Integrating Discipline-Specific Communication Instruction based on Workforce Data into Technical Communication Courses*

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Abstract

Because of Georgia Tech's collaboration between the School of Literature, Communication, and Culture (LCC), College of Computing (CoC), and Industrial and Systems Engineering (ISyE) departments, our curriculum model combines several approaches. The humanities-driven technical communication instruction teaches narrative professional writing skills within a science, technology, and culture context. The computer science department teaches general analytical skills for adapting to ever-changing demands of a dynamic field. The National Science Foundation (NSF)-sponsored approach combines these two and provides discipline-specific writing instruction based on actual workforce reports and real-world email protocol. This interdisciplinary pilot is created for Computer Science students, but aims to provide a model for various disciplines that any individual instructor can incorporate into his or her own curricula.

This model of curriculum development is based on Georgia Tech's NSF-sponsored project to bring workplace communication into a Technical Communication course. Personal interviews have been conducted with computer science engineers; supervisors; and senior executives. The results of the interviews have been used to tailor Technical Communication to the computer science discipline. These findings will be described along with the course content and preliminary student assessment data.

I. Introduction

Georgia Tech is engaged in a collaborative effort that combines approaches from the College of Computing (CoC), the School of Literature, Communication and Culture (LCC) and a workforce communication project originated in the School of Industrial and Systems Engineering. The goal is to integrate the pedagogical philosophy of the Computing faculty with LCC's emphasis on

studies of science, technology, and culture, and to integrate workforce communication tools into discipline-specific Technical Communication Practices courses designed for computer science majors. The skills emphasized are producing workplace presentations and documents. Three sections of 25-student courses are restricted to computer science majors. The goal is to develop a curriculum that can be specific to individual disciplines and still teach general analytical communication skills. This is being accomplished by employing actual documents collected from the workplace as communication models and adapting skills identified through the interviews into evaluation rubrics used for the students and the instructor of the course.

The project includes five kinds of activities. First, coordinators from the humanities and computer science departments share communication needs and approaches to instruction, and formulate a syllabus that meets both sets of requirements. Second, curriculum is created that incorporates documents and communication skills identified through interviews with practicing professionals. Third, students practice their workforce communication skills with personal feedback from their instructor. Fourth, students complete assignments requiring the production of workplace documents such as emails and white papers. Fifth, for evaluation purposes, students provide examples of their work before and after instruction. For instance, students' memo-writing skills are evaluated before and after the instructor teaches letter writing.

In this paper, we will first summarize the highlights of relevant publications, second, outline the results from humanities-computer science collaboration, and third, describe strategies for teaching workforce communication. Fourth, the methods for integrating classroom and workforce approaches are laid out. Fifth, the assessment procedures are identified, and finally, future work is covered.

II. Highlights of Publications Regarding Writing and Presenting in Computer Science

Computer science students need to build stronger communication skills in order to position themselves for upward mobility in the workplace.[1] A modest estimate claims that scientists and engineers spend 25% of their professional time writing a variety of technically oriented documents (about 15% formal, 10% informal)[2,3,9], and the Accreditation Board for Engineering and Technology (ABET)[4] has made an unmistakable statement by requiring that oral and written communication skills be included in curricula. We must also recognize that computer scientists need to be increasingly versatile in their workforce communication skills. In computer science fields, a trend of interdisciplinary teams in the profession is on the rise. The professional field of computing has been described as having shifted to the "information industry" of "non-computer firms such as banks and investment service providers, law practices, entertainment conglomerates, and many others whose mission is to sell content and supporting services directly to the general public."[5] This shift entails "cross-functional" requirements of computer science professionals who must now expand their abilities to deal with not only technical problems, but also issues of user concerns and communication.

Regarding communication skills, publications have indicated that engineers in the workplace are increasingly required to possess solid writing and oral presentation skills. In a 1993 survey of

employers, 70 to 80 percent indicated that communication skills are valuable in new engineers. Other surveys have documented the need and suggested educational emphases.

Collaboration has been shown to increase the success of communication instruction in technical and engineering disciplines. An ideal configuration of participants would include: 1) communication instructors in a writing department;[6] 2) engineering faculty involved in setting communication goals;[7] 3) outside technical communication consultants meeting with faculty; [18,8] 4) a steering committee established by the technical communication department; including "engineering faculty from all departments, the dean of undergraduate studies, mentor representatives from industry, and technical communication faculty" (p. 690)[9] and 5) an advisory board including workplace professionals and faculty.[9]

However, most communication instruction efforts do not involve direct contact with the workplace. The workplace is a different discourse community from academia and therefore requires different communication strategies. Members of a discourse community "have certain expectations from interaction with their community". They "write in ways that are useful to the community and … familiar" to community members.[10] The academic discourse community includes interaction based on essays and reports while the technical workplace discourse community's interaction is based on contracts, status reports, proposals, technical reports, and technical presentations.[11] Of course, maintaining separation of the two spheres is important because students are gaining foundational knowledge in the academic community that they will apply in different ways in the workplace. Technical communications is at a nexus where students can learn how to activate their knowledge base by practicing their analytical skills.

Discipline-specific instruction in communication skills makes the content of a course more relevant to students. Although across-the-curriculum applications have met with much success, it is widely noted that "what constitutes an effective communication differs from discipline to discipline and from profession to profession."[12] Discipline-relevant content is believed to motivate learners and provide the contextual use of discipline-specific vocabulary.[13] Curriculum based on information gathered from practitioners in the workplace adds "high functional context" that helps students transfer workplace communication skills, learned in the classroom, to their job. [4, 14, 15]

Current technical communication instruction and textbooks created for computer science students often focus on arming students with processes and techniques to help them manage a core of documents that will most likely be required in the workplace.[16,17] Computer science courses are often separate from the communication courses, though many schools have begun to integrate communication instruction with students' home department courses.[18] Still, there is a strong argument for teaching discipline-specific communication skills through courses taught by content experts in communication. And technical communicators emphasize the importance of applied research and the teachability of case histories.[19]

III. Strategies for Teaching Communication Skills to Computer Science Students

The discipline-specific curriculum developed for computer science students was initiated through collaboration between the School of Literature, Communication, and Culture (LCC) and the College of Computing (CoC). Faculty in CoC were interviewed to find out 1) what they thought were the greatest communication needs of their students, 2) how these needs were currently being met in computer science courses, and 3) skills that they would like to be taught in LCC's Technical Communication Practices course. We also discussed the pedagogical philosophy of the computing department, which, in brief, is to arm students with analytical skills that will enable them to be productive in a variety of professional scenarios. For example, computer science faculty at Georgia Tech do not necessarily emphasize the details of each current coding language but rather train students to assess the affordances of a tool or configuration and choose the best solution. This pedagogical model translates smoothly to teaching technical communication because it highlights the necessity of audience analysis, organization and planning, and efficient execution. The CoC is also developing a leading edge department in Human Computer Interaction (HCI), and this field requires not only a keen sense of evaluating technological alternatives but also an ability to analyze cultural and ethical factors.

To meet these tenets, LCC has developed a course that requires students to complete written and oral presentation assignments that are frequently required in the computer science field, such as white papers, documentation and instructions, technical definitions, and websites along with research papers, proposals, memos, and emails. Drawing from a standard technical communication textbook, the instructor lectures on how to assess these communication scenarios and also provides specific instruction on topics such as visual design, usability issues, and a range of cultural and ethical topics. The relevance of computer science technology to cultural and ethical topics is examined through in-class discussions of texts such as the Senate transcript introducing the "Global Internet Freedom Act" (2002), with its accompanying policy statement whose practical implications only computer scientists can understand; "Tear Down this Firewall" (2002); foundational essays on connectivity like "As We May Think" by Vannevar Bush (1945) and "The Digital Dilemma: Intellectual Property in the Information Age" by The National Academies (2000); "The Ethic of Expediency" by Steven B. Katz (1992) on the risks of technical writing; and the history of the white paper beginning with "The British White Paper of 1922."[20] The department's lens of "Science, Technology, and Culture" adds a historical perspective to the impact of technology on society.

Students in this course are encouraged to find their own samples of workforce communication in their field. For instance, one assignment requires students to bring in a white paper, summarize the content and significant design elements in a presentation for the class, and write an original white paper modeled on the real ones gathered by the class. This process is achieved through several draft stages and meetings with the instructor, computer science faculty and occasionally, professionals in the relevant specialties. This kind of interaction with the professional world outside of academia has been highly motivating to students because it validates the purpose of learning a certain communication skill. Along this line of reasoning, we have conducted extensive interviews with professionals in the workplace and developed that data into additional curriculum.

IV. Gathering Communication Data from the Computer Science Workforce

As stated above, one objective of the Technical Communication Practices course for computer science majors is to introduce students to a variety of professional documents and presentations that they will be required to produce in the workplace and to provide general skills for completing these communication tasks. The documents include various memos, emails, analytical reports, proposals, documentation and instructions, and white papers. Three oral presentations of varying length and content are included as well.

The orientation of the workforce communication project places emphasis on the kinds of communication materials and tasks encountered by computer scientists in their professions. We have interviewed computer scientists, supervisors and CEOs using a standardized process informed by "job communicative analysis" that helps us collect empirical workforce documents and evaluation criteria.[20] We have also gathered background information about jobs available to professionals with computer science training. The documents collected from this process are edited to provide anonymity for companies, their employees, and their property.

We have talked with professionals working in a wide range of industries, including software firms, a hospital, an attorney's office, a moving company, a beverage company, a financial company, and an energy services company. The documents we have been offered include emails, proposals, meeting agendas, white papers, user documentation, slides, project plans and reports, and descriptions of verbal communications. Response to this project has been positive, and all participants have emphasized how crucial communication skills have been to their success in the workforce.

The results of the interviews are used to construct three kinds of instructional tools. First, the communication skills are included in the Norback Criteria of Communication Excellence. This document includes 50 criteria in the following categories:

1. Receiving Messages (These criteria help students prepare for communication by gathering and verifying information about their audience.)
2. Audience Awareness (These criteria help students refine their documents and slides by analyzing characteristics of their audience.)
3. Communication as Problem Solving (These criteria help students resolve differences in perception of methods, tasks, and goals.)
4. Constructing Messages (These criteria help students design and organize documents and slides that efficiently deliver important points.)
5. Delivering Messages (These criteria help students effectively deliver their messages and interact smoothly with their audience.)

The second type of instructional tool being developed is evaluation rubrics, based on the Criteria, that provide guidelines for successful communication. These rubrics are formulated for use in peer reviews, self reviews, and evaluations by the instructor. The rubrics will be made available during the presentation. Third, examples of actual documents from the workplace are

incorporated into the instructor's established curriculum. Again, these examples will be shared during our presentation.

V. Integrating Workforce Data into Established Communication Curriculum

The goal of this project is to create flexible, discipline-specific teaching tools that can be easily adapted into nearly any technical communications course. Ideally, an instructor teaching a class of students from several engineering disciplines could adapt the workforce pieces as easily as an instructor teaching a class of students from the same discipline. The challenge of satisfying both the specific and general needs of engineering students is met by combining broadly applicable workforce data with specific documents and projects that are relevant to a specific area of study. As we continue to expand our project to include more disciplines, we are able to provide sample communication pieces to a larger variety of students. At this point, we have covered ISyE, Electrical and Computing Engineering (ECE), and computer science professionals, and we plan to expand to the fields of Management and Biomedicine.

A crucial component in making any curriculum work is the ease and reliability it offers to the instructor. Our "drop-in" curricula are designed so that an instructor can reference experts in the workforce without being an expert themselves. The discipline-specific focus of the data identifies the documents and assignments most frequently required in the workforce and models best practices as well.

Concretely, the drop-in modules include a set of readings on how to use workforce data for learning communication skills, evaluation rubrics based on the Norback Criteria for Communication Excellence, and actual workforce documents. We suggest that the instructor follow a few basic steps to incorporate and highlight the workforce materials (which we will share examples of at the presentation):

1) Conduct a basic in-class discussion of the issues addressed by this kind of discipline-specific curricula, and educate students on the value of "high functional context" materials. A textbook chapter based on the information gained in the workforce interviews is provided to facilitate these discussions.[21]
2) Integrate the Norback Criteria of Communication Excellence as a guide to preparing and evaluating projects. The Criteria are provided in full format and also offered as separate evaluation rubrics. Teachers and students can thus target certain skills and use the rubrics for peer evaluation, self critiques, and for calculating grades. These tools enable faculty and students to give standardized constructive feedback.
3) Offer the workplace documents in class so students can study actual examples of communication in their field. Each document is accompanied by contextualizing information that explains the situation requiring the communication, and describes the position and experience of the author. Also, the document type and common uses are described.

VI. Assessment

Multiple types of assessment information are being collected in the project. Working with the Office of Assessment at Georgia Tech, the investigators are measuring student progress by administering three assessment pieces to students. Examples of all three pieces will be shared during the presentation.

First, to assess student improvement in technical writing, each student completes a written exercise at the beginning and end of the semester. The exercise is designed to measure change in writers' abilities in audience analysis; clear and persuasive argumentation; organization, style, and clarity; and document design.

Second, attitudinal surveys are distributed. These instruments are designed to measure change in the levels of students' confidence in their communication skills from the beginning of the semester to the end.

Third, a focus group of computer science students from the past year will be conducted to determine student satisfaction and how capably the curriculum has met their needs.

VII. Future Work

Content and delivery of curricula will be modified in response to results from the assessments. Student feedback from questionnaires and surveys will be applied to facilitate understanding and application of materials. Faculty input will continue to be implemented to ensure that the workforce curriculum is effectively integrated into technical communication instruction. In this way, the curriculum will provide computer science students with a balance of general rhetorical skills, relevant assignments from the computer science field, and models from the workforce.

A web site housing a database will be developed that provides criteria to evaluate workforce communication and workforce materials edited for anonymity. The site will be easy to access through a simple user name and password interface that will help us record the number of viewers, their academic status, their major, and their home institution. We also hope that a web site will aid in disseminating our research.

In addition to general background information, we have dedicated time in the interviews to discussing corporate culture, which we have simply defined as "the values and expectations of a company." This topic has elicited generous responses, though interviewees are somewhat surprised to be asked directly about this factor of their work environment. One respondent characterized computer science professionals as "competitive, type A" personalities who can thrive in a competitive environment, and offered the advice, "Learn to listen." Other professionals suggested, "Don't be shy, but be careful and remember to speak within the confines of your direct manager's comfort level." "Keep in mind that one of your most important audiences is management—learn to 'talk finance' and always ask, 'What does it mean to management?'" Another professional took up the same theme and encouraged computer science

majors to “be able to handle money issues—do you think Bill Gates is still just writing code?” Several people emphasized the need for “people skills” and characterized their advanced roles as “translators” who must be able to understand and communicate with both management and technical experts. This topic of corporate culture and strategies to navigate professional environments is currently being developed into a separate teaching tool. This piece will include an edited video of a panel of computer science professionals discussing different instantiations of corporate culture and effective ways of succeeding in the societal realm of non-academic work environments.

Finally, we will seek to teach communication courses in tandem with faculty and other courses in the College of Computing with the intent of emphasizing the importance and applicability of communication skills in several components of students’ training.

Biographical Information

X. Biographical Information

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Dr. McNair is the Associate Director of the Communication Program in the School of Literature, Communications, and Culture and a faculty member at Georgia Tech. She teaches a variety of communication courses and has done research and curriculum development for SRA/McGraw Hill and for a number of universities. Dr. McNair has also assisted in the workplace communication research and has co-authored communication instruction for engineering undergraduates.

JUDITH SHAUL NORBACK

Dr. Norback is the Director of Workplace and Academic Communication in Industrial and Systems Engineering and a faculty member at Georgia Tech. Before arriving at Tech five years ago, she headed her own firm, the Center for Skills Enhancement. She conducted research and curriculum development on basic and communication skills for the U.S. Department of Lab, the National Skill Standards Board, and a number of universities. Since 2000, her research has focused on workplace communication skills needed by practicing engineers. She has also co-taught Senior Design, led the workplace communication research and coordinated the activities in the Communication Lab and co-authored the communication instruction for undergraduate engineers, co-taught Senior Design, and coordinated the activities of the ISyE Workforce Communication Lab.

BEN MILLER

Ben Miller is a Brittain Fellow in Technical Communication at Georgia Tech and a Doctoral Candidate in Comparative Literature at Emory University. He teaches an array of courses on Technical Communication, Literature and Science, Media Theory and the Western Canon.

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