

Need for Public Speaking in the Engineering Curriculum

Dan Budny and Tim Tallon, University of Pittsburgh

Abstract - *When considering the skills of an engineer, one might say that he/she must have sharp technical skills – be good in math and science. Others might say that an engineer should be able to problem solve effectively. While both of these views are correct, they are also, as of more recently, incomplete. With the changing of modern business practices, employers are saying that their engineers must also be – now more than ever – confident public speakers and leaders. The widespread change in employers’ views resonated deeply into the engineering education community, even shaping the criteria for ABET accreditation. Following these changes, engineering universities have experimented with developing the public speaking and leadership skills of their students in a variety of ways – some successful, while others not as fruitful. Although well-intentioned, many of these experiments get implemented without a thorough evaluation on their helpfulness to students. Until the approaches of these skills are formally assessed, universities will not fully understand the consequences of their curriculum.*

Key Words – *public speaking, communication skills, leadership, teamwork, engineering education.*

There is a Need

Current ABET accreditation requirements emphasize the importance of “soft” skills in planning and achieving excellence in engineering education. What engineers need to experience and know, in addition to “hard” knowledge, is “process-oriented skills and awareness-oriented skills” [1]. Process-oriented skills include “communication, teamwork, and the ability to recognize and resolve ethical dilemmas” [1]. These skills are powerful when combined with awareness skills involving “understanding the impact of global and social factors, knowledge of contemporary issues, and the ability to do lifelong learning” [1]. But what are the most effective ways of incorporating process and awareness-oriented practices into engineering curricula already crowded with necessary science, math, and disciplinary courses? How can engineering schools, which must ensure that their students graduate with sound hard skills, also ensure they are graduating engineers who have encountered and practiced communication, teamwork, and the ability to recognize and resolve ethical dilemmas; who are cognizant of the potentially enormous social impact of engineering; and who have skills which facilitate lifelong learning in these very areas?

Schools of engineering are parts of larger educational institutions, and, as such, have the opportunity and obligation to make the best use of the resources a whole university has to offer. Here at the University of Pittsburgh, the Swanson School of Engineering faculty and administration have worked in tandem with librarians and with faculty from the English Department’s Composition Program to develop tools and projects to increase students’ engagement with the “soft skills” of communication and aware, responsible professionalism. The Swanson School of Engineering has made curricular moves that require students to see the

importance of research and writing in learning about engineering and the importance of communication to engineering excellence even beyond the college years.

However, successful engineers must also rely on strong communication skills in nearly every aspect of their work [2, 3]. Currently, engineering curricula prepare students for the job market's technical writing demands, but do they equip students with the necessary public speaking or leadership skills?

What the Industry Expects

From an employer's point of view, public speaking and leadership skills are non-negotiable. According to the NACE's Job Outlook 2010, communication skills rank at the top of employers' lists in skills they seek in potential employees [4]. From this same survey, the ability to work in teams (leadership) also ranks as third most important [3]. According to the Occupational Outlook Handbook, employers seek "engineers and scientists who possess administrative and communication skills in addition to technical knowledge in their specialty. The reason industry puts such a large demand on these skills is because engineers must effectively lead groups and coordinate projects" [3].

The Need for More Guidance

In a recent survey, over 60% of entry-level engineer employers deemed communication skills as "needing increased emphasis" in engineering education. Moreover, 2 of the top 10 required skills ranked as important to engineering practice related to making oral presentations. Despite the importance of these skills, not all universities require public speaking instruction for students [5].

Universities provide writing and communication skills through the general education elective requirements. However, with the variety of course offerings a student can select courses which may require writing assignments but avoid any public speaking. Thus, the humanities and social science electives may not provide the background required by industry.

The engineering curriculum tries to address this communication need by having lab report and project report requirements but again most of these fall short in proving public speaking. The senior design courses require an oral presentation by every student, but these courses typically come in the last semester and thus, do not provide the required practice and repetitive exposure that is needed to become effective at public speaking.

Students and Anxiety

Poor presentational skills can compromise a student's credibility and image in their field [5]. In one study, an engineering professor and his TAs observed students with no formal public speaking training. They identified students' common habits while speaking in public, which are listed below:

1. High levels of anxiety,
2. Gaps in organizational focus,
3. Poor delivery skills,

4. Awkward presentation format,
5. Poorly prepared visuals, and
6. Unprofessional dress.

The author also noted that habits will only persist until they are formally addressed in an environment conducive to learning speaking.

What students' need is the same formal education in public speaking as they do in any science field. In the sciences we begin with the basics in an introductory course, and then the concepts are improved with follow up experiences in the second and third year, until the student demonstrates his/her proficiency in the senior design course.

Pitt's Actions and Classes

At the University of Pittsburgh, engineering students have the option to take one of two public speaking classes:

- (1) Public Speaking (COMMRC 0520) and
- (2) Communication Skills for Engineers (ENGR 1010)

Although these classes address these skills, they only reach out to a few. For example, "Communication Skills for Engineers" is only offered in the Spring term, seating 50 students at a time. Fifty students may seem like a lot, but there are roughly 2,000 undergraduate engineering students at the University of Pittsburgh main campus alone [6]. As long as these public speaking classes are limited and optional, the majority of engineering students will lack formal presentation and public speaking training.

In addition, ABET accreditation requires communication skills to be developed in engineering classes, normally taking the form of group presentations and team-based assignments. Although these efforts are giving students practice, they lack:

- (1) Personal feedback to know where to improve their skills,
- (2) Consistent and long-term practice to build confidence [2].

To address these issues the Freshman Program at the university has added a writing and communication component into the first two Introduction to Engineering courses. In the fall all students must take ENGR0011, the first semester Problem Solving course, and ENGR0081 the first semester seminar course. ENGR0011 has an extensive writing component that involves a semester long project that produces 4 written projects and a presentation at the end of the semester. The presentation component is integrated into the Peer Mentor component of ENGR0081. Thus, this presentation fulfills the first step or introductory exposure of public speaking for every student. By having the student presentation in the small mentor section, less than 15 students, the student's first public speaking experience takes place in a very friendly and informal setting. This addresses the anxiety issue stated above. In addition, by having four independent writing assignments throughout the semester, that each produce a milestone production, we are also addressing item 2 above, by providing the organizational focus needed

by novice public speakers. The mentors also meet with each student one-on-one and review the presentation before and after the first presentation, to provide feedback prior to the formal presentation. This allows us to address format, visual aids, and delivery skills, with each student.

During the second semester Problem solving course, ENGR0012, continues the development of the student communication skills. During this class each student presents a formal technical paper in a professional conference setting. As during the first semester, the project is broken down into five milestones to assist the students in the development of the format and structure. Once again the students meet each week with their peer mentors to discuss their paper process. In addition, we add evaluation by outside practicing engineers. Since the papers are going to be presented at the freshman conference, which involves some 130 papers, the conference must be divided into 30 concurrent sessions. Each session is assigned an practicing engineer to act as the session chair. These session chairs meet with the students at least twice during the preparation process to assist the students with their written paper and oral presentation. By adding the professional engineers into the process we are able to address issues on profession dress and proper presentation formats.

Thinking Outside the Classroom

The introduction to public speaking in the freshman year is a great start, but without additional follow-up courses, many of the skills learned in the freshman year will be lost by the time the student gets to the senior design course. Because of the lack of classes offered, we must look to other alternative opportunities for public speaking and leadership.

The University of Pittsburgh identified several ways to promote students public speaking and leadership through:

1. Better publicizing the Pitt Emerging Leaders Program to Engineering students;
2. Better publicizing the Pitt Freshman Engineering Leadership Team (FELT)
3. Encourage students to become involved with the freshman conference
4. Requiring Engineering students to take at least one Public Speaking class;
5. Giving more thorough evaluations of in-class presentations;
6. Holding in-class debates to help students think on their feet;
7. Establishing a Toastmasters club for Engineering students;
8. Implementing a workshop on Public Speaking [2, 5].

The Pitt Emerging Leaders Program

As quoted from the program, “The Emerging Leaders Program has been designed to complement your classroom and student life experiences by focusing on the behaviors that strengthen your personal effectiveness and leadership development. The Emerging Leaders Program is a part of the Cross Culture and Leadership Development office's initiative to create thoughtful, Impactful global leaders” [7].

This program offers a unique a personal leadership development program for all undergraduate students at Pitt. Participants are introduced to the fundamentals of leadership, including self-

knowledge, valuing others, personal accountability, integrity, and change [7]. This program provides learners with opportunities to:

- Explore and assess your leadership skills and style
- Practice and experiment with new leadership behavior
- Receive feedback on your style and behavior
- Plan for your on-going leadership development [7]

By better publicizing or even requiring this program, more engineering students could benefit from this more formalized leadership program.

Freshman Engineering Leadership Team (FELT)

The Freshman Engineering Leadership Team are student leaders in the School of Engineering who help ease the transition of freshmen from high school to college [8]. Overall, the team is comprised of student Ambassadors and student Peer Advisors. The FELT Ambassadors help acquaint prospective students with Pitt's Swanson School of Engineering by giving campus tours and by assisting with various recruitment and admissions programs. The FELT Peer Advisors assist current freshmen with registration, are available for consultation daily, and offer a variety of ongoing workshops that help students master time management, study skills, and test preparation strategies. These students also manage the ENGR0081 small seminar sections during the fall and assist the freshman students with their first semester presentation. The combination of these positions gives the FELT students the ability to speak in front of varying groups and lead their freshman or tour groups.

Freshman Conference

As noted above each freshman must present a paper during the second semester at the freshman conference. Over the past ten years, a variety of administrative procedures have been used to supervise the conference and improve the environment for the freshman. Five years ago it was decided to add Co-chairs to each of the conference sessions. The Co-chairs were under graduate students that participated in the conference during their freshman year. The Co-Chairs permitted us to meet with the students every week instead of only twice during the semester. The addition of the Co-Chairs has greatly improved the quality of the freshman presentations. However, the Co-chairs now also give the upper class engineering students the opportunity to also increase their group leadership and public speaking skills. This has resulted in a win-win situation that allows the Swanson School of Engineering the ability to work in an academic classroom setting with the present freshman and to work outside the classroom with the upper class engineering students.

Required Public Speaking Courses

As mentioned earlier, there are communication courses offered, but many times not required. A simple departmental requirement would drive students to more formally practice their speaking skills. However, this also put a burden on the humanities department to offer more sections of the course. Thus, this may be a good solution, but not one that can be controlled by the school of engineering.

Better In-Class Evaluations

Most of the classes that require in-class presentations do not give complete evaluations on students' public speaking skills. By providing students with a written evaluation on their presentation skills – eye contact, vocal variety, body language, etc – students will know where they can focus their attention when presenting. An evaluation of the presentations, as simple as listing students' strengths, places to improve, and comments on their style will go a long way to improving the students ability. The main problem with this solution is it requires that the person doing the evaluation has the necessary skills and time to provide meaningful feedback. In the typical engineering lab setting many of the TAs are ESL students. Since English is their secondary language they may not feel comfortable providing feedback.

In-Class Debates

A simple way to integrate these skills into an engineering course would be to require a student debate or in-class discussion. Before exams or after a major paper, students could report their findings and defend their results in an in-class debate. This would give students the opportunity to think on their feet and practice their “real”-world engineering impromptu speaking skills.

Toastmasters International

To personally address these issues the author became active in Toastmasters International. The basic Toastmasters International program is summarized in Table 1.

The value of being involved in this organization provided training that was impossible to get from the limited course offerings at the university. Thus, as a structured and potentially long-term solution, we propose establishing a Pitt Engineering Toastmasters club that could provide an opportunity to help engineering students develop these skills.

Beyond academia, more than 850 companies have started corporate Toastmasters clubs for their employees. Of these companies, many of them are engineering firms, including Dow Chemicals, ExxonMobil, Emerson Process Management, and Zachary Engineering Corporation [9]. In the spirit of developing public speaking and leadership skills, a Toastmasters-related club or event has the consistent and proper potential to prepare engineering students.

TABLE 1
WHAT IS TOASTMASTERS INTERNATIONAL [9]

Toastmasters International (TI) is the world's leading non-profit educational organization that helps its members to develop their communication and leadership skills in a positive, supportive environment.
Background: Founded in the basement of a YMCA in Santa Ana, California, Ralph C. Smedley held the first meeting of what would eventually become Toastmasters International in 1924. Today, TI is headquartered in Rancho Santa Margarita, California, and serves more than 250,000 members in more than 12,500 clubs in 106 countries.
Members Have the Opportunity to: • Learn and practice techniques of effective public speaking. • Prepare and deliver formal speeches on subjects of their own choosing. • Give impromptu talks on assigned topics. • Gain speaking experience that relates to specific career needs. • Sharpen their listening/evaluation skills. • Learn proper parliamentary procedure. • Preside as a meeting chairman. • Gain valuable leadership management experience • Gain personal confidence that will help when speaking to one person or one thousand. • Enter Toastmasters International's Annual Speech Contest, "The World Championship of Public Speaking."

Workshop on Public Speaking

Lake Superior State College held a 90-minute workshop that benefitted its students. Although not equivalent to a class or Toastmasters club, such a workshop could give students a clear direction to giving presentations and leading teams. Thus, it is also proposed that a student organization such as the Engineering Student Organization could take the lead on organizing student workshops throughout the year. At the present the Civil Engineering ASCE chapter holds review sessions for the FIE exam, so a similar format could also be used to promote public speaking.

Summary

By offering students more public speaking and leadership opportunities, a larger percentage of the engineering student population could improve their "soft skills." As a possible curricular alternative, an active Toastmasters club could provide the long term public speaking opportunity for a large number of students. Although Toastmasters is a reliable option, there are several more decentralized alternatives that can be implemented to help students. These include:

- (1) Better publicizing the Pitt Emerging Leaders Program to Engineering students;
- (2) Requiring Engineering students to take at least one Public Speaking class;
- (3) Increase the number of upper class students into the Freshman Conference;
- (4) Giving more thorough evaluations of in-class presentations;
- (5) Holding in-class debates to help students think on their feet;

(6) Implementing a workshop on Public Speaking [2, 5].

References

- [1] Shuman, L., Besterfield-Sacre, M., McGourty, J. 2005. "The ABET 'Professional Skills'—Can They be Taught? Can They be Assessed?" *Journal of Engineering Education*. 94:1 (41-55)
- [2] Ford, Julie. D. and Scott W. Teare. "Communicating Design: A Multidisciplinary Approach towards Engineering Capstone Design Courses" New Mexico Institute of Mining and Technology.
- [3] Bureau of Labor Statistics. "Engineers" Occupational Outlook Handbook 2010-11. <http://www.bls.gov/>
- [4] NACE. Job Outlook 2010. <<http://www.nacweb.org>>
- [5] Hayward, Pamela A. "Public Speaking 101: In 90 Minutes or Less." American Society for Engineering Education Annual Conference. June 1996.
- [6] University of Pittsburgh Swanson School of Engineering. "Quick Facts" <<http://www.engr.pitt.edu>>
- [7] University of Pittsburgh. "Emerging Leaders Program." <http://www.emergingleaders.pitt.edu/>
- [8] University of Pittsburgh Swanson School of Engineering. "Freshman Engineering Leadership Team" <<http://www.ie.pitt.edu/freshman/about/felt.html>>
- [9] Toastmasters International. "Corporate Sponsors" <<http://www.toastmasters.org>>