

ASEE-GSW2004-046

Integrating the Teaching of Technical Communications into a Multidisciplinary, Capstone Design Course

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Abstract

This paper describes the evolving and growing relationship between the Cullen College of Engineering at the University of Houston and the University of Houston Writing Center with the intent of improving the technical communications skills of engineering students. This interaction is currently through two design courses: a senior, multidisciplinary capstone design course and a sophomore, introduction to design course, in the Department of Mechanical Engineering. The interaction with the senior course is currently in its third semester and has resulted in a series of just-in-time workshops, opportunities for individual consultations for the students with Writing Consultants, and the development of standardized grading criteria for both oral and written assignments for the senior class. This spring is the second semester in which the workshops will be offered in the senior class. The interaction has just begun with the sophomore course and will not be discussed in this paper. The expectation is that this interaction is on the verge of expanding to other courses and other departments in the College of Engineering.

Introduction

In “Why Johnny Can’t Write, Even Though He Went To Princeton,” the *Chronicle of Higher Education*¹ highlights the problem of students progressing through their undergraduate education without developing the writing skills necessary to communicate effectively in their chosen fields of study. A reduction in general communication skills is an added problem for colleges of engineering who have been under increasing pressure for many years to produce engineering graduates with better communications skills. Technical communications has typically been taught in “technical writing” courses that

follow the traditional “Freshman English” courses. Many colleges of engineering and even engineering departments, e.g., Mechanical Engineering and Electrical and Computer Engineering at the University of Texas at Austin^{2,3}, Electrical and Computer Engineering at Georgia Tech⁴, and Mechanical Engineering at Virginia Tech⁵, have responded by establishing their own technical communications programs.

The University of Houston (UH) has recently initiated a campus-wide approach to the teaching of writing with a special program specifically designed for teaching “writing in the discipline” in order to provide students with the needed skills. The rationale behind this initiative is that general composition courses cannot adequately prepare students for discipline-specific writing.

Technical communications training has not been offered as a formal course at the University of Houston for some time. In our Cullen College of Engineering it has been more or less up to the individual faculty members in their own courses to provide technical communication instruction on a “need to know” basis. Laboratory courses usually require written and sometimes oral reports. Typically the “design” classes have a reporting component. In both cases it is up to the course instructors to set standards for quality and to decide how much time to reserve for teaching technical communications. Perhaps even more damaging is the fact that none of the evaluating or the teaching is performed by “trained communicators,” and there has been little communication among the instructors, even in the same department, to establish communication standards or formats.

So What’s New at the University of Houston?

The impetus for change for the engineering authors of this paper was the creation of a new multidisciplinary, capstone design course in the Cullen College of Engineering. This undergraduate course is required for undergraduates in three of the five departments in the College: Electrical and Computer Engineering, Industrial Engineering, and Mechanical Engineering. The course is centered around the activities of up to twenty-five multidisciplinary teams composed of four students each as described in two recent papers^{6,7}. Apart from the requirement for the completion of projects and the validation of their results, the main emphasis of the course is instruction in technical communications and project management. This paper will focus on the improvement achieved in the instruction of technical communications and will describe the development of a relationship between the Cullen College of Engineering and the UH Writing Center⁸. The Writing Center is involved in many activities including assessment, instruction, curricular innovation, community outreach, professional development and research in the teaching of writing. The interaction with the Writing Center described in this paper is through its Writing in the Disciplines (WID) Program⁸. This paper will describe the on-going relationship between the instructors of the capstone design course and the staff of the WID program that has already resulted in a series of just-in-time (JIT) workshops, a process for individual consultations for the students, the general upgrading of the communication requirements for the course, and the development of formal grading criteria for both oral and written assignments.

The Writing Center, its history, role and activities, will be described next. The current communication requirements for the capstone course will then be listed followed by a description of the details of the interaction between the Writing Center and the course instructors. Finally, student feedback on the communications component of the capstone design course for the fall 2003 class will be presented.

Writing Support at the University of Houston

In response to several internal “pressures”, the UH English Department established a Writing Center in the fall of 2000, but it quickly established a life of its own, and, effective last fall, it has officially cut its ties with the English Department. Its support now comes directly from the Provost’s Office. Through small group meetings and tutorials, Writing Consultants (trained undergraduates) provide sustained, individualized writing instruction to any student at the University. The Writing Center began training Writing Consultants as front-line instructors when revamping an ailing English Department’s Developmental Writing Program in January 2001. After Writing Center intervention, the pass rate soared from 65% to 90%, and has since maintained that level. The increased pass rate was validated – and the Writing Consultant model was proven effective – by a year-long independent study demonstrating that in subsequent writing courses, Developmental Writing students deemed “underprepared” upon university admission achieved final grades at or above the mean final grade of their “prepared” peers. This model has been adapted for English as a Second Language (ESL) composition courses, with similar results.

Effective Writing is Discipline-Specific

Effective communication is the expressed goal of writing instruction. However, as intellectual demands change by discipline, rules, practices, and values of writing also change. In response to the need for discipline specific assistance in writing and with the support of the Provost’s Office, the WID program was established in Fall 2002 within the Writing Center. Whereas the Writing Consultant model addresses the diversity of academic preparedness among students with individualized programs of instruction, the WID addresses the diverse types of academic writing in the support it offers to writing instruction and practice. The WID Program began as a resource for faculty motivated to examine and improve writing practices in their disciplines, but it has been significantly expanded as the interest in the program spread across the campus

WID staff partner with faculty, departments, and colleges to answer the following questions:

- What are common forms and writing conventions within this discipline?
- What writing skills are required at each level?
- What are students’ common writing weaknesses and strengths?
- What is “good writing” in this discipline?

The WID Program initiated a campus-wide dialogue that has already resulted in several innovative interventions in, among other places, the Law Center, the Hilton College of

Hotel and Restaurant Management, and the College of Liberal arts and Social Science. As a result, the perception of writing instruction and practice on the UH campus is fundamentally changing. Writing is no longer the province of one department or a skill mastered through a basic course; it is the responsibility of the university at large. Through individual consultation, directed department meetings, professional development workshops, student intervention, and instructional innovations the WID Program and Writing Center are implementing plans that are effecting university-wide curricular change.

The Interaction between the Writing Center and Cullen College of Engineering

Senior Capstone Design

The capstone design course in the Department of Mechanical Engineering (ME) at the University of Houston has been around since the early 1960's. In the mid-80's the Department of Industrial Engineering (IE) joined the course so that project teams were composed of both ME and IE students, but the relative sizes of the Departments (annual graduations rates of about 60 BSME and 10 to 15 BSIE) and the nature of the projects (mostly ME in nature with only a few in IE) prevented an interdisciplinary experience for all design teams. Six years ago the Department of Electrical and Computer Engineering (ECE) added the course as a degree requirement for all students entering in the fall, 1998 and thereafter. Currently (spring 2004) eighty-seven students are enrolled (54 in ECE, 14 in IE and 19 in ME). It is anticipated that approximately 60 students in the fall and 100 students in the spring from the three departments will eventually be enrolled in the course on a continuing basis.

A previous paper⁶ has reviewed the recent changes in the course content and philosophy necessitated by the approximately tripling in the enrollment; this paper will concentrate on the changes associated with our increased emphasis on technical communications and the interactions between the UH Writing Center and the College of Engineering. The changes have resulted from a decision to remove most of the course lecture "content" and focus more on a very "hands-on" approach (on the instructors' part) to managing and encouraging multidisciplinary teams working on multidisciplinary projects. The "lecture" material has been "repackaged" and is now presented in interactive, cohort meetings⁹.

The course is organized to provide "just-in time" (JIT) instruction to as many as 24 four-person, multidisciplinary teams working on industry and faculty sponsored design projects. Each team member is personally responsible for the one oral and one (different) written report. These reports could be a proposal, a progress report or a technical report. These two reports represent 15% of the individual's course grade. Five, group-prepared, written Planning Reports (See Figure 1 for a description of the Planning Reports.) are required and reviewed in the cohort meetings. The group is also responsible for a short, initial "bidding" proposal, a final technical report, a final oral presentation, a poster and an extended abstract. To this point, all grading has been the responsibility of the three course instructors.

To support the students' communications activities in the capstone course, the UH Writing Center has developed a series of workshops. Students with the individual responsibility to prepare a specific oral or written report are required to attend one of the JIT workshops on the appropriate topic. These workshops are scheduled about two weeks prior to the submission or presentation. The grading criteria for these assignments (See Tables 1, 2, and 3.) are available for each type of report, written and oral, and these are discussed in the workshops. In addition to the required workshops (two for each student) each student must attend at least three of the approximately ten additional workshops. (They may attend more than one on any topic.) These 90-minute workshops are limited to an enrollment of 20, and are available on the following topics (All are given more than once.): proposals; progress reports; technical reports; posters; extended abstracts; abstracts, introductions & conclusions; mechanics & proofreading; tone in professional communications; effective use of figures and examples; and paragraph structure. The details of the course structure can perhaps be best understood from the spring 2004 capstone class schedule as seen in Table 4. The following explanations are necessary to completely understand the schedule.

There are 87 students divided into 22 four-person teams and one three-person team. The 22 teams are grouped into six cohorts, i.e., C1, C2, C3, etc. We shall meet only three times as a 87-student class, for the first week (2 meetings) and for the final. The rest of the meetings are by cohort. The "cohort meetings" (in green) are facilitated "working" meetings with informal presentations, review of the teams' Planning Reports, critiques⁹, and work on the projects by the teams. The presentation and due dates for written reports are in blue, e.g., February 17th and 19th for the proposal, with the student responsible indicated, e.g., student "A" or "D", etc. (On each team each student is assigned to be A, B, C or D.) Individuals present to their own cohort plus two other rotating cohorts about every two or three weeks. The UH Writing Center (WID) workshops are in purple and occur throughout the semester. Note the third and fourth workshops (WCs #5, #6 and #7) on proposals on February 3rd and 5th are two-weeks before the proposal presentations on February 17th and 19th.

Within the Capstone course, the formal grading criteria serve a dual purpose: clarifying expectations for student work and norming grading standards. On a larger scale, these criteria are critical in the development of college-wide standards for student communication skills, and thus also critical to the efficacy of programs developed to teach those skills.

Planning Report / Preparation Instructions **ECE/INDE/MECE 4334: Capstone Design, Spring, 2004**

Rationale

Planning is an important element of project management and can take place in various timeframes: the entire project (three months for this course), monthly, weekly and even daily. Examples of daily planning are the schedules or agendas you prepare for your meetings. The Gantt Chart is an example of a planning aide for the entire project. This semester, we are focusing on a reporting process to help us to better understand how the project is progressing and to help you practice and experience a team planning activity.

Purpose

The Planning Report covers approximately a two-week period and allows you to evaluate your progress with respect to the entire project plan and to plan the period's activity in more detail than is available from the Gantt Chart.

Contents of the Planning Report

Your Project Facilitator will determine the exact contents of your report. At a minimum, it will include items 1, 2, and 3 in the following section (a narrative summary of the group and individual activities and plans and a current Gantt Chart).

You will need to purchase a compression binder and a set of tabbed dividers numbered from one to six. Each period, the Planning Report should be submitted behind a different tab, beginning at two and progressing upward. Tab one should contain your *Group Organization and Project Abstract assignment*. Each Planning Report should include:

1. Accomplishments for the just completed period up to the day of submission:
 - Group Activities and Accomplishments
 - Individual Accomplishments and the number of hours worked on each for the period.
 - Supplementary Information attached behind the forms (sketches, calculations, product specifications, price lists, alternative designs and conceptions, budgets, etc.)
2. Plans for the next period's activities:
 - Group Activities Planned and how does this plan compares with your Gantt Chart.
 - Individual Activities Planned.

There should be a one-to-one correspondence between the "Activities Planned for the Group" and the "Activities Planned for the Individuals." The "Group Activities" and the "Group Accomplishments" should relate directly to the "Group Activities Planned" for the previous period. For the individual activities report, in period n the "Accomplishments for the period" should begin with the "Activities planned for the period" taken directly from the report of week $n-1$. There should a clear indication of the status of each activity, e.g., completed, 60% completed, not begun, etc. If an activity was not completed as planned, an explanation should be provided. Additional activities undertaken (but not part of last period's plan) may be added after the initially planned activities. The status of these additional activities should also be indicated. These forms should be typed and may be extended to multiple pages as needed.

3. A currently valid Gantt Chart for your project. A Gantt Chart for the project should be prepared and submitted with the first Planning Report and revised each period thereafter. At a minimum the revision should indicate the work completed since the last reporting period, but it may also include actual changes in the schedule due to delays and revisions in the overall plan. Each updating should be indicated on the Chart, e.g., revised: 10 March 2004. The Gantt Chart should appear on a single page with the bottom of the chart either at the bottom of the page or to the right of the page. (Do not write on the back of the pages.) This chart should be labeled as the Gantt Chart. (There is no need to use a figure number for this informal report as there is not a convenient way to reference the figure from the text.)
4. A currently valid precedence chart may be required at the discretion of your Facilitator.

Figure 1: Instructions for Preparing the Bi-weekly Planning Report

Criteria For Grading: Oral Proposals

1. Title Slide/Outline

- Were the group, project topic, and sponsor/client identified?
- Were the subject and focus of the presentation identified?
- Was an outline provided that detailed the structure of the presentation?
- Was the presenter professional and engaging in demeanor?

2. Introduction and Background

- Did the presenter clearly identify the larger context of the project?
- Did the presenter clearly identify the problem to be solved, the task representing the solution to the problem, and the approach(es) to be used in completing that task?
- Was the introduction and background readily understandable to the audience?

3. Statement of Goals

- Were final and intermediate goals specifically identified?
- Were these goals concrete, realistic, and specific? (i.e., not “research.”)
- Were the goals sequential and spaced at regular intervals, enabling them to serve as “milestones”?
- Did the goals provide an outline for the Methodology section?

4. Methodology

- Was an achievable process defined for each goal?
- Was it clear how each goal will be accomplished?

5. Scheduling (Project Plan)

- Did the goals lead incrementally toward the major project objectives?
- Was the scheduling realistic given external environmental factors?
- Did the scheduling demonstrate an effective and continuous use of available resources? (parallel tasks for group members)

6. Conclusion/Summary

- Did the conclusion provide an effective, clear review of the presentation’s key points?
- Did the conclusion make the project sound reasonable and achievable?
- Did the presentation end on a positive note?
- Did the presentation end conclusively, without being abrupt?

7. Time

- Was the presentation an appropriate and effective length? (approximately ten minutes; or at least between eight and eleven minutes)

8. Quality of Presentation

- Was the presentation clear and readily understandable?
- Did the presentation’s level of detail demonstrate that the group is capable of completing the project as proposed?
- Did the visual aids enhance the presentation and engage the audience’s understanding?
- Did the presenter interact appropriately with the audience and visual aids? (e.g., using eye contact to connect with the audience or draw attention to slides when appropriate)
- Did the presenter exhibit professional mannerisms of speech, gesture, and behavior? (e.g., avoiding distracting movements and interruptions in speech; maintaining appropriate volume; appearing relaxed, confident, and knowledgeable, etc.)

Table 1: Criteria For Grading: Oral Proposals

Criteria For Grading: Oral Progress Reports

1. Title Slide/Outline

- Were the group, project topic, and sponsor/client identified?
- Were the subject and focus of the presentation identified?
- Was an outline provided that detailed the structure of the presentation?
- Was the presenter professional and engaging in demeanor?

2. Introduction and Background

- Did the presenter clearly identify the larger context of the project?
- Did the presenter clearly identify the problem to be solved, the task representing the solution to the problem, and the approach(es) to be used in completing that task?
- Was the introduction and background readily understandable to the audience?

3. Statement of Goals

- Were final and intermediate goals specifically identified?
- Were these goals concrete, realistic, and specific? (i.e., not “research.”)
- Were the goals sequential and spaced at regular intervals, enabling them to serve as “milestones”?
- Did the goals provide an outline for the Progress Description section?

4. Progress Description

- Was the progress clearly defined for each goal?
- Was the current status of each goal clear?
- Were problems encountered and if so were resolutions clearly and positively described?
- Were there any changes in the requirements and was it clear how they would effect the outcome of the project?
- Is the technical detail presented adequate and relevant?

5. Scheduling (Project Plan)

- Was the project schedule presented and was the current status identified?
- Were any significant changes to the schedule explained?
- Was it clear whether the team is on track to complete the project on time?

6. Conclusion/Summary

- Did the conclusion provide an effective, clear review of the presentation’s key points?
- Has the presenter convinced the audience that the project can be completed on time?
- Did the presentation end on a positive note?
- Did the presentation end conclusively, without being abrupt?

7. Time

- Was the presentation an appropriate and effective length? (approximately ten minutes; or at least between eight and eleven minutes)

8. Quality of Presentation

- Was the presentation clear and readily understandable?
- Did the presentation’s level of detail demonstrate that the group is capable of completing the project?
- Did the visual aids enhance the presentation and engage the audience’s understanding?
- Did the presenter interact appropriately with the audience and visual aids? (e.g., using eye contact to connect with the audience or draw attention to slides when appropriate)
- Did the presenter exhibit professional mannerisms of speech, gesture, and behavior? (e.g., avoiding distracting movements and interruptions in speech; maintaining appropriate volume; appearing relaxed, confident, and knowledgeable, etc.)
- Were technical details presented accurately?
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Table 2: Criteria For Grading: Oral Progress Reports

Criteria For Grading: Oral Technical Reports

1. Title Slide/Outline

- Were the group, project topic, and sponsor/client identified?
- Were the subject and focus of the presentation identified?
- Was an outline provided that detailed the structure of the presentation?
- Was the presenter professional and engaging in demeanor?

2. Introduction and Background

- Did the presenter clearly identify the larger context of the project?
- Did the presenter clearly identify the problem to be solved?
- Was the introduction and background readily understandable to the audience?

3. Statement of Goals (Statement of Work)

- Were final and intermediate goals specifically identified and were they consistent with the problem to be solved?
- Were these goals concrete, realistic, and specific? (i.e., not “research.”)
- Did the goals provide an outline for the Methodology Section?

4. Accomplishments (The goals become accomplishments in the Technical Report)

- Was each goal accomplished?

5. Methodology

- Was the methodology clearly defined for each goal?
- Did the methodology seem reasonable?
- Is the technical detail presented adequate and relevant?

6. Process

- Was the process sufficiently described?
- Was the right balance of analysis, design and experiment, etc. used?
- Did the presenter instill confidence in the process?

7. Results

- Was there an obvious relationship between the goals and results?
- Were the results presented clearly and convincingly?
- Were the results believable?

8. Conclusion/Summary/Recommendations

- Did the conclusion provide an effective, clear review of the presentation’s key points?
- Did the conclusion follow directly and naturally from the results?
- Was the conclusion consistent with the goals?
- Were the recommendations clearly stated?
- Did the presentation end on a positive note?
- Did the presentation end conclusively, without being abrupt?

9. Time

- Was the presentation an appropriate and effective length? (approximately 20 minutes; or at least between eighteen and twenty-five minutes)

10. Quality of Presentation

- Was the presentation clear and readily understandable?
- Were technical details presented accurately and convincingly such that the audience was confident of the results and conclusions?
- Did the visual aids enhance the presentation and engage the audience’s understanding?
- Did the presenter interact appropriately with the audience and visual aids? (e.g., using eye contact to connect with the audience or draw attention to slides when appropriate)
- Did the presenter exhibit professional mannerisms of speech, gesture, and behavior? (e.g., avoiding distracting movements and interruptions in speech; maintaining appropriate volume; appearing relaxed, confident, and knowledgeable, etc.)

Table 3: Criteria For Grading: Technical Reports The Students’ Opinion

UH Writing Center (WC) in purple; Facilitated meetings in green; Group due dates in red; and Individual due dates in blue.

Tuesdays: 5:30 to 8:30

Thursday: 5:30 to 8:30

January 20, 2004

Attendance Required in W122D3
Course expectations and philosophy
Website and UH Writing Center
Announcement of Projects
Informal mixing; form teams

January 27, 2004

Cohort Meetings I
C1 @ 5:30 in N376D
C2 @ 7:00 in N376D
WC#1& #2 @ 5:30&7 (Abs, Intro and Conc)

February 3, 2004

Cohort Meetings II
C1 @ 5:30 in N376D
C2 @ 7:00 in N376D
WC#5 @ 5:30 & 7 (Proposals)
Planning Report #1 due from Cohorts 3,4,5,&6

February 10, 2004

Cohort Meetings III
C1 @ 5:30 in N376D
C2 @ 7:00 in N376D
WC #8 @ 5:30 (Mechanics and Proofreading)

February 17, 2004

Proposal: Oral (A) and Written (D)
C1, C2 & C3 @ 5:30 in W122D3
WC #10 @ 5:30 (Progress Reports)

February 24, 2004

Cohort Meetings IV
C1 @ 5:30 in N376D
C2 @ 7:30 in N376D
WC #13 @5:30 (Tone in Prof Com)
Planning Report #2 due from Cohorts 3,4,5,&6

March 2, 2004

Progress Reports: Oral (B) and Written (C)
C1, C5, & C6 @ 5:30 in W122D3
WC #14 @ 5:30 (Paragraph Struct)

March 9, 2004

Cohort Meetings V
C1 @ 5:30 in N376D
C2 @ 7:00 in N376D
WC #16 @ 5:30 (Using Figure, Examples)
Planning Report #3 due from Cohorts 3,4,5,&6

January 22, 2004

Attendance Required in W 122D3
Apply for projects (due to at end of class)
Projects, Teams Cohorts announced
by 5 PM Friday via website

January 29, 2004

Cohort Meetings I
C3 & C4 @ 5:30 in N376D & N357D
C5 & C6 @ 7:00 in N376D & N357D
WC#3 @ 5:30 & 7:00 (Abs, Intro and Conc)

February 5, 2004

Cohort Meetings II
C3 & C4 @ 5:30 in N376D & N357D
C5 & C6 @ 7:00 in N376D & N357D
WC#7 @ 5:30 (Proposals)

February 12, 2004

Cohort Meetings III
C3 & C4 @ 5:30 in N376D & N357D
C5 & C6 @ 7:00 in N376D & N357D
WC #9 @ 5:30 (Mechanics and Proofreading)

February 19, 2004

Proposal: Oral (A) and Written (D)
C4, C5 & C6 @ 5:30 in W122D3
WC #12 @ 5:30 (Progress Reports)
Planning Report #2 from Cohorts 1 and 2

February 26, 2004

Cohort Meetings IV
C3 & C4 @ 5:30 in N376D & N357D
C5 & C6 @ 7:00 in N376D & N357D

March 4, 2004

Progress Reports: Oral (B) and Written (C)
C2, C3, & C4 @ 5:30 in W122D3
Planning Report #3 due from Cohorts 1 and 2
WC #15 @ 5:30 (Paragraph Struct)

March 11, 2004

Cohort Meetings V
C3 & C4 @ 5:30 in N376D & N357D
C5 & C6 @ 7:00 in N376D & N357D
WC #17 @ 5:30 (Using Figures, Examples, etc)

<p>March 16, 2004 SPRING BREAK</p> <p>March 23, 2004 Cohort Meetings VI C1 @ 5:30 in N376D C2 @ 7:00 in N376D WC #16&17 @ 5:30 # 7 (Technical Reports)</p> <p>March 30, 2004 Technical Reports: Oral (C) and Written (B) C1, C4 & C5 @ 5:30 in W122D3 WC#19 @ 5:30 (Mech and Proofreading)</p> <p>April 6, 2004 Cohort Meetings VII C1 @ 5:30 in N376D WC #20&#21 @5:30&7(Progress Reports) Planning Report #4 due from Cohorts 3,4,5,&6</p> <p>April 13, 2004 Progress Reports: Oral (D) and Written (A) C3, C4 & C5 @ 5:30 in W122D3 WC #23&#24 @ 5:30 & 7 (Posters)</p> <p>April 20, 2004 Cohort Meetings VIII C1 @ 5:30 in N376D C2 @ 7:00 in N376D WC #25&#26 @5:30&7 (Extended Abstracts) Planning Report #5 due from Cohorts 3,4,5,&6</p> <p>April 27, 2004 Set up Posters by noon</p> <p>May 4, 2004 **</p> <p>May 11, 2004 Final Exam</p>	<p>March 18, 2004 SPRING BREAK</p> <p>March 25, 2004 Cohort Meetings VI C3 & C4 @ 5:30 in N376D & N357D C5 & C6 @ 7:00 in N376D & N357D WC#18 @ 5:30 (Technical Reports)</p> <p>April 1, 2004 Technical Reports: Oral (C) and Written (B) C2, C3 & C6 @ 5:30 in W122D3 Planning Report #4 due from Cohorts 1 and 2 WC# 20 @ 5:30 (Mech and Proofreading)</p> <p>April 8, 2004 Cohort Meetings VII C3 & C4 @ 5:30 in N376D & N357D WC #22 @5:30(Progress Reports)</p> <p>April 15, 2004 Progress Reports: Oral (D) and Written (A) C1, C2 & C6 @ 5:30 in W122D3 WC#25 @ 5:30 (Posters) Planning Report #5 due from Cohorts 1 and 2</p> <p>April 22, 2004 Cohort Meetings VIII C3 & C4 @ 5:30 in N376D & N357D C5 & C6 @ 7:00 in N376D & N357D WC #72 @ 5:30 (Extended Abstracts)</p> <p>April 29, 2004 * Poster Session 10 to 5:30 Grading: 1 to 5:30</p> <p>May 6, 2004 Final Technical Report Due</p> <p>May 13, 2004</p>
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* Final Presentations: Saturday May 1;
Parallel sessions in E233D3 and E321D3;
sessions: 8 to 12 N and 1:30 to 5 PM
lunch: 12 N to 1:30 PM, in E312D3

** Teams must schedule a one hour
"demonstration" sessions with facilitators
between 12N April 26 and 5 PM May 10.

Table 4: Spring Capstone Schedule for Spring 2004

The Student's Opinion

Table 5 presents the results from surveys administered at the beginning and end of the semester to students in the Fall 2003 capstone course. Students were asked to state their level of agreement with the given statements where “5” indicated strongly agree; “4”, agree; “3”, neutral; “2”, disagree; and “1”, strongly disagree. There were 42 students in the class. The total number of responses for each statement is given in the sixth column, N. The “mean” is determined by multiplying the number of responses in each column by the “weight” of that response, e.g., “5” for strongly agree, summing over all the five columns, and dividing by N. With regard to the decreased responses to the “workshop” statements, it is noted that students were not required to attend all the workshops. Data for only six of the workshops are shown since the attendance at the others was not sufficient to provide a statistically meaningful result.

On the average, the students agreed that their communication and writing skills had improved by taking the course (4.04/5.0 and 3.95/5.0). Only 4 of the 42 (10%) disagreed and about 75% agreed or strongly agreed that their skill level had increased. For four of the six workshops, there was over a 70% “approval rate”, e.g., at least 70% of the responses agreed or strongly agreed that they were helpful.

There was only a marginal increase in the students’ “before” and “after” self- assessment of their ability to express themselves clearly. Although the number of students who disagreed or strongly disagreed that they were able to express themselves clearly through writing or speaking decreased from 12 to 3. The results for the first statement (an appreciation for the importance of communication skills for engineers) is a little disappointing.

A standard deviation was determined for each response, and it is listed in the last column under σ . However, the significance of this variable is questionable in the present context. This measure of “scatter” is really only meaningful for a symmetric and continuous distribution. Neither condition is satisfied for these data sets. These are discrete data that form highly bimodal and even tri-modal patterns. Therefore, the real significance of this variable is questionable, but it is still a measure of the scatter and therefore can be a useful quantity.

Beginning of Semester

Communication skills are important for engineers.
 I am able to express my knowledge clearly through writing.
 I am able to express my knowledge clearly through speaking.
 Writing helps me organize my knowledge.
 I can communicate complicated information to others.

5	4	3	2	1	N	mean	σ
34	6	1		1	42	4.71	0.73
5	22	9	4	2	42	3.57	0.98
8	16	12	5	1	42	3.60	1.00
8	23	10		1	42	3.88	0.79
8	19	10	3	2	42	3.67	1.02

End of the Semester

Communication skills are important for engineers.
 I am able to express my knowledge clearly through writing.
 I am able to express my knowledge clearly through speaking.
 Writing helps me organize my knowledge.
 I can communicate complicated information to others.

5	4	3	2	1	N	mean	σ
27	13	2			42	4.60	0.58
10	21	7	2		40	3.98	0.79
12	20	7	1		40	4.08	0.75
9	23	8			40	4.03	0.65
7	19	13	1		40	3.80	0.75

My communication skills have improved by taking this course.
 My technical writing skills have improved by taking this course.

16	17	5	3	1	42	4.05	1.00
14	17	7	3	1	42	3.95	1.00

I found the following workshops helpful:

- proposals
- abstracts, introductions and conclusions
- progress reports
- technical reports
- posters
- extended abstracts

7	15	2	6	1	31	3.68	1.12
4	15	4	3	1	27	3.67	0.98
4	13	10	5	2	34	3.35	1.05
2	11	9	2	2	26	3.35	1.00
7	16	4	3	2	32	3.72	1.10
7	9	6			22	4.05	0.77

Table 5: Results from Two Student Surveys for Fall 2003 in the Capstone Design Course

Conclusions

This paper has described three significant changes/activities currently taking place on the University of Houston campus: the evolution of the UH Writing Center and, in particular, its Writing In the Disciplines Program; the evolution of an multidisciplinary capstone design course involving three departments; and the interaction of these two activities to improve the technical communications abilities of engineering students.

The course instructors are pleased with the demonstrated improvements in the overall communication abilities of the students. To pin point the exact reason would be difficult (e.g., the WC workshops, the WC writing consultants, the WC/Instructor developed grading criteria, the increase emphasis on communications as stated by the instructors,

the work in the cohort meetings, etc.), but certainly much credit should go to the efforts of the staff of the WID program. However, writing and speaking abilities remain difficult skills to quantify. In any event the students' responses, provided through two surveys, have been positive. About 75% "agreed" or "strongly agreed" that their communication and technical writing skills had improved by taking the course. The workshops received a 70% approval rating (either "agreed" or "strongly agreed" that the workshops were helpful.

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Biographical Information

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Jenna Terry is Program Coordinator and founding employee of the University of Houston's Writing In the Disciplines (WID) Program. She earned an MFA in fiction from the University of Houston and a BA with Honors in History from Wesleyan University. At the University of Houston she has taught composition and served as the inaugural Developmental Writing Coordinator. She has worked at Houghton Mifflin's Adult Trade Books Division and has published in general interest magazines and presented at national conferences on fiction writing, publishing, and writing pedagogy.

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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.

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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.