

# Strategies for Engineering Education Utilizing Global Project Management Protocol

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**Abstract - According to the Bull Survey (1998) projects do not fail from a lack of reports, data sheets, graphs, or statistics; they fail due to a lack of effective communication and coordination. Whether the work is local and small in scope or large and coordinated over several continents, information access influences a team's productivity and performance. The coordination of international engineering distance learning and research project management is inherently complicated. The need for simple to use, easily accessible tools to assist with distance learning communication, research project management, and process tracking is rapidly growing. These tools can help to control local and international relationships between professors and students, research leads and associates, industry project managers and development team members and headquarters and satellite offices. In this paper, we are proposing new techniques in utilizing off-the-shelf software to effectively provide project stakeholders with a common road map to ensure consistent delivery of information and data tracking via the web.**

*Key Words-* About four, alphabetical order, key words or phrases, separated by commas (for suggestions: Camera-ready, FIE format, Preparation of papers, Two-column format).

## INTRODUCTION

In order to effectively respond to the diverse challenges of rapid globalization in both industry and higher level education, effective management tools and techniques are required to balance the needs for information access, resource synchronization and task execution. The process of managing the complex and often times disparate elements within a project must be optimized in order to provide stakeholders with the most desirable outcomes. Project management methodologies, regardless how good, are simply pieces of paper<sup>1</sup>, unless there is a culture to experiment, accept, and use project management tools. The project management tools and techniques discussed in this paper are applicable for project coordination efforts for

both industry and academic projects such as distance learning course delivery.

## SAMPLE TECHNIQUES USED IN INDUSTRY

In an effort to drive high performance and results while keeping costs down, outsourcing project development efforts is a growing trend throughout industry. At Harcourt Inc., a variety of techniques are used to manage software product development. These standardized tools and techniques are used for both small scale internally developed projects as well as large scale projects whose development is coordinated over multiple continents.

The use of Microsoft Project software partnered with a fully accessible project-dedicated web site provide a highly effective tool set that allows for the coordination and reporting of project tasks, timelines and resources. Although there are multiple software programs available to track project schedules, the use of Microsoft Project software is a powerful management tool in that it allows for links to attach additional critical task information other than what is listed in the project schedule, compare progress against baseline work and run a multitude of reports. Once the base information is populated within a schedule template, this software allows any stakeholder to generate key information in a variety of different formats to meet their particular needs.

## DELIVERING AND MANAGING DISTANCE LEARNING COURSES

Undoubtedly, distance learning is gaining popularity among non-traditional university students and also with those who are required to work in order to support their education. Most of the Florida state universities are facing a shortage of classroom space due to a rapidly growing student population and budget cuts. One reasonable and viable option to address this situation is to take the classroom to the student via the internet.

Successfully delivering online courses to students can be managed much like a project by utilizing the same tools and techniques used by industry for product development. At the

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University of Central Florida, Engineering Technology Department, we have experimented with different models and techniques and have examined the results in order to improve our ability to effectively deliver online courses to students.

Treating online course delivery as a project, requiring careful analysis of tasks, timelines, resources and assessments, consistently delivers desirable results for both professors and students. A project can be defined to be any series of activities and tasks that<sup>2</sup>:

- Have a specific objective to be completed within certain specifications
- Have known start and end dates
- Have funding limits (if applicable)
- Consumes resources (i.e., money, people, equipment)

Project management, on the other hand, involves project planning and project monitoring<sup>2</sup>.

Correlations can be found between the steps required to teach university level courses and the steps required to create a product regarding the level of planning and coordination needed to ensure that the end results accommodate either the academic needs of a program's curriculum or a particular business strategy.

In order to utilize project management techniques in delivering courses we took the following steps:

1. Identify objectives and desired outcomes for every course – This step requires a high level of coordination to ensure that these objectives fit with the curriculum. Faculty develop these objectives and outcomes with input of program coordinators based on input from various stakeholders.
2. List all topics that need to be covered within a course – Like objectives and outcomes, the topical coverage of a course must also fit within a context of a curriculum. The decision of what topics are covered is a subset of the total curriculum that is decided upon when the course is created. It is also continuously reviewed to ensure that it is current and supports the overall curriculum needs.
3. Consider each topic as a task and identify all activities that need to be completed such as lectures, posting assignments or projects – This is a task that is performed by the faculty teaching the course. In essence the faculty member, at this point, is the project manager of the course.
4. Define all assignments or project elements such as research activities, deliverables, due dates, etc.
5. Assure communication channels if more than one student is involved in any project.
6. Facilitate a mechanism for student communication and exchange of information.
7. Identify a time line that clearly marks important dates such as exam dates, topics that need to be covered in a certain time period, deadlines for returning assignments, etc.

8. Provide an interactive course website allowing student access to all recorded lectures, class notes, e-mail, access to grades, professor feedback and communication, a bulletin board, calendar, discussion and chat room for all involved in the course. (These sites can be created by using available commercial software or can be developed in-house. This site must be capable of providing real-time access to information and capable of accepting documents to be loaded by students user generated content.)
9. Identify appropriate evaluation methods. Ensure assessment of all tasks performed including identification of grading criteria. Require a peer review by project team members after each project as a part of the student's overall grade. (In one case, we identified ten projects for a course and grading was based on the number of successful projects completed and submitted on time.)

If an online distance learning course is considered a project, then the professor assumes the role of project manager. In this role they need to:

- Define work requirements – what needs to be done in an assignment or a project
- Define the quality of work – determine baseline of acceptability
- Define the resources needed
- Track progress
- Compare actual outcome to expected outcome
- Make adjustments

A successful course delivery can be defined as having achieved the course objectives. This model creates a multi-dimensional learning environment that allows students not only to be involved in assimilating course content but also exposes them to tools and techniques used in a real-life work environments.

#### **SAMPLE TECHNIQUES USED AT THE UNIVERSITY OF CENTRAL FLORIDA**

As part of an effort to increase the quality and availability of distance learning course offerings at the University of Central Florida's College of Engineering and Computer Science Department, professors in the 2006 academic year were encouraged to change to the iCLS model. This model used as its primary delivery mechanism a desktop video recording capability which allows professors to easily record lectures from their office computers and make these lectures available through the internet. This model is highly efficient as it allows the creation of good quality course content to be created and easily distributed to students.

The author was one of the early adopters of the new technology and as a result of using it in the Fall 2005 semester, paradigm changes were made in the course offerings for the Spring and Summer 2006 semesters (CET 4429 Applied Database II and CET 4583 Web Systems I). The primary change was a shift of the primary learning mode

from passive (lecture/exam based) to experiential (assignment/project based). Data was collected as to the effectiveness and the perception of these changes among the students which indicated a very positive response to the changes. This work includes the details of the changes made in the course offering plan and the results of these changes. The paradigm change proved to be effective and the results of this study indicate that the courses are more effective and provide a higher level of student learning. It is recommended to explore the change of more courses to the new paradigm, while continuously monitoring the effect on different types of courses.

### METHODOLOGY

The Applied Database II course is taught annually in the Spring Semester and has been taught by Dr. Ron Eaglin for the past several years. The course is the second semester in a two course sequence. To enhance student learning, the intent was to utilize passive learning techniques to enhance the effectiveness of the experiential learning used in the course. The intent was to use a strong balance of the three primary teaching/learning styles that made up the elements of the course. The newest element introduced into the course was the use of streaming video. This video was recorded from the professors desktop and made available on a video server. The web forums, group areas, project areas, and assignments were made available via WebCT™ used at the University.

TABLE 1

<b>COURSE ELEMENTS USED IN CET 4429</b> Passive Elements	Streaming Video, Textbook, Web Reading
Interactive Elements	Web forums, emails, group assignments, group meeting(s)
Experiential Elements	Group Project, Hands-on Assignments

The student requirements for this course were ambitious and required students to finish with a team capstone assignment and a final assignment where the students were required to develop an OLAP cube to complete a business intelligence assignment. Some techniques were utilized to assist the students in achieving the goals of the course while at the same time making the course manageable.

### DESKTOP VIDEO

The instructor desktop recording setup consisted of Camtasia software running on the desktop PC, A Logitech PC Camera and a Logitech dedicated USB Microphone. With this setup the instructor was able to record video directly from the desktop, encode it and place it on a video server. The video recorded on the desktop allows for the embedding of the instructor video within a presentation video as shown in Figure 1. The ability to record video on the desktop has a number of advantages to the instructor - it allows for the creation of lectures content to be done conveniently including allowing answers to student questions to be answered with rich video content. The only lag time between the video response and the posting of the response is the

amount of time required to prepare, create, and encode the video to the video server.

This video capability does require that faculty look at traditional lecture content differently. In a typical class the material presented is dependent upon the time frame of the course. The typical lecture is designed to last one hour or another time period based on the course schedule. In desktop recorded video, the amount of time is flexible, so instead of concentrating on the amount of time for the video – the instructor is free to concentrate on the content which is intended to be covered. In the CET 4429 course I found that most video segments took 15 to 30 minutes and covered a single distinct topic. Each week the students might have between one and five video segments as required viewing.

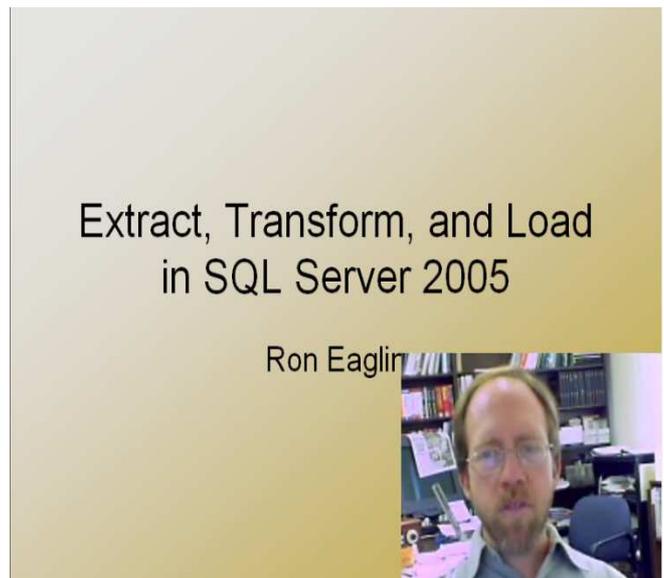


FIGURE 1  
IMAGE EMBEDDED AS PICTURE IN PICTURE IN A RECORDED LECTURE

### EXPERIENTIAL ASSIGNMENTS

The core of the learning material in the course was centered on the experiential learning assignments. Each of these assignments was an open-ended assignment that required the students to produce some tangible output and document their work. Seven individual and four group assignments were given. From conversations with the students, it was estimated that the students spent between 10 and 60 hours on the different assignments. The required submission was a document with screen captures of their progress and completion of the assignments. An example assignment is shown in Table 2.

The point value for each assignment was based upon the estimated amount of effort required to complete the assignment. The assignments were counted as 40% of the overall course grade based on the fact that they required the bulk of the course effort.

TABLE 2  
EXAMPLE ASSIGNMENT AS GIVEN IN CET 4429

Using the Adventure Works database you will be creating an OLAP cube.
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Your measure will be sales. You will have three dimensions; Store: Store Type, Location, and Size; Customer: Marital Status, Income, Gender, Education; Product: Name, Model.

Looking at the data from the cube and using business intelligence tools you will need to come up with a sales recommendation. Which stores or customers or regions should you target which products or with which salespersons? In the end you should come up with one recommendation and have supporting documentation for this recommendation.

You will be uploading a single DOC file with the results of your analysis. It will contain screen captures of your fact tables, OLAP cube, Data Mining or Analysis Support, and final recommendations.

## GROUP PROJECT

The other major experiential portion of the course was the group project. The class was broken into group teams of 4-7 students and assigned a basic group project. Each project had an external contact that had been arranged by the instructor. The requirements for the project were that the teams would produce a database and interface design to meet the needs of their client including the correct architecture of stored procedure. Even though the requirements did not call for it, 2 of the 4 teams that completed projects chose to take the product through design and to full implementation based on their clients. Students were required to produce a system design, a recorded project presentation, and documentation for the final project grade. The project presentations have been made publicly available at the web site <http://ent.ucf.edu/courses/Dr.Eaglin/courses-taught.htm>. The group project was 30% of the overall course grade.

## EVALUATION OF LEARNING STYLES

A number of surveys were given towards the end of the term. The required University "Student Perception of Teaching", a Learning Styles Survey, and a Perception of Outcomes Survey. The results of the Learning Styles Survey is shown in Table 3.

Most notably, are the results of questions of 2, 3, 4, and 5. Students appeared to be evenly split on preferring face-to-face classes, with the majority of students neutral. Students leaned away from courses that only utilized a minimal use of the web, and did lean towards courses that had some face to face meeting. In evaluating the current methodology, the majority felt that it was good, but there was also strong disagreement from some students.

Another result of the survey was the perception of quality of the video. It was not asked if video quality and the availability of the video materials hindered student learning. The perception of the quality was surveyed, even though students disagreed that the video was clear and readable, they did agree with the audio, PowerPoint, and document camera material being clear and easy to read. It was made clear through interaction with the students that the perception of video quality did have an effect on their overall perception of the course. Audio quality was also related to be important, but the importance of this was not surveyed.

An important element of the course was the interactive learning, which the lack of a face-to-face environment made challenging. Interaction was handled through WebCT™.

Even though there was disagreement from some students, the majority felt that it did increase the level and quality of interaction between students, and between students and faculty.

The last question was about the University providing adequate support for students who use the web. The majority of students agreed with this (10 of 18) agreed that the support was adequate. Two students strongly disagreed. Experience with this course and other courses also made the inequity of student effort in group projects apparent. Some students felt that at least one of their group partners did not contribute to the overall team effort. Some comments of the class members are shown here.

"Having to count on a group and an outside sponsor. Some college students are just horrible slackers and procrastinators. It stinks that 1 guy in the group should have to routinely carry the load. I know business wants team players, but can't those skills be developed outside of the classroom? I mean shoving 4 strangers into a binding situation is not an effective way to build a team."

"What I liked least was not being able to fire a project group team member."

The Learning Style Survey contained the following questions:

1. My learning preference is classes that are mainly face to face
2. My learning preference is classes with only a minimal use of the Web and mostly face to face
3. My learning preference is classes that equally mix Web and face to face instruction
4. My learning preference is classes with extensive use of the Web, but still some face to face instruction
5. My learning preference is classes that are entirely online with no face to face meetings
6. The current method of delivery is good
7. Instructions for accessing classes on the computer are clear and understandable
8. Video is clear and readable
9. Audio quality is clear and distinct
10. PowerPoint slides are clear and easy to read
11. The amount of time that PowerPoint presentations are used is appropriate for material presented
12. Videos contain a variety of presentation formats (talking heads, slides, documents)
13. Material presented on the document camera is clear and easy to read
14. PowerPoints for the class are available on WebCT
15. Instructor responds to emails in a timely fashion
16. WebCT discussion board is used by students and the professor
17. WebCT email is used
18. eCommunity is used
19. The professor uses teams for course work
20. Teams (if used) are virtual
21. Teams (if used) are face to face mainly
22. In this course the use of the Web increases the amount of interaction between students
23. In this course the use of the Web increases the amount of interaction between students and faculty

- 24. In this course the use of the Web increases the quality of interactions between students
- 25. In this course the use of the Web increases the quality of the interactions between students and faculty
- 26. WebCT is used for modules and/or assignments
- 27. Class involves laboratories
- 28. Class includes research report or project
- 29. Exams are live and online
- 30. Exams are only online
- 31. UCF provides enough support for students and faculty who utilize the Web

**TABLE 3  
RESULTS OF LEARNING STYLES SURVEY IN CET 4429**

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Question 1	2	2	11	2	1
Question 2	1	3	4	6	4
Question 3	3	5	4	4	2
Question 4	2	9	1	3	3
Question 5	2	5	2	5	4
Question 6	2	7	4	2	3
Question 7	5	6	4	2	1
Question 8	4	3	2	7	2
Question 9	4	5	3	6	0
Question 10	8	4	1	4	1
Question 11	5	7	3	1	2
Question 12	3	9	6	0	0
Question 13	5	7	4	0	2
Question 14	8	7	2	1	0
Question 15	8	5	2	1	2
Question 16	8	5	3	0	1
Question 17	4	7	3	3	1
Question 18	0	0	7	4	7
Question 19	7	8	2	1	0
Question 20	3	9	4	1	1
Question 21	0	1	5	8	4
Question 22	3	8	2	3	2
Question 23	1	11	3	1	2
Question 24	4	7	4	0	3
Question 25	3	8	4	1	2
Question 26	10	4	3	0	1
Question 27	0	2	7	1	8
Question 28	4	9	5	0	0
Question 29	1	6	4	2	5
Question 30	13	4	1	0	0
Question 31	1	10	5	0	2

**OVERALL EVALUATION OF THE COURSE**

The overall evaluation of the course is done through a standardized University “Student Perception of Teaching”

survey performed for all classes at the end of each semester. This survey does not contain specific question on the format of the course, but the results of the survey do provide insight to the effectiveness of the methodologies used in the course. A summary of this survey is shown in Table 4. Specific elements of a course that are challenging in this format are the ability to effectively communicate with the students. Survey questions that specifically pertain to communication in the course (with evaluation scores) are items 1 (2.94), 7 (3.00), 9 (2.82), 10 (3.06), and 11 (2.76). These scores are near or above department historical averages for these questions for the questions in previous semesters. This would indicate that within the perception of the students it is possible to have effective communication without the requirement for traditional class meeting.

The final survey summarized in Table 5 shows the students perception of their own abilities to meet the objectives of the course. This table demonstrates that the majority of students feel comfortable with their level of knowledge in the basic requirements and objectives of these courses. Some students feel less confident in their abilities in topics that require programming or the application of programming logic (Objectives 8, 10, 1, 12, and 13). This may indicate a need for a stronger programming background requirement for these topics. It was also indicated in comments that the students felt that the assignments that involved programming were challenging.

The Student Perception of Teaching Survey contained the following questions:

1. Reaction concerning your performance in this course was:
2. The instructor's interest in your learning was:
3. Use of class time was:
4. The instructor's overall organization of the course was:
5. Continuity from one class meeting to the next was:
6. The pace of the course was:
7. The instructor's assessment of your progress in the course was:
8. The texts and supplemental learning materials used in the course were:
9. Description of course objectives and assignments
10. Communication of ideas and information:
11. Expression of expectations for performance:
12. Availability to assist students in or outside of class:
13. Respect and concern for students
14. Stimulation of interest in the course:
15. Facilitation of learning:
16. Overall assessment of instructor

**TABLE 4  
SUMMARY OF STUDENT PERCEPTION OF TEACHING SURVEY**

	Excellent	Very Good	Good	Fair	Poor	Average
Question 1	5	8	2	2	0	2.94
Question 2	8	6	3	0	0	3.29
Question 3	7	5	3	1	1	2.94

Question 4	8	6	1	1	1	3.12
Question 5	6	5	5	0	1	2.88
Question 6	7	3	5	1	1	2.82
Question 7	7	5	4	0	1	3.00
Question 8	4	3	7	2	1	2.41
Question 9	6	5	4	1	1	2.82
Question 10	8	5	2	1	1	3.06
Question 11	5	6	4	1	1	2.76
Question 12	4	7	5	1	0	2.82
Question 13	9	4	4	0	0	3.29
Question 14	7	6	2	1	1	3.00
Question 15	7	4	5	0	1	2.94
Question 16	7	6	3	0	1	3.06

The Course Objective Outcomes Survey contained the following questions:

1. I am comfortable with the use of SQL to perform single table queries.
2. I am comfortable with the use of SQL to perform multiple joined table queries.
3. I am comfortable with the use of SQL to perform database functions (table creation, user management)
4. I understand and can use the relational DB model to create logical structures of tables including primary and foreign key constraints.
5. I am capable of using normalization to refine the design of a relational database system.
6. I am capable of using entity-relationship or other design techniques to design a relational database model of information.
7. I am capable of creating relational DB structures to represent 1:1, 1:n, and n:n data relationships.
8. I am capable of writing stored procedures to achieve desired database requirements.
9. I am comfortable with the use and creation of views to meet specific database needs for query or data display.
10. I am capable of basic management capabilities of an enterprise database (Oracle or SQL Server).
11. I can use the Microsoft ADO to retrieve, insert, and update a database for a client or other type of application
12. I understand the structure and role of XML as a data representation and exchange standard.
13. I understand the role of Business Intelligence Systems, their relationship with databases, and the basic steps of converting data into business intelligence.

TABLE 5

SUMMARY OF THE COURSE OBJECTIVE OUTCOMES

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Question 1	19	1	1	1	0

Question 2	12	8	1	0	1
Question 3	15	4	2	1	0
Question 4	15	6	1	0	0
Question 5	10	7	4	1	0
Question 6	12	8	2	0	0
Question 7	14	7	1	0	0
Question 8	9	8	4	1	0
Question 9	11	8	2	1	0
Question 10	8	9	4	1	0
Question 11	8	8	4	2	0
Question 12	3	10	8	1	0
Question 13	2	10	9	1	0

## CONCLUSION

Project management tools and techniques are critical in assuring the successful tracking and execution of tasks associated with a project. While these techniques are widely in industry, the application to use them for online course delivery requires further research. Although student surveys show that online lectures provided in distance learning courses need enhancement, initial results of applying project management tools and techniques for the delivery of engineering courses has proved promising. Web based courses do have new challenges that are not presented in traditional live courses and not all students adapt well to this delivery method. It is possible however to provide a successful learning environment within this format. Faculty considering the use of web video and online courses should first have a strong understanding of the elements that make up a successful learning environment. An understanding of the technology and the way the technology is perceived by the students is also necessary for a successful delivery. Based on the flexibility (for students and faculty) and quality, this delivery mechanism would be recommended for courses to students at a distance, or students that are unable to attend a traditional live lecture schedule. Faculty should not assume that video delivery can simply replace in-class delivery without making changes to other elements of the course pedagogy to compensate for the loss of the face-to-face, synchronistic course elements.

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