Negotiating Comfort in Difference: Making the Case for Interdisciplinary Collaboration

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Abstract

The face of engineering education is changing. Engineering students’ education not only emphasizes technical skills learned through math, science, and computer technology, but in many cases, also has a leadership focus, manifested through an emphasis on oral communication, writing, teamwork, and ethics. In response to the growing demand for engineers to occupy positions of leadership in organizations upon graduation, engineering educators have had to rethink the approach taken to undergraduate education from one with a technical focus to one with a technical and leadership focus. One such approach involves integration through interdisciplinary collaboration. Interdisciplinarity can be described as the interaction among two or more different disciplines. An interdisciplinary group consists of persons trained in different fields of knowledge with different concepts, methods, data and terms organized into a common effort on a common problem with continuous intercommunication among the participants from the different disciplines. The purpose of this paper is to highlight the interdisciplinary collaboration between faculty and graduate students from the College of Humanities and College of Engineering at the University of Utah.

The objective of this collaboration is to prepare engineering students to be the leaders of the future by equipping them with both technical and leadership skills. So, through the integration of communication, writing, teamwork and ethics into the existing engineering curriculum, graduates of the program will be prepared to occupy positions of leadership in organizations. But, to fully understand interdisciplinary work (and its successes and failures) one must first understand that disciplines are cultures. Thus, when individuals from two or more disciplines seek to collaborate in teaching or research, the result is a “culture clash” of sorts. This clash is evident through differences in language, practices, and norms. The goal, however, is not to minimize all difference, but rather, work from a place of “comfort in difference,” whereby members of the cultures can learn about and be sensitive to said differences, but also work to co-create meaning through interaction.

This paper, then, is about “comfort in difference” and describes how interdisciplinary collaboration involves a process of socialization whereby individuals learn about each other, learn to be sensitive to difference, and work toward a common understanding through dialogue in order to realize the program’s goal.
Changes in Engineering Education

Industry and accreditation boards alike agree that the emphasis placed on technical skills, though necessary for engineering students, is not sufficient. Specifically, increased attention has been placed on so-called “soft skills” including speaking, writing, and teamwork. For example, interview responses from employers point to the increasing difficulty students have with the transition from student to professional. This difficulty, employers argue, is largely due to a lack of necessary skill development including the ability to work as a team, the ability to communicate, and an awareness of workplace expectations. Despite the fact that teamwork is an integral part of engineering life and that the importance of communication skills in engineering has a long history, students are entering the workforce largely unprepared for these aspects of their jobs. In fact, the problem with communication skills is sometimes so severe that one employer was quoted as saying, “engineers are probably the worst writers we’ve seen.” The trouble does not end with writing, however. Another interviewee responded by saying, “most of them [entry-level engineers] come to us without a good ability to deliver a presentation.” The result has been increased time and effort on-the-job having to be devoted to the development and implementation of training programs designed to target the deficiencies of these professional skills.

Similarly, the Engineering Curriculum Task Force of the College of Engineering and Applied Science at Arizona State University recommended curriculum changes due to the shortfall of engineers to meet the needs of the engineering profession. One such shortfall was the result of a lack of understanding and mastery of communication skills and ethics and professionalism. Questionnaires received from students, alumni, and industry representatives supported the task force’s recommendations. That is, all groups ranked communication skills high. Of particular importance, perhaps, is the fact that communication skills were rated second in importance behind problem recognition and solution skills by industry experts. In fact, communication skills were rated as more important than either mathematics and science skills or depth and breadth of technical skills. From this information, we can see that the insufficient development of communication skills is a chronic problem that needs to be continually addressed. The message here is not that communication skills are more important than technical skills. For, new engineers without strong technical backgrounds are likely to struggle and ultimately fail. However, this information points to the ever increasing importance of professional skill development. That is, technical knowledge is necessary, but not sufficient for success in the organization.

The Accreditation Board for Engineering and Technology (ABET) recently revised their criteria for evaluation (for accrediting engineering programs) to include (among other things) an ability to function on multidisciplinary teams, an understanding of professional and ethical responsibility, and an ability to communicate effectively. In addition, national leaders in education cite the importance of a broad-based curriculum, a curriculum that is integrative and interdisciplinary and emphasizes the non-technical aspects of engineering, including teamwork, communication skills, leadership abilities, and knowledge of ethics.

As students make the transition from student to professional, they are faced with many demands. What is becoming increasingly obvious is that technical ability is necessary, but not sufficient for successful transition from school to work. As a result, engineering educators have had to rethink
their approach to education in order to equip students with the necessary professional skills to be effective in industry.

Integration through Interdisciplinary Collaboration

In order to prepare engineering students for their future as professionals, several approaches to teaching have been employed. These include requiring completion of a technical writing course, participation in writing/speaking across the curriculum programs, integrated communication/engineering courses, and integrated communication/engineering programs. Perhaps one of the earliest actions taken in response to the criticism that engineers are poor writers was the addition of a required technical writing course. That is, engineering students in addition to taking the required math, science, and engineering courses, were required to take a technical writing course, usually offered through an English or Communication department. Students in these courses found themselves learning the basics of technical writing with a business focus, along side students from disciplines all across campus. Though a good starting point, one general course in technical writing does little to improve engineering students’ appreciation for the various forms their technical writing will take, and does even less for improvement of their speaking abilities.

A second approach is exemplified by writing/speaking across the curriculum programs. These programs move beyond the technical writing course requirement to a more specific approach, whereby writing and speaking assignments are developed specifically for the engineering curriculum and are incorporated into various courses. Students in these courses are writing and speaking about and in relation to their engineering tasks, thus gaining practical communication skills and producing documents for various purposes and audiences.

Integrated communication/engineering courses represent a third approach. These are often a part of, or result of successful writing/speaking across the curriculum programs and include a partnership between engineering faculty and faculty from other departments that emphasize speaking and writing, such as English, Technical Communication, or Communication. Finally, integrated communication/engineering programs, though rare at this point, offer minors in communication-related fields, or certificate programs in technical communication, for example.

In addition to the aforementioned approaches, many universities also have writing/speaking/communication centers that serve to provide individual tutoring to engineering students working on writing or speaking assignments. Most also offer resources to faculty and students alike, including tips on how to complete a writing or speaking assignment, as well as tips on how to evaluate said assignments.

More and more, engineering programs are moving toward interdisciplinary collaboration in the form of integration, whether it be courses, programs, or somewhere in between. The Center for Engineering Leadership at the University of Utah represents such an endeavor as faculty and graduate students from the College of Humanities work side-by-side with faculty and graduate students from the College of Engineering. Such programs, though invaluable to the students’ preparation to enter the workforce, are not without challenges. Perhaps the most prevalent challenge is the “mixing” of disciplinary conventions and expectations. Disciplines are cultures
and as such, each discipline is recognizable through various norms, roles, rituals, language, etc. When two different cultures converge, a clash results, that if not addressed, can prove to undermine the work of integration and ultimately prove detrimental to the students’ educational experience. I will now explain our approach to collaboration and highlight the cultural differences that have surfaced as a result of this joint effort.

Present Case: Collaborative Efforts and Cultural Differences

In response to the demand that engineering graduates be able to communicate effectively, work in teams productively, and have a sophisticated understanding of ethics, an interdisciplinary endeavor has been undertaken. Specifically, the College of Humanities and the College of Engineering have joined forces to provide undergraduate engineering students with both the technical knowledge and professional skills to occupy positions of leadership in organizations. This approach is integrated in that students receive instruction in communication, team dynamics, and ethics in their engineering courses while learning engineering principles. This situated approach not only improves students’ understanding of the “soft skills” but also improves their learning of the technical material, or engineering science.

The structure is such that graduate students from the Communication Department, the University Writing Program, and the Philosophy Department attend engineering courses, lecture/lead class discussions, and provide feedback on student performance. These consultants work side-by-side with engineering faculty and graduate students. As such, cultures collide and even the most subtle differences are pronounced and can create an environment that makes collaboration challenging at best and impossible at worst. Classroom discussions, interaction with faculty and students, and communication in meetings have illuminated some of the cultural differences that are present in assumptions and language. Not only are there broad cultural differences between the humanities and engineering, but there are also cultural differences across engineering departments, thus complicating the collaboration.

Currently, the collaboration includes the departments of Mechanical Engineering (ME EN), Chemical and Fuels Engineering (CHFEN), and Civil and Environmental Engineering (CVEEN). I will briefly summarize our work in each department. Our efforts in Mechanical Engineering, a department with a seven year history of collaboration, have emphasized the development of a departmental template. Because communication skills have been the focus of integration for several years, the focus has shifted to include development and expansion of teamwork, as well as the incorporation of communication and composition theory. See figure 1 as an example.

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¹ Graduate teaching assistants are referred to as consultants because they do not assume the same responsibilities as traditional teaching assistants. Though they lecture periodically and provide feedback to students, they do not act as graders, a conception commonly associated with the title, teaching assistant. As a result, we refer to them as consultants to minimize confusion regarding their role in the classroom.

² For the purpose of this paper, I will only focus on the generalities across engineering departments. That is, I will highlight the cultural nuances that we, as members of the humanities discipline, have observed when interacting with both faculty and students.
Although this chart is not all encompassing, it does provide an example of the theoretical grounding, abstract concepts, and professional skills the students are exposed to each year. It is imperative that students receive professional skills instruction throughout their four plus years at the university. As a result, we introduce students to communication skills, teamwork, and ethics at the freshman level, and gradually progress to their senior year, at which time, they should have developed a sophisticated understanding of these professional skills.

This is our first attempt at integration in the departments of Chemical and Fuels Engineering and Civil and Environmental Engineering. As such, our efforts have been primarily experimental and diagnostic, rather than developmental. That is, we have observed the classes and diagnosed some opportunities for student learning and improvement and have experimented with in-class exercises and lectures. Because integration is in the formative stages, we have not yet begun to develop a theoretically grounded template for these departments. Instead, we have experimented with speaking, writing, and teamwork in several courses as figures 2 and 3 indicate.

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I am omitting a deep discussion of ethics for the purpose of this paper. The integration of ethics instruction is in its formative stages and we have developed a junior level course that was collaboratively created by both engineering and philosophy faculty. This course is team taught, and relies heavily on guest speakers from industry to share their experiences and provide case studies. As a result, my focus is on the communication skills and teamwork aspects of this project.
As evidenced in the above charts, we have followed a similar approach as that taken in Mechanical Engineering. That is, we have tried to work with classes (whenever possible) at each level, freshman through senior. Because our collaboration is so new, we worked with the faculty per their requests and tried to both learn about the curriculum and courses and also help students as best we could. We had numerous meetings to try and brainstorm how we might best integrate communication skills and teamwork, and communication consultants attended classes every week.

Our involvement in these three departments has been extensive and as a result, we have encountered numerous cultural differences, that, if left unaddressed, could adversely affect the success of this program. Examples of the cultural assumptions we have observed to be associated with the engineering discipline include, but are not limited to the following:

- Conception of writing and speaking as secondary processes to engineering
- Conception or writing and learning to write as limited to proofreading and editing
- Assumption that communication skills are adequate and that adequate is good enough
- Assumption that communication consultants are graders
- Assumption that content and form can be separated for grading purposes
- Assumption that professional skill development must supplant technical skill development
Assumption that communication only occurs with other engineers
Assumption that communication consultants lack the necessary engineering knowledge to be credible in the classroom
Assumption that consultants are available any time for drop-in meetings
Assumption that communication skills are learned rather than developmental
Conception of the engineering discipline as inherently masculine and the communication/writing discipline as inherently feminine

In contrast, those who are associated with the communication/writing disciplines work from a different set of assumptions. Not surprisingly, the assumptions are most often in direct opposition to those associated with members of the engineering discipline. The cultural assumptions associated with members of the discipline of humanities are as follows:

- Conception of writing and speaking as integral to engineering
- Conception of writing and learning to write as an exercise in critical thinking
- Assumption that communication skills are adequate, but that adequate is not good enough
- Assumption that communication consultants are providers of feedback designed to improve performance
- Assumption that content and form cannot be separated for grading purposes or otherwise
- Assumption that professional skill development enhances technical skill development
- Assumption that communication occurs with multiple audiences, not just other engineers
- Assumption that a limited knowledge of engineering, coupled with knowledge of communication, facilitates credibility
- Assumption that meetings must be scheduled in advance
- Assumption that communication skills, like technical, engineering skills are developmental
- Conception of the engineering discipline as inherently masculine
- Assumption that engineering faculty and students must be taught to “see the error of their ways”
- Assumption that all engineering students are lacking with respect to communication skills

It may seem that these differences are too pronounced for fruitful collaboration to ever take place. Quite the contrary, however, it is because of these differences that collaboration is possible and rewarding. Although it may appear as though conversion is the only possible answer, it is possible to work together, from different disciplines with different assumptions, as long as trust and respect are fostered. With trust and respect, it is possible to negotiate comfort in difference.

Comfort in Difference

The approach that I am advocating for working with the cultural differences is one of negotiating comfort in difference. It is naïve to assume that conversion is possible. In fact, conversion is not desirable\(^iv\). Rather, we should learn to appreciate our differences and work within them.

\(^iv\) Conversion in this sense refers to Humanities faculty and staff “showing” the Engineering faculty and staff the flawed nature of their thinking with respect to communication and professional skill development. Although some of the assumptions are likely to impede true collaboration (i.e. communication skill development must supplant...
comfortably. How do we go about negotiating comfort in difference? Awareness, dialogue, and trust represent the three keys negotiating comfort in difference; they allow us to lessen the magnitude of the cultural differences so that we might work together not despite of the differences, but because of them.

First, and perhaps the most basic approach to negotiating comfort in difference, is the mere awareness that individuals with different disciplinary backgrounds are likely to have different assumptions. These assumptions are not inherently better or worse than any other, they are just assumptions. Recognition of differences and understanding the normalcy of these differences can go a long way to promoting comfort even in the face of disciplinary division. So, for example, if we as humanities faculty are aware of the assumption (on the part of engineering faculty) that content and form can and should be separated for grading purposes, even though we believe otherwise, it helps us to work side-by-side with engineering faculty to understand that this is their position. This does not mean that we compromise our educational principles and separate content and form when providing students with feedback; rather, we share our assumptions and engage in dialogue about the merits and drawbacks of both viewpoints, the second level of negotiating comfort in difference, to which I now turn.

The second level of negotiating comfort in difference is dialogue. So, while awareness of differences if a very important first level of comfort, it is through dialogue that we can clarify and question the assumptions. We often forget just how fruitful dialogue can be when taking on a disciplinary project of this nature, but it is through dialogue that latent beliefs become manifest. Dialogue not only enables us to clarify each other’s assumptions, it also makes apparent the rationale behind such assumptions. For example, if humanities faculty assume that professional skill development enhances technical skill development and engineering faculty assume that professional skill development supplants technical skill development, dialogue about each of these positions will illuminate the reasons why such positions exist. For instance, studies show that learners remember 10% of what they read, 26% of what they hear, 30% of what they see, 50% of what they see and hear, 70% of what they say, and 90% of what they say as they become more engaged academically. This is the reason humanities faculty argue that speaking and writing in the engineering classroom need not supplant, but rather enhances students’ learning of engineering concepts. If we engage in dialogue about this, it is possible to come to an understanding about the critical role professional skill development plays in the mastery of the engineering curriculum.

Awareness of differences and dialogue about those differences are important, but not sufficient. The third level of negotiating comfort in difference is fostering an atmosphere of trust. In other words, awareness of difference leads to dialogue which serves to clarify and increase understanding of difference, which in turn, fosters trust. Through dialogue, we learn that we all have the students’ best interest in mind, regardless of our beliefs about how to best equip students with the proper skills and knowledge to be successful upon graduation. So, if we trust that both engineering and humanities faculty are student-focused, rather than personally focused (technical skill development), it is not in the best interest of this type of program for one group to convert another. Rather, through trial and error and experimentation with various assignments and exercises in the classroom, engineering faculty and staff are likely to modify their thinking as a result of student success. This is far more powerful and much more positive than one group converting another.
This cooperative atmosphere, in turn, fosters a common sense of ownership for the program, thus enhancing commitment to its success. It is this commitment to success that enables both Engineering and Humanities faculty to experiment in the classroom and decide how best to engage students in active learning of engineering and professional skills.

Although awareness, dialogue, and trust are somewhat abstract concepts, they represent the foundation of negotiating comfort in difference. From here, tangible activities (i.e. faculty workshops, joint research projects, teaching and learning symposiums) can promote moving beyond the cultural differences to finding a space of cultural similarity. These are not possible, however, without the foundation of comfort in difference. The goal is to move beyond the bifurcation of engineering versus humanities and the notion of an either/or approach to one that incorporates a dialectical approach, that embraces contradictory opposites. It is through communication that patterns of stability and change are negotiated. Through this communication and periods of stability and change, we can embrace both engineering and communication. It is this notion of embracing the both/and that exemplifies negotiating comfort in difference.

The Spirit of Collaboration: Concluding Remarks

Engineering education is changing. Technical skill development is no longer sufficient to prepare graduates for the transition from student to professional. Industry experts and accreditation boards are calling for more attention to professional skill development. Requiring an additional course in writing/communication/technical communication is not meeting students’ needs. Rather, students benefit from the integration of communication and teamwork skills, such that they need to be developed and honed over the course of several years, much like engineering skills. It is our goal at the Center for Engineering Leadership to develop innovative ways for students to learn about and through communication.

Interdisciplinary collaboration of this magnitude is no easy task. Collaboration is time consuming, but also rewarding for both faculty and students. Our philosophy of collaboration can be summarized with one word – patience. We have to be patient and fully understand departmental needs, course material, and cultures before we can begin to develop curriculum that will positively and meaningfully impact students. To facilitate collaboration in the spirit of patience, frequent communication is required in order to negotiate expectations and roles and to learn from each other so that we might engage in best practices for integration. Through awareness, dialogue, and trust we are striving to negotiate comfort in difference.

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References


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