2006-2483: INTEGRATING COMMUNICATION-INTENSIVE CLASSES AND COMMUNICATION STUDIOS INTO THE LOUISIANA STATE UNIVERSITY COLLEGE OF ENGINEERING

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Integrating Communication-Intensive Classes and Communication Studios into the Louisiana State University College of Engineering

Introduction:

Should instruction in an engineering college include what some perceive to be the ancillary skills of written and oral communication? Certainly, ensuring that students learn the requisite fundamentals of engineering and its mathematical and scientific underpinnings is already a daunting challenge. In answering this question, the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) developed an outcomes-based accreditation initiative called *Engineering Criteria 2000*[1] (EC2000). One of the EC 2000 criteria (Criterion 3 under "Program Outcomes and Assessment") is the necessity for engineering graduates to demonstrate the ability to communicate effectively.

While considered progressive and innovative, EC2000 was not without its critics. Funded by a National Science Foundation grant, the American Society of Mechanical Engineers (ASME) completed a one-year study of the implementation of EC2000[2] that revealed some difficulties with its implementation. One of this study's observations warrants some particular discussion here. The contribution of an external Advisory Board was described as follows (emphasis added):

> Involvement of the program Advisory Board was expressed as a positive result of EC2000. These groups provided a very useful resource to the program in establishing educational objectives and defining associated measurements of student outcomes. *The major design experience benefited from board input, particularly with regard to "real world" problems and improvement in communication skills*.

One might ask why these representatives from industry have given such emphasis to the need for graduating engineers who have mastered communication skills. We contend that there are three major influences making communication a critical skill for engineers. The first of these is the opportunity for advancement that is afforded engineers in the corporate environment. One need only to look at the senior managers of technology-driven industries to realize that there is a heavy representation of engineers in this group. The ability that allows engineers to move into management is increasingly identified as communication skill. Writing appears to be crucial according to the College Board's survey[3] of 120 major American corporations. In addition, the ability to communicate complex information orally and visually[4] is also emerging as a necessary skill for managers in technical fields.

A second major factor contributing to the need for better communication skills is the evolving trend toward multi-disciplinary teams that include many non-engineering participants. The most recent edition of the U.S. Department of Labor *Occupational Outlook Handbook*[5] summarizes this well:

> Engineers should be creative, inquisitive, analytical, and detail oriented. They should be able to work as part of a team and to communicate well, both orally and in writing. Communication abilities are important because engineers often interact with specialists in a wide range of fields outside engineering.

The third influence that necessitates communication skills in U.S. engineering colleges is the increasing globalization of the economy and competition from those educated in other countries. Once again, the *Occupational Outlook Handbook* describes the competitive advantage for U.S. engineers who communicate well (emphasis added):

> There are many well-trained, often English-speaking engineers available around the world willing to work at much lower salaries than are U.S. engineers. The rise of the Internet has made it relatively easy for much of the engineering work previously done by engineers in this country to be done by engineers in other countries, a factor that will tend to hold down employment growth. Even so, *the need for onsite engineers to interact with other employees and with clients will remain*.

Boeing is a prime example of a company that deliberately recruits engineers with communication skills. It is largely managed by trained engineers, heavily reliant upon multi-disciplinary design teams, and at the forefront of a globally-driven economy. As a result of its cooperative initiatives with universities, Boeing developed its widely publicized document entitled "Desired Attributes of an Engineer."[6] Prominently listed among its ten stated attributes is "Good communications skills: written, oral, graphic and listening."

Although some would contend that merely recognizing the need for communication skills is a major victory, it is still far short of the goal of actual implementation. Meeting this implementation goal prompted the College of Engineering (COE) at Louisiana State University (LSU) to launch a cooperative program with a campus-wide initiative designated as Communication across the Curriculum (CxC). This paper describes that cooperative program and highlights some of its critical elements.

Communication across the Curriculum (CxC) at LSU:

In 2003, now-deceased LSU alumnus Gordon Cain gave LSU a major gift to establish a program that would improve student communication skills at LSU. Because he was an engineer, he was especially interested in enhancing the abilities of engineering students, but from the beginning, the vision for the program was that it be university-wide. The Communication across the Curriculum (CxC) Program was established in 2004, and its Director and Assistant Director have successfully built faculty consensus around three projects: Communication-Intensive Courses, with criteria for them approved in 2005; High-Level Communicator Certification for Students, beginning in 2006, including digital portfolios of communications projects for all students; and Communication Studios to support faculty members and students as they emphasize communication in four modes: written, spoken, visual, and technological. The CxC Program enjoys the direct support of student government leaders, faculty members, deans, and provosts. Its first Faculty Summer Institute received outstanding reviews from those who attended (some 38 full-time and over

60 in total) and has resulted in faculty leadership in communication initiatives across the campus, including the COE, which is the focus in this report.

Current Status of Communication Initiatives in Engineering:

The first step in integrating specific communication skills into the COE was to identify a core faculty group representing each of the departments. This core group of eleven faculty members prepared for a leadership role in the communication project by attending a CxC-sponsored Faculty Summer Institute during the summer of 2005. The engineering team received a comprehensive orientation to the campus-wide CxC program and explored how their participation could lead to the incorporation of communication goals in the COE curriculum. They worked on their individual syllabi, as well as college-wide projects such as the development of a Communication Studio for the COE. They shared their ideas about the college's need for communication skills and their newly-revised syllabi with faculty members representing all colleges at LSU, who provided an interdisciplinary audience for their ideas. This orientation was supplemented with presentations by recognized leaders in the various aspects of communication from other major universities (MIT, Missouri, George Mason, and Clemson).

Faculty leaders at the Summer Institute argued that a critical key to success for the new communication program in the COE would be support for faculty and students who are expected to emphasize communication skills. A major accomplishment during the fall of 2005 was the opening of the first Communication Studio on campus. It represents a joint effort of the COE, CxC, students who supported the project with funds from their Technology Fee, and the Provost's office. The Engineering Communication Studio (Studio) has state-of-the-art technology applications at 17 computer work stations and comfortable lounge seating for an internet café atmosphere. The lounge area is located in a wireless internet hotspot, making it a popular location for students using personal laptop or notebook computers. With its movable seating, this area is also heavily used for small group discussions of team projects.

A conference room in the Studio is equipped for critiques of oral presentations, one of the requirements of Communication-Intensive courses. Most useful is a SMART Board™, a touch-sensitive display permitting control of computer applications directly from the display, including writing notes in digital ink that can be saved or shared via email. A dedicated camcorder is available for students to videotape and edit their presentations, which can also be viewed via the SMART Board™ display. The conference room is further equipped with a conference telephone and modular furniture, making it a functional site for capstone design teams to discuss progress and details with their advisors and corporate sponsors.

The Studio's three-dimensional (3-D) printer enables students to see their designs come to life by creating a functional ABS plastic model directly from design files. This allows students not only to construct complex shapes but also to test the form, fit, and function of individual components in their overall design project. One positive outcome of locating the 3-D printer in a setting shared by all the engineering disciplines has been the growth of applications faculty and students can now envision for this resource.

To further support students and faculty, the Studio is staffed with a Communication Coordinator and two Communication Instructors. These three professionals have been working directly with students and faculty to enhance students' written, oral, visual, and technological communication skills. The support for faculty has ranged from assisting in the development of course syllabi that integrate communication components to developing rubrics for assessing critical skills and providing classroom instruction on communication-specific topics. This cooperative relationship has also led to faculty referring students to the instructors for individualized and team tutorials. It is not lost on the students that the instructors are familiar with the course content and goals; therefore, the tutorials are perceived as being more relevant and having a more immediate impact upon their academic performance than stand-alone courses or tutorial programs outside the COE. One goal of CxC is to facilitate more on-site tutoring from other programs so that their assistance will also be perceived as more relevant to engineering students.

An Early Assessment of Results:

With only one semester of implementation, assessment of program results is limited to observations, including feedback from faculty and students. Quite often, the faculty members' responses are an acknowledgement of the value of integrating communication into the engineering curriculum, but they are then tempered by the limits on classroom time in any designated course and the perceived additional workload being placed upon them and their students.

While working with faculty members to help modify course syllabi, Studio staff members have been successfully demonstrating that, in most cases, the selected courses already have existing communication components; thus, frequently no additional workload is being incorporated. Most often, the Studio staff's primary task is simply identifying those aspects of the course that are Communication-Intensive. By the end of the first semester, six engineering courses had been certified under the established CxC criteria as "Communication-Intensive," with double that anticipated by this time next year. All such courses will be identified on students' transcripts so that employers and graduate programs will know that LSU students have had this additional experience.

Studio staff have further assisted faculty by developing rubrics for the assessment of specific communication skills. As faculty members have become more comfortable with rubrics, there have been no issues raised regarding the increased workload upon the faculty member. Here again, it is our observation that the assessment of the communication skill had previously been underway but with less structured or focused methods. Indeed, another of the beneficial outcomes of this process has been the increased identification of students in need of additional tutoring in some basic communication skills. This tutoring, provided by Studio staff, has resulted in dramatic increases in the performance of students who willingly participated. One student (privately identified as our "star pupil") improved the grades on her written reports from failing to a consistent "A" on each report later in the semester. Use of the Studio as a resource for engineering students has steadily increased since its mid-semester opening in October 2005.

Informal interviews with students have also shown that there is no increased workload in the designated courses over what the students had anticipated. Rather, there are indications that the students feel that expectations have been better defined and that the value of acquiring the communication skills is well worth the effort. This latter result is more pronounced in the seniors who have already begun the employment search process.

Interviews with faculty members regarding success of the program to date have been uniformly positive. In the Chemical Engineering Department, faculty members found that students who availed themselves of the tutorial resources available in the Studio improved at least one letter grade in assigned written reports over the semester. An Environmental Engineering professor related that two classes were assigned oral presentations as a part of the final grade for the class. Both classes, one sophomore-level and one senior-level, were encouraged to seek assistance from the Studio staff. Only the sophomore-level class members practiced their presentations in the Studio's conference room with Studio staff in attendance. When the oral presentations of both classes were critiqued by independent evaluators, all commented on how the sophomore students' presentations were significantly better than those of their senior counterparts.

The COE has also sought opinions from outside the academic community regarding the value of the current direction of the Studio. The COE Dean's Advisory Council was given a detailed briefing on the Studio facilities, charter, and progress to date. This Council unanimously expressed its opinion that the Studio was contributing favorably to a comprehensive engineering education and that its mission should receive continued support from the university and the alumni.

In order to seek a more focused independent critique of the Studio, the Dean of the COE appointed an Engineering Communication Advisory Council. This Council is comprised of a small group of engineers who hold senior-level positions in government and private industry. These engineers typically communicate at varying technical and managerial levels, conduct comprehensive evaluation of engineers' work products, and set the criteria for the education and skills desired in new hires in their respective organizations. After a detailed orientation, the Council concurred with the direction the Studio has taken to date and has offered suggestions for future initiatives.

The Engineering Communication Outlook at LSU:

Certainly one of the highest priorities for the near term is to increase the number of courses in the COE that are certified as Communication-Intensive. Given the initial successes with certifying courses, we think that a reasonable goal is provide at least three certified courses in each engineering discipline by the end of June 2007. To promote course certification, the CxC program has developed a brochure for all faculty members that outlines the criteria and instructions for certification, as well as a searchable database of instructional materials on its website (http://cxc.lsu.edu). The Studio also has a web presence that informs students and faculty of its services, and faculty members will continue to consult with the staff there as they design Communication-Intensive courses.

A second CxC program, High-Level Certification for students, will be promoted beginning in the spring of 2006. This is a program for all students, including engineers, who seek to identify themselves as highly skilled in written, oral, visual, and technological communication. Two of the requirements for the certification include designing and launching a digital portfolio or website that displays their projects in an effective manner.

Finally, staff members at the Studio are designing focused workshops for students on particular skills, e.g., how to display complex data in effective charts, tables, and animated graphics; effective style in writing for engineers and other audiences; and effective oral communication using state-of-the-art presentation software. Faculty and staff at LSU are also sharing the results of their work with engineering faculty members and communication specialists at other universities through the CxC website, conferences, and publications. They welcome collaborative exchanges with other universities.

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