfaction in applying what they have learned.

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APPENDIX A

The projects completed include a wide range of tasks including:

1. Developing an IT plan for a non-profit organization addressing issues of email, Internet presence, staffing, training, and LAN development.
2. Development of a client server database for a police department. System was windows based on an Ethernet LAN with security at data element level
3. Develop plan for second-generation architecture for an ISP including network design, software, and server selection.
4. Plan and development of a corporate Intranet for a human resources department of a large national company. Included the design of dynamic web pages to ensure easy update of information.
5. Plan for initial move of small company into electronic commerce; include design of web pages, content selection, determination of commitment level, and evaluation competition moves in EC.
6. Work with a chamber of commerce to develop geographic information systems to address issues of growth and development in the county.
7. Develop an online notification for users of an electron commerce provider.
8. Analyze and recommend third generation database for an insurance company after reviewing need requirements and legacy systems.
9. Automate loan generation and administration process for an entrepreneurial fund.
10. Design and implement an online advising system for university program advisors.
11. Work with a medical services company to establish electronic communication systems for physicians.
12. Design and install a LAN for small non-profit org.
13. Assess value and make recommendation on vendor for implementation of an Internet banking option by a small financial org.
14. Identify and develop specific technology requirements and a recommended solution in designing the next generation insurance agency.
15. Design web site and plan to link LAN to Internet and develop security steps to protect the main system for a company.

APPENDIX B

Student Skill, Data and Project Preference form

Name:

Day Phone:(   )

Evening Phone (Optional):

email:

fax#:

Academic Concentration:

Work Organization:

Relevant Experience:

Project Management:

Yes _____ No_____ Some_____None_____

System Development Life Cycle:

Planning_____Analysis _____ Design _____

Development _____ Implementation_____

Maintenance_____

Tools:

Project Management /scheduler:

Internet Experience: HTML___Front page___Search engines only___ No Experience__

What skill sets do you bring to the project?

What are your expectations for this course?

Project Preferences (Which Project interests you and why?) Give order of preferences and use the back of this page.

Biography

James Novitzki is an Associate Professor and Chairman of the Information Technology Department in the School of Professional Studies in Business and Education at Johns Hopkins University. He teaches the capstone course several times a year. Dr. Novitzki is the author of 20 papers and articles on the subject of improving the quality of information technology education.