One Semester Capstone Design Courses: Issues, Problems and Solutions

Richard Bannerot
Ross Kastor
Department of Mechanical Engineering
University of Houston

Paul Ruchhoeft
Department of Electrical and Computer Engineering
University of Houston

Abstract

In this paper we shall address some of the specific issues/problems of developing a successful one-semester, interdepartmental capstone design experience for large classes. We have developed satisfactory (but not optimal) solutions to these problems, and these solutions will be discussed in the paper.

Introduction

At last year's ASEE GSW Conference we presented a paper[1] reviewing the history and current status of the interdisciplinary capstone design experience for the Departments of Electrical and Computer Engineering, Industrial Engineering and Mechanical Engineering at the University of Houston. In 1998 the Department of Electrical and Computer Engineering at the University of Houston began requiring the completion of a new capstone design course as part of its BSEE and BSCE degrees. Through mutual agreement they created a new course number ECE 4334 and joined the existing INDE/MECE 4334 capstone design course, required of all students in the Departments and Industrial Engineering and Mechanical Engineering. This paper describes the challenges and the specific problems encountered and the changes, i.e., solutions, that have been implemented. The capstone design course that existed in 1998 had been essentially unchanged since 1981.

The Pre-Existing Course

The pre-existing course was a one-semester, 3-hour credit course that was offered every fall and every spring on an alternating day-night schedule by a single instructor. Teams of four students were assigned (through a bidding process) a project. About 80% of the projects were provided and sponsored by local industry and a majority of them were petroleum-related. The remainder of the projects were provided and sometimes sponsored by faculty. In addition to the client-provided "engineer-in-charge," each team

was assigned a faculty advisor. Short, weekly progress reports were submitted to the course instructor. Formal written and oral proposals and final reports were required from each team. There were also several other individual "reporting documents." The course also had considerable content, e.g., the design process, oral and written communications, project planning, risk analysis, ISO 9000, engineering ethics, statistics, optimization, present value analysis, and neural networks. Individual homework assignments and short quizzes were given throughout the semester over the lecture material. Officially the course was two hours of lecture and three hours of "lab" each week. However, the class typically met for four to five hours a week early in the semester so that much of the content was covered by mid-semester. Few formal class meetings occurred during the last half of the semester as students were allowed to concentrate on their projects.

Problems Associated with the Transition to the New Environment

It was understood from the beginning that some changes would have to be made in the conduct of the capstone course when the electrical engineering students were added to the course. These are the anticipated new issues:

Enrollment
The course enrollment in the mid 1990s was between 30 and 40 students. (About 60 BSME and 15 BSIE degrees granted a year.) It was clear that changes would be necessary as the College grants approximately 100 BSEE and BSCE (computer engineering) degrees annually.

Team Teaching
It was clear that additional faculty would have to be assigned to teach the course.

Mulyidisciplinary Teams
Previously there were no restrictions on the make up of the teams. The new course would require that at least two disciplines be represented on each team. (Computer and Electrical Engineering are considered as the same discipline.)

Multidisciplinary Projects
As noted the projects in the past had been primarily from the "oil patch" which was appropriate for a primarily mechanical engineering course in Houston. However, with the new course enrollment expected to be primarily electrical and computer engineering students, a larger variety of projects would be required.

Problems Associated with Team-Oriented Design Courses

There was also an even longer list of issues, unrelated to the growth of the course, that the instructors felt should be addressed. Many of these issues are common to team-oriented design courses:

Individual Grades
One of the objectives of the course is to teach students to become "team" oriented and to accept both the responsibility and rewards of team membership. However, grades are

assigned to individuals in an academic environment. As an alternative to simply assigning to individuals the grades earned by their teams, we desired to introduce a measure of individual accountability into the grading process while at the same time not burdening the students with "make-work" tasks that had little to do with their projects.

Class Participation
Students tend to become preoccupied with their own projects and pay little or no attention to the other projects. We felt students would benefit from some involvement with the other projects.

Project Completion
A team's inability to satisfactorily complete its project is a frequent problem in general and even more critical in a one semester, last semester design project. When students have completed all degree requirements except the last design class, it is difficult to hold them up. However, the assignment of an unsatisfactory grade is hardly "satisfactory" for anyone including the instructor who also has an investment in the project. We wanted to develop a process that would make it more likely that projects would be satisfactorily completed on time.

Design Content
The ultimate product of any design process (regardless of the discipline) is an artifact (using the broadest possible definition) that satisfies the constraints and aspirations of the client. One of the aspects of engineering design that sets it apart from design in many other disciplines is analysis. We wanted to assure that our designs were based on good engineering analysis and produced a satisfactory artifact.

Demonstration of a Successful Design
Validation of the product of the design is an important part of the design process. We prefer projects that result in an artifact that can be tested (validated). The question is what to do about artifacts that fail their "test", about teams that fail to produce a testable artifact and about projects that, by definition, will not produce an "artifact."

Quality Evaluation and Feedback for Writing and Oral Assignments
Grading assignments is of course required. "Quality" evaluation and useful feedback are desirable and very important for the student. We felt that both might suffer as the class size increased.

Assistance in Writing and Oral Communication
By the time students reach senior standing one might think that it is unnecessary or too late to provide assistance or instruction in writing or oral assignments. For the majority of students this "extra help" may not be necessary, or perhaps only minimal help is required. However, for many, especially those for whom English is a second or third language, considerable help could be used. What are the options for such students?

Uniformity of Grading
In a large design class it is impractical for one person to be responsible for grading all the written assignments or all the oral presentations. Also, there is a subjective element to

grading written and oral reports and the products of design. How can we be assured that the grading is as fair and uniform as possible?

Class Communication
Communications in a large class with all students working on exactly the same topic, e.g., heat transfer, is difficult. Successfully communicating in a large design class with numerous reporting and demonstrating requirements, with numerous scheduling issues, with numerous projects, with potential team dysfunction, etc. is almost impossible. We knew we had to move from the regular meeting/lecture format.

Client Consistency
Clients provide a project description to the instructors. Modifications may be required before a project is approved and submitted to the class for the proposal process. However, the client's objective is seldom the same as the instructor's and there is usually a little give and take at the beginning and the project description is modified. As the project proceeds, new ideas evolve; old ideas are shown to be unacceptable or unworkable; and there is a tendency on the part of the client to modify the project. There many be personnel changes in the client's company, a new client's representative may appear. How are the issues associated with a changing set of constraints and goals handled in light of the course requirements, e.g., finish on time, produce an artifact, validate results, etc?

Quality of Client Consulting
Despite the client's good intentions at the beginning of a project, many issues effecting his availability and interest may be beyond his control. One of our more common problems is a client's failure to provide promised information, materials, equipment or access in a timely manner, if at all. It is hardly fair to hold the student team responsible for the client's failure to deliver, but neither is it fair to give the team a "free ride" for its project.

Teaching Evaluations
Most colleges of engineering routinely require teaching/course evaluations for all their classes. Usually the same form is used for all classes whether that class is a laboratory, a lecture or a design class. Unfortunately, the form is usually directed toward classroom performance in lecture classes with questions like:

- Did instructor presented material clearly and effectively?
- Did the instructor encouraged interaction with the class?
- Was the teaching assistance available and helpful?
- Did the facilities adequately met course needs?

These questions hardly seem appropriate for a course with no lectures, with no teaching assistants and for studio courses that must be held in a lecture room because no other facilities are provided. Finally, instructor/student interaction is desirable for the student when the student has the choice. When students are forced to participate (making presentations and being called on at random), they are not so receptive and appreciative. After answering these types of questions, most negatively, the students are pretty well programmed for a negative response to the final question: "Is this instructor an effective engineering educator?" Personal experience has demonstrated that, for a given instructor,

teaching evaluations are significantly lower in design classes than they are in traditional lecture classes.

Responses to the Transition Problems

Not all of the transition problems have been completely worked out yet, but we are satisfied with these solutions, some of which could be viewed as temporary.

Enrollment
Enrollment reached 86 in the spring, 2003. It has not peaked yet, as we expect over 100 in spring 2004. However, we believe that we have developed an approach that modularizes the class and the teaching. Most of our success is due to the high level of commitment and cooperation demonstrated by the teaching team. Team teaching and modularization will be addressed further in the next section and in the section titled, "Individual Grades."

Team Teaching
The teaching load is uniformly distributed among the three instructors in such a way that should the enrollment fluctuate, the teaching load could easily be shifted to any number of instructors, such that each "load" would be approximately equal. The key to this redistribution is the fact that the most of the activity in the class centers on the student teams. As described in the earlier paper[1], each team has

- a "client", boss or sponsor who is responsible for providing support (material, space, personnel and financial) for the project and information related to the background and needs.
- a faculty advisor who is a technical consultant, and
- a facilitator (one of the course instructors) who monitors the team activities and provides advice as needed (and fills in for the client and/or the advisor should the need arise).

As noted each instructor becomes the facilitator for a number of teams, nominally one-third of the teams if there are three instructors. All of one facilitator's teams become a cohort. In the spring, 2003, each cohort consisted of seven to eight, nominally four person teams. In the fall, 2003, each cohort consisted of three to four, nominally four person teams. (Student are required in ECE and urged in the other departments to take the capstone course in their final semester. Therefore the fall graduates take the course in the fall and the spring and summer graduates take the course in the spring as the course is not offered in the summer.). More details will be given on the activities of these cohorts in the "Individual Grades" and the "Class Participation" sections.

Multidisciplinary Teams
It has not been possible to assure that at least two departments are represented on each team. Teams are self-formed and bid on projects as described in the last year's paper[1]. They are "required" to have an interdisciplinary team, but the last few teams formed are from the depleted pool. This fall, of the eleven teams only one represented only a single department.

Multidisciplinary Projects

Assuring that all projects have "something for everyone" continues to be an unresolved problem. On the other hand this "problem" could be viewed as more representative of "real engineering." For the most part the projects do not require a high level of technology, and any student with a solid background in physics has probably seen the "science" necessary to address the project. In many ways it could be viewed as a positive that the student's problem solving skills are being utilized rather than only their discipline related analysis skills.

Responses to the Team-Oriented Design Course Problems

These solutions should be applicable for any size team-oriented classroom environment. We feel that there was a significant increase in student satisfaction last fall when many of these innovations were introduced for the first time.

Individual Grades

The major portion of the individual grade should be linked to the team performance. However, we believe that a significant portion should be based entirely on the individual's performance. and we have developed a process that will allow us to determine an individual grade component without interfering with the team activity. During the semester each team is responsible for five written and five oral formal reports: a proposal, two progress reports, a mid-term technical report and a final technical report. The final technical report (both written and oral) is a team activity. However, each member of the team is individually responsible for the one of the other four reports. Therefore, each member gives an oral presentation and prepares a (different) written report. Of course, other team members help. This requirement has the added advantage of forcing each team member to become knowledgeable about all aspects of the project. Teams also attend cohort meetings (discussed below) five times during the semester in which they informally discuss their projects and respond to questions from the other teams and the instructors for about 30 minutes. A "cohort" exam is given at the end of the semester in which each individual in the cohort is expected to be able to address questions about any the three or four projects in his cohort. Individual participation (questions asked and answers provided) in the cohort discussion is recorded and contributes to an individual component of the grade. A peer evaluation[2] is administered at the end of the semester in which each student ranks the participation of the other team members. When there is substantial agreement within a team that a given individual has been a particular "good" or "bad" team player, the instructors will consider the possibility of raising or lowering this individual's "team grade." Before a student's team grade is adjusted, however, the instructors give serious consideration to all relevant factors, e.g., participation in cohort, personal interaction with and complaints from the team throughout the semester, etc. Peer evaluations rarely provide unexpected results. In fact, if they do, we feel that there has a failure to communicate between the team and the instructors throughout the semester.

Class Participation

Engineering students tend to be competitive and solitary. This behavior carries over into their teams. One of our goals was to stimulate more interest in and interaction among the

teams. We drew on our limited exposure to the studio environment and the teaching critique as utilized in the visual arts. In a formal process instituted for fall 2003, the cohorts meet for two-hour "studio critiques" every three weeks. At least two and usually all three of the instructors attend, and the facilitator for that cohort presides. In turn each team presents an informal five to ten minute review and update for its project followed immediately by a question and answer session. Members of the other teams in the cohort are first encouraged, and then called upon, to ask the first questions. The facilitators then ask questions. Some of these questions evolve into assignments for the team to resolve before the next cohort meeting. With three cohorts this fall and three meetings a week (MWF from 8 AM to 10 AM), each "studio critique" takes one week to complete. When the teams are not meeting in their cohorts they are working on their projects or attending the optional writing workshops. (See section, "Assistance in Writing and Oral Communications."). Every three weeks a member of each team has to present an oral report (Recall the section, "Individual Grades."). These presentations take place before their own cohort plus one other cohort. Therefore, again over a week's time, each cohort meets twice, once with each of the other two cohorts. At one of those meetings the teams from a given cohorts present. The presenting and meeting order change for each cycle so that over the course of the semester, each cohort hears two reports from each of the other two cohorts. These two activities: the studio critiques and the presentations have resulted in the development of a welcome synergism among the teams. One of the most obvious benefits is that teams have come to realize that several teams have similar problems that they are willing to work on together. At the next level of cooperation, even if the teams do not share similar problems, individuals have useful experiences to share with other teams. Finally, the students, generally, expressed a much greater interest in not only their own projects but in the projects of others. The WE versus THEM mentality was seen to diminish, and many students became interested in seeing not only their team succeed, but also in seeing that other teams were successful.

Project Completion

We have adopted a policy that the final product of the semester must be complete and validated, i.e., it does what it is suppose to do. The hope is that all proposals can be fulfilled. However, the reality is that some projects, as originally conceived, cannot reasonably be completed. Therefore, teams are given the opportunity, with the instructors' approval, to renegotiate the final product during the semester. The point is that something must be designed, built and tested. If the original plan was unrealistic, the team must provide an alternative. The point is, "We couldn't finish." is not an acceptable solution.

Design Content

Engineering design is analysis-based design. The team must demonstrate that basis of its product is analysis and not simply trial and error, although all design has some trial and error associated with it.

Demonstration of a Successful Design

At the end of the semester, each team schedules an hour meeting with the instructors. This meeting occurs at a time and place convenient for the team to demonstrate that its

artifact works as defined in the latest approved proposal. This meeting also provides the instructors' with their last opportunity to challenge the results and claims for the project.

Quality Evaluation and Feedback for Writing and Oral Assignments

So far the instructors have taken responsibility for personally grading all assignments. Each instructor has graded the written assignments from his cohort (4 to 8 teams or 16 to 32 individual formal reports, an equal number of informal team "planning reports", and four to eight formal team final reports). All the instructors participate in grading the oral reports (60 to about 120). The formal posters, the initial proposal for team formation, and formal proposal were also graded by all the instructors. So far we believe that the students are receiving quality evaluation and feedback. However, we are about to hand over part of this evaluation process to others. This change will be discussed in the next two sections.

Assistance in Writing and Oral Communication

We have enlisted the assistance of the University of Houston Writing Center. The Writing Center is administered by the Provost's Office and supported by student fees. Its purpose is to support writing across the campus. At present it employs six professional staff and approximate thirty student assistants recruited primarily from the University's Honors College. They have carried out a variety of formal support programs for several colleges. However, their main function is to provide writing support to individual undergraduate students. Students can make 30 minute appointments for advice on their writing and oral presentation assignments. This assistance does not include "proofreading", but does provides assessments and suggestions about which areas of the paper require improvement. The Writing Center also schedules writing tutorials to help student with the "basics." In the fall 2003 the Writing Center developed and gave thirteen workshops (60 to 90 minutes each) exclusively for our class. These have included "just-in-time" workshops on proposals, progress reports, technical reports, and posters which provide help for both the written and oral reports. Students responsible for each of these assignments are required to attend. The workshops also cover such topics as business communication, abstracts, introductions, conclusions, tone in professional communications, ESL, proofreading, paragraph structure, and proper use of figures and tables. In addition to the two required workshops covering their particular reporting assignments, students must attend at least three other workshops.

Uniformity of Grading

As noted above, all oral reports are currently heard and graded by all instructors and a consensus grade assigned. However, the grading for the written assignments is done by cohort, and one person does all the grading for one cohort. We are satisfied that each cohort is graded consistently, but it is difficult to claim consistence for the entire class. However, members of the cohort know who will be grading their work and are given instructions by that grader. With the help of the Writing Center we are developing grading rubrics which attempt to identify (after much discussion) the expectation for both the oral and written reports. The rubrics will serve not only as grading guides for new instructors and other graders, but also as guides to help the students to better prepare their talks and documents.

Class Communication
Last year we begun using Blackboard, a website based software, as "communications central" for the class. Its use has been very successful. As an example, the calendar for the Fall 2003 course as posted on the website is given in Figure 1 (at the end of the paper). All assignments and all instructions are also posted. The "communication" feature (email) allows efficient information exchange among all students, teams, clients, faculty advisors and instructors/facilitators. Student's questions can be answered and, if appropriate, the answers are communicated to the entire class via email and the web site. Grades are also entered into a secure location at the website to which individual students have access.

Client Consistency
We don't have a good answer here except to make it clear to the client that his project description is not to be changed without approval from the instructors. Unilateral changes in the statement of work are unacceptable.

Quality of Client Consulting
Again the problem varies greatly. Some clients are very excited about the project and provide excellent advice. We simply warn the students that if they are not getting the help they need from the client that the students should report this problem as soon as possible. The instructors will contact the client and if, in fact, they believe that there is a problem, will take over the project themselves. For whatever reason we have been experiencing a significant reduction in the number of industry sponsored projects over the last few years. The instructors are not entirely in agreement about whether this is a good or bad thing.

Teaching Evaluations
No progress has been made in attempting to change the current teaching evaluation process or instrument. The challenge for design teachers is to convince the administration that students do actually benefit more from their hard work in design classes than in most lecture classes even if the student teaching evaluation seem to indicate otherwise.

Summary and Conclusions

This paper has presented a series of issues and their resolutions associated with the approximately tripling of the enrollment in a one semester capstone design course while transforming the class from one consisting largely of mechanical engineering students to one in which the number of electrical engineering students dominates. Additional issues associated with team-oriented design classes in general were also addressed. The significant changes that have been introduced into the course over the last year are: using a web site to enhance information transfer; using cohorts to modularize an otherwise difficult to manage number of students; using a "studio critique" environment to encourage open discussion of projects, to provide a less threatening environment which allows student to informally discuss their projects, and to get teams involved in other teams' projects; involving a group of professional communicators (the staff of the UH

Writing Center) in the teaching and evaluating of the oral and written reports; and establishing well defined expectations for the products of the design process.

References

1. Richard Bannerot, Ross Kastor, and Paul Ruchhoeft, "Interdisciplinary Capstone Design at the University of Houston," Proceedings of 2003 ASEE-Gulf Southwest Annual Meeting, University of Texas at Arlington, Arlington, Texas, March, 2003.
2. R. W. Brown, "Autorating: Getting Individual Marks from Team Marks and Enhancing Teamwork," *Proceedings, 1995 Frontiers in Education Conference*, IEEE, Atlanta, GA, November 2-4, 1995, available at <http://fie.engrng.pitt.edu/fie95/3c2/3c24/3c24.htm>

RICHARD BANNEROT

Richard Bannerot is a professor in the Department of Mechanical Engineering at the University of Houston. His research interests are in the thermal sciences and in engineering design education. For the past twelve years he has taught the required "Introduction to Design" course at the sophomore level and has recently become involved in teaching the capstone design course. He is a registered professional engineer in the state of Texas.

ROSS KASTOR

Ross Kastor is a lecturer in the Department of Mechanical Engineering at the University of Houston. He has been teaching the capstone design course since 1991. He completed more than 40 years as a drilling engineer for Shell Oil Co., where he spent 16 years teaching drilling engineering in Shell's inside schools. He majored in machine design at The Ohio State University where he received the BSME and MSME degrees. He is a registered professional engineer in the States of Ohio and Texas.

PAUL RUCHHOEFT

Paul Ruchhoeft joined the faculty of the Department of Electrical and Computer Engineering at the University of Houston in 2000 as a Research Assistant Professor after receiving his BSEE from the University of Texas at Austin and his MSEE and PhD from the University of Houston. He became a tenure track Assistant Professor in 2001. His research interests are in the areas of nanolithography and nanofabrication. He began teaching the multi-disciplinary, capstone course in 2001.

ECE/INDE/MECE 4334 CALENDAR
Fall 2003

Classes are from 8 am to 10 am unless noted otherwise. Writing Workshop are conducted in the UH Writing Center . Presentations will be in E223 D3. Meetings are in W122 D3 for the first week. Time and Place for the Final Presentations will announced later.

Class topics: black, Group due dates: red, Lectures: green, Writing Center: purple and Individual due dates: blue.

Monday	Wednesday	Friday
August 25, 2003 *Attendance required*[1] Introduction to course and website Announcement of projects, UH Writing Center	**August 27, 2003** *Attendance required* Form groups (due at end of class) Apply for projects (due 5pm)	**August 29, 2003** Assign projects Bring draft of Planning Reports to group meetings on Sept 3 and 5
September 1, 2003 Labor Day Holiday	**September 3, 2003** Groups 1-6 meet with instructors in Room N376D. Bring completed *Group Organization and Project Summary* assignment Groups 7-12 meet in ECC	**September 5, 2003** Groups 7-12 meet with instructors in room N376D. Bring completed *Group Organization and Project Summary* assignment Groups 1-6 meet in ECC
September 8, 2003 **(8:30am) Lecture on Oral Presentations**	**September 10, 2003** Planning report 1 due for Cohort I **Writing Workshop (8:30am): Proposals**	**September 12, 2003** Cohort I meets instructors in N376 Planning report 1 due for Cohort II
September 15, 2003 Cohort II meets instructors in N376 Planning report 1 due for Cohort III	**September 17, 2003** Cohort III meets instructors in N376 **Writing Workshop (8:30am): Abstracts, Introductions, and Conclusions**	**September 19, 2003** Cohort I and II: Oral (A) and Written (D) Proposal from Cohort I
September 22, 2003 Cohort II and III: Oral (A) and Written (D) Proposal from Cohort II Last day to drop w/o grade	**September 24, 2003** Cohort III and I: Oral (A) and Written (D) Proposal from Cohort III	**September 26, 2003** **Writing Workshop (8:30am): Progress Reports**
September 29, 2003 Planning report 2 due for Cohort I **Writing Workshop (8:30am): Tone in Professional Communications**	**October 1, 2003** Cohort I meets instructors in N376 Planning report 2 due for Cohort II **Writing Workshop (8:30am): ESL & Proofreading Clinic**	**October 3, 2003** Cohort II meets instructors in N376 Planning report 2 due for Cohort III Cohort I and III: Oral (B) and Written (C) Progress Report I from Cohort III
October 6, 2003 Cohort III meets instructors in N376 Cohort II and I: Oral (B) and Written (C) Progress Report I	**October 8, 2003** Cohort III and II: Oral (B) and Written (C) Progress Report I from Cohort II	**October 10, 2003** **Writing Workshop (8:30am): Technical Reports**

[1] Students who miss one of the first two classes will be dropped from the course roster unless prior arrangements have been made

from Cohort I		
October 13, 2003 Lecture Planning report 3 due for Cohort I **Writing Workshop (8:30am): Paragraph Structure and Relevant Information**	**October 15, 2003** Cohort I meets instructors in N376 Planning report 3 due for Cohort II **Writing Workshop (8:30am): Using Figures, Examples, and Organizational Cues**	**October 17, 2003** Cohort II meets instructors in N376 Planning report 3 due for Cohort III **Writing Workshop (8:30am): ESL & Proofreading Clinics**
October 20, 2003 Cohort III meets instructors in N376 Cohort I & II Oral (C) and Written (B) Mid-term Tech Rpt from Cohort II	**October 22, 2003** Cohort II & III Oral (C) and Written (B) Mid-term tech rpt from Cohort III	**October 24, 2003** Written statement of work due Cohort III &I: Oral (C) and Written (B) Mid-term Tech Rpt from Cohort I
October 27, 2003 Planning report 4 due for Cohort I **Writing Workshop (8:30am): Progress Reports**	**October 29, 2003** Planning report 4 due for Cohort II Cohort I meets instructors in N376 **Writing Workshop (8:30am): ESL & Proofreading Clinics**	**October 31, 2003** Planning report 4 due for Cohort III Cohort II meets instructors in N376
November 3, 2003 Cohort III meets instructors in N376	**November 5, 2003** Cohort I & III Oral (D) and Written (A) Progress Report II from Cohort I	**November 7, 2003** Cohort II and I Oral (D) and Written (A) Progress Report II from Cohort II
November 10, 2003 Cohort III and II Oral (D) and Written (A) Progress Report II from Cohort III	**November 12, 2003** **Writing Workshop (8:30am): Posters**	**November 14, 2003** Planning report 5 due for Cohort I **Writing Workshop (8:30am): Extended Abstracts**
November 17, 2003 Cohort I meets instructors in N376 Planning report 5 due for Cohort II	**November 19, 2003** Cohort II meets instructors in N376 Planning report 5 due for Cohort III	**November 21, 2003** **Cohort III meets instructors in N376**
November 24, 2003	**November 26, 2003** Thanksgiving Holiday	**November 28, 2003** Thanksgiving Holiday
December 1, 2003 Final Report Due; schedule review	**December 3, 2003** Posters Due: Set up in Atrium	**December 5, 2003** Final Presentations
December 8, 2003 Schedule meeting with Facilitators	**December 10, 2003**	**December 12, 2003**

Individual Report Periods:

Due Dates	*Type*	*Type*	*Student*
Sept 19-24	Proposal	Written Oral	A D
Oct 3-8	Progress Report	Written Oral	B C
Oct 20-24	Technical Report	Written Oral	C B
Nov 5-10	Progress Report	Written Oral	D A

Figure 1: Calendar of Events for Capstone Design for Fall, 2003