Responding to Need for Improved Communication Skills of Engineering Students at Louisiana State University

Tiffany Walter Choplin
Engineering Communication Studio
Louisiana State University

Warren N. Waggenspack, Jr.
Associate Dean of Undergraduate Engineering Studies
Louisiana State University

Warren R. Hull, Boz Bowles
Engineering Communication Studio
Louisiana State University

Lillian Bridwell-Bowles
Director of Communication across the Curriculum
Louisiana State University

Abstract

Through the generosity of a distinguished alumnus, Louisiana State University was able to establish a campus-wide program that focused on improving students' communication skills. This program, Communication across the Curriculum (CxC), created three central initiatives: Communication Studios, Communication-Intensive Courses, and the Distinguished Communicator award. To address the ABET requirements for communication and teamwork, the College of Engineering, in cooperation with CxC, opened the Engineering Communication Studio, which provides state-of-the-art technology, a physical space conducive to teamwork, and communication instruction from three full-time staff members. The Studio resources include a 3D scanner, a rapid prototype modeler, a large-format printer, and a range of engineering and communication software packages. The Studio also features fourteen computer workstations; a Wi-Fi hotspot lounge; a conference room with teleconferencing capabilities, a wall-mounted video capture system, and a SMART Board™; and, finally, a wide range of audio-visual equipment and technical references in the Studio lending inventory. On the curricular level, the staff works with faculty to integrate communication assignments within existing courses in order to incorporate communication skills without detracting from traditional content. These courses are identified as Communication-Intensive in the University Course Offerings Booklet, and then become a critical component of the Distinguished Communicator award. A second component of this award requires students to build a digital portfolio that showcases their communication skills. As the students progress in their engineering curricula, the Studio provides a vital support system to improve the requisite communication skills to succeed as engineering professionals.

Introduction

Mathematics and scientific principles have long been the heart of a sound engineering education program. Indeed, it has been observed that engineers communicate globally with a common technical language that often seems to surmount traditional written and conversational constraints. However, the reality is that engineers must also communicate across many professional disciplines, especially in the current trend toward globalization. The most recent edition of the U.S. Department of Labor *Occupational Outlook Handbook*[1] highlights the communication requirement 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."

Increasing globalization of the economy and competition from those educated in other countries are also factors for engineering graduates. 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*."

The need for the teaching of communication skills has now been acknowledged as crucial to preparing students for professional engineering careers. This need was formalized when the Engineering Accreditation Commission of the Accreditations Board for Engineering and Technology (ABET) put forth criteria in the *Engineering Criteria 2000*, specifically criterion 3 under "Program Outcomes and Assessments," which requires students to graduate with both teamwork and communication skills[2].

At Louisiana State University, implementation of the ABET requirement was fortuitously assisted in 2003 through the generosity of a now-deceased alumnus who wished to establish a university-wide program that would focus on improving students' communication skills. Because he was an engineer, his primary interest was to accomplish this task in engineering classes first, but from the beginning, he envisioned this program as a means of addressing student needs across all curricula. The initiatives described in this paper are among the key elements of the resultant program that have been successfully implemented.

The Communication across the Curriculum (CxC) program was established at LSU in 2004, with the goal of integrating communication skills in four modes into existing curricula across the university. The modes were defined as: written, spoken, visual, and technological. To build

faculty consensus, three key elements were established: Communication Studios, Communication-Intensive (C-I) courses, and the LSU Distinguished Communicator (D-Comm) certification for students.

Communication Initiatives and the College of Engineering

Engineering Communication Studio

During the fall of 2005, a cooperative effort between CxC and the College of Engineering (CoE) resulted in the opening of the first of several Communication Studios on campus. The Engineering Communication Studio (Studio) has state-of-the-art technology software at 17 computer workstations 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 preparation and critiques of oral presentations. Most useful is a SMART Board™, a touch-sensitive display permitting control of computer applications directly from the display, and includes the capability to save and share notes from discussions via email. The conference room is further equipped with a conference telephone, a large dry erase board, and modular furniture, making it a functional site where capstone design teams discuss progress and details with their advisors and corporate sponsors. Students can record deliberations or presentations using a wall-mounted camera connected to a user-friendly DVD recording system.

The Studio's rapid prototype modeler enables students to see their designs come to life as it creates 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 rapid prototype modeler in a setting shared by all the engineering disciplines has been the increase in applications that faculty and students can now envision for this resource. The recent addition of a 3-D scanner complements the rapid prototype modeler by allowing students to create scans of exiting parts, import the scan into CAD software for changes in design. The design can then be printed in the rapid prototype modeler.

A large-format printer allows students to create posters and CAD drawings in formats up to 42 inches wide. The Studio offers bond and photographic quality paper options, which allows LSU students, faculty, and staff to create poster drafts in grayscale before printing in color on glossy paper.

Both specialty printers are available solely for instructional support purposes, and charges recover only the cost of materials. Students can print a color poster on high-gloss photographic paper for less than $20.00. Three-dimensional printing costs are calculated based upon the volume of ABS plastic modeling material used in the project. Typical prototype parts can be produced for less than $10.00. Students can pay using their LSU ID cards, which also function as debit cards.

In order to promote the development of digital portfolios and other communication projects, the Studio offers equipment for student checkout. Students can choose between a corded or a wireless microphone system, which works with either a lapel microphone or a handheld, omni-directional microphone. This microphone system is compatible with the digital camcorder and tripod that are also available for student use. In addition to audio-visual equipment checkouts, the Studio features a growing reference library, including engineering-specific references and writing style guides.

To further support students and faculty, the Studio is staffed by a Communication Coordinator and two Communication Instructors. These three professionals work directly with students and faculty to enhance students' written, oral, visual, and technological communication skills. Support for faculty ranges 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 often leads faculty to refer students to the Studio instructors for individualized and team tutorials. Students know that the instructors are familiar with the course content and goals; therefore, students perceive the tutorials as being more relevant and having a more immediate impact upon their academic performance than stand-alone courses or tutorial programs outside the CoE. In addition, the Studio is staffed by 12 student monitors, all of whom are engineering majors. These students are expected to learn to use all the Studio resources in order to aid the full-time staff in addressing student needs.

Communication-Intensive (C-I) Courses

A primary role of the Studio staff is to support students and faculty in C-I courses within the College of Engineering curriculum. C-I designated courses meet specific criteria concerning communication, such as focusing on at least two of four communication modes (written, visual, spoken, and technological); multiple iterations of communication-based projects, including instructor feedback; inclusion of informal communication, such as small-group communication and risk-free, writing-to-learn assignments; and concentrating at least 40% of the course grade on communication. Currently in the CoE, there are 31 C-I designated courses throughout the curriculum, ranging from introductory to capstone courses. All Engineering disciplines have at least one C-I designated course in their core curriculum.

The Studio staff supports faculty teaching C-I courses by helping with assessment of communication-based assignments, sharing the teaching load, and consulting on syllabus and assignment development. One of the main contributions to C-I courses by Studio staff is responding to communication-based assignments. The Studio staff often helps with paper grading, responding to oral presentations and poster presentations, as well as providing instruction and support on technological projects like digital portfolios. Frequently, Studio staff help instructors develop rubrics that are used not only by the instructors, but by the entire class as a peer response exercise. Because the Studio staff is usually more experienced in teaching communications than the engineering faculty members, the Studio staff contributes to teaching in the class by giving presentations and demonstrations on communication topics, including the writing process, poster design, and good oral presentation techniques. In addition to in-class sessions, the Studio organizes workshops on communication topics that take place in the Studio,

during and outside of class hours, as well as providing one-one-one consultations as necessary or requested.

The Studio staff members also consult with classroom instructors on syllabus development and assignment development. Because of the C-I course requirement that declares part of the communication assignments be informal and ungraded, many traditional engineering assignments must be altered or supplemented to allow for these tasks. Studio staff helps find ways to incorporate informal assignments into already crowded curricula without sacrificing important traditional content of these curricula. One example recently occurred in a 3-D imaging class. The instructor had tried several methods of teaching the idea of sectioning in a CAD drawing, but had been unhappy with the low level of student involvement, interest, and progress. On recommendation from a Studio staff member, the instructor altered the well-known pedagogical concept of free-writing to a free drawing assignment. At the beginning of class, the instructor had the students draw whatever they wanted on their computers, warning them that their drawings would eventually be posted for the class to see. The instructor then used these drawings to teach the lesson, and later reported that the level of student interest was much higher than it had ever been for that concept. In another case, Studio staff helped an instructor build a progression of assignments that included an oral presentation and a report. The idea was to let the slides from the presentations serve as storyboards for the final reports. Again, this instructor reported the syllabus as a successful one.

One of the requirements of C-I courses is the implementation of a feedback loop for all formal communication assignments, and participation in these feedback loops is another way the Studio staff participates in C-I courses. Studio staff is available for one-on-one consultations with students as well as consultations with groups, such as those assigned to senior capstone projects. In addition to consultations, Studio staff help faculty to develop rubrics for communication assignments and also serve as assessors for in-class presentations and poster sessions. The nature of in-class Studio participation is determined by consultation with faculty members, and the student consultations are usually done by appointment. Maintaining a high profile in C-I courses contributes to an ongoing emphasis on good communication skills throughout the CoE.

LSU Distinguished Communicator Certification

In addition to C-I courses, in 2006, through the CxC program, students were offered the opportunity to be recognized as LSU Distinguished Communicators (D-Comms) based on exemplary levels of communication skills developed over their undergraduate years. Students who complete the rigorous requirements are identified as “LSU Distinguished Communicators” on their transcripts and also recognized at commencement. To meet the D-Comm requirements, students must complete at least 12 credit hours of C-I courses, assemble a digital portfolio showcasing their communication skills, have their portfolios approved by designated academic advisors, and show evidence of leadership on campus and in the community. In the inaugural spring of 2006, 7 of the 8 recipients of LSU Distinguished Communicators came from the CoE. Over the past two years, engineering graduates have comprised of 19 of the 27 D-Comms.

To explain the success of recruitment, it is important to highlight the culture of engineering education and the type of student that an engineering program attracts. In the highly competitive

discipline of engineering, the students actively pursue honors and awards that will distinguish themselves from their peers. There are several incentives for the students to complete the Distinguished Communicator Certification. First, in taking the Communication-Intensive courses, the students have multiple opportunities to learn and to practice communicating the complexities of their disciplinary knowledge clearly and effectively, which will help them immeasurably as future professionals. Secondly, the digital portfolio is often seen by students as a best-works showcase allowing them to present their most successful communication projects to potential employers or graduate school admissions committees. Students seeking Distinguished Communicator certification must build digital portfolios that present examples of written, oral, visual, and technological communication, which demonstrate their ability to communicate in a variety of platforms for their intended audiences.

Several former D-Comm graduates have contacted the Studio staff post-graduation to praise the program and its help in preparing them for their professional roles in the field of engineering. A biological engineering graduate received a 12% raise in starting salary from her state job in recognition of her D-Comm status. Another mechanical engineering graduate attributes his success in writing technical documents and in giving oral presentations, which account for a majority of his job tasks, to strategies he learned while completing the D-Comm certification. Looking towards the future, 43 engineering students are now in enrolled in the D-Comm certification program. The Studio staff is exploring incentives to recruit students early and work with them until they graduate. Arguably, the earlier the Studio staff reach students, the better students' overall progress and final products will be, and the better prepared they will be to communicate in their future professional roles.

Summary and Conclusions

The Engineering Communication Studio continues to grow in student use from semester to semester, as well as in faculty participation and buy-in through Communication-Intensive courses. As the number of engineering courses certified C-I continues to rise, so does the number of students using the Studio. Between the instructional support provided by Studio staff and the technological equipment available, students enrolled in C-I courses account for a large percentage of the Studio's usage. The Studio's goal is to certify at least 4 courses in each department as C-I. Over the last year, the CoE has increased the number of C-I courses to a total of 31, some consisting of multiple sections. Two departments, Mechanical Engineering and Construction Management, have met the goal of certifying 4 C-I courses. Within these C-I courses, and through the students' use of the Studio, Studio staff are able to recruit talented students for the LSU Distinguished Communicator program. As the cooperation between the C-I instructors and Studio staff develops, ways to integrate communication tasks into traditional engineering content courses diversify and improve over time and over multiple collaborations.

References

1. Department of Labor, *Operational Outlook Handbook (OOH), 2006-07 Edition*, US Bureau of Labor Statistics, [Online], Available: http://www.bls.gov/oco/home.htm.

2. Engineering Accreditation Commission, *Criteria for Accrediting Engineering Programs Effective for Evaluations During the 2005-2006 Accreditation Cycle*, Accreditation Board for Engineering and Technology, Inc., Report, Nov. 2004.

TIFFANY WALTER CHOPLIN
Ms. Choplin is a Technical Communication Instructor in the Engineering Communication Studio at LSU. She earned a bachelor of arts in English and Political Science from the University of Kansas, a master's degree of English from the University of Kansas, and is currently finishing her PhD in English from Louisiana State University.

WARREN N. WAGGENSPACK, JR.
Dr. Waggenspack is currently the Associate Dean for Engineering Undergraduates and holder of the Ned Adler Professorship in Mechanical Engineering at LSU. He obtained both his baccalaureate and master's degrees from LSU ME and his doctorate from Purdue University's School of Mechanical Engineering. He has been actively engaged in teaching, research and curricula development since joining the faculty in 1988. He currently serves as Co-Director of the Education and Outreach program with LSU's NSF-EPSCoR Center for Bio-Modular Multi-Scale Systems (CBM2) and is responsible for the development and implementation of several of the centers K-12 and public outreach programs.

WARREN R. HULL, SR.
Mr. Hull is currently the Engineering Communications Coordinator at LSU. He earned a B.S. in Mechanical Engineering from Louisiana State University and an M.S. in Environmental Health from Harvard University. His engineering career spans nearly 40 years. He is a licensed Professional Engineer who was previously an engineering consultant, and is also a retired military officer.

BOZ BOWLES
Mr. Bowles is a Technical Communication Instructor in the Engineering Communication Studio at LSU. He earned a baccalaureate degree in English and a Master of Fine Arts in Creative Writing from Virginia Commonwealth University. He is a former assistant editor of Blackbird: an online journal of literature and the arts, and his writing has appeared in a variety of magazines, including River Oak Review, Rainbow Curve, and Red Rock Review.

LILLIAN BRIDWELL-BOWLES
Dr. Bridwell-Bowles is a Professor of English and Director of Communication across the Curriculum (CxC) at LSU. She received her baccalaureate and master's degrees from Florida State University and her doctorate from the University of Georgia. She has worked with communication in various fields for 23 years, led a number of successful grants on communication in technical fields, and served as the Chair of the Conference on College Composition and Communication. She was previously a member of the faculty at the University of Minnesota.