
AC 2011-636: ROLE MODELS IN ENGINEERING

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Communication Skills and the Importance of Role Models

Abstract

The promise of articulate engineers able to construct concise papers directing their audiences to exact interpretations is the wish of all engineering departments. Engineers who are both well versed in their areas of expertise and able to convey this information have been a goal of colleges of engineering for decades. English departments on every campus in the country have performed the task of giving information on writing and sometimes presentation skills to engineering students on a one or two class basis. This one-time basis has constituted an engineer's indoctrination into communication skills (mostly attached to skills oriented to the arts and letters). Once this internship is over, the experience (whether good or bad) is placed behind (usually on a cold, back burner), and the engineers immerse themselves in their technical study, usually devoid of communication skill concern. The time has arrived for a simple fact to be made known. The most important role models in the area of communication skills are individuals who have always been in the engineering student's sight, the engineering professors. Professors in the engineering departments, as in most majors, are the focal point of their students, and their words far outdistance comments from individuals outside the major area. By uniting the faculty in a concerted effort to explore and improve communication skills, both engineering students and the world in general will profit. By analyzing what is done in each course in the engineer's major, by creating a continuum of communication skill instruction and evaluation in every department, and by utilizing in-place (through careful discussion) technical assignments to emphasize needed communication; the engineering student will be more willing to accept and investigate the need for communication skills.

This paper addresses the need for members of all engineering departments to express to their colleagues the various ways in which they use written and oral communication techniques in their courses. There is also an equal responsibility for department chairpersons to further the dissemination of communication skill information to their department members. Individual faculty members should also think beyond the assignments that are given to students to issues that are raised in their own writing and speaking. These activities are important to students so that they can see the necessity of communicating well for their future success. Students will more readily accept the premise that communication is a vital part of an engineer's life if they are given that information along with their technical material and in the context that college professors have to spend a great amount of time writing, too.

Introduction

A great deal of text has been devoted to the issue of creating good communicators out of engineers who are educated in traditional technical courses. Vast numbers of articles and books have suggested ways to ensure that at least the outward look of a writer's effort conforms to acceptable norms. Classes are required, papers are assigned, some comments are voiced; but in so many cases the retention of communication skill is not assured and does not become an integral part of the engineer's existence. Engineers need to understand the bond between their technical knowledge and

their communication skills. This bond must be accomplished in the most efficient amount of time so that it creates a lasting awareness of technical communication and its importance in every engineer's career. This is especially important in an engineer's education where time is critical and the direct reflection of the importance of elements in the educational system must be clearly understood by the student.

The required courses of the typical engineer offer little room for flexibility. By the junior and senior years, students are fairly programmed into set schedules. Engineers, then, must be provided with something that will give them the skills to produce the text needed to survive in the real world and do it in a manner that requires the least amount of superfluous effort. Supplying large numbers of writing courses will not improve the situation. Since there is no room in the schedule of the engineer, these courses will not be taken even if there is a definite awareness of need on the part of the student. Something must be done and the means is closer than one thinks.

Analysis

There exists in every college of engineering a vast untapped resource that up to this time seems to be ignored by the seekers of improved writing effort. The resource is the engineering faculty itself. No members of any department have reached their positions without producing large amounts of text and presenting information to a variety of audiences. Papers written in their undergraduate years, theses, dissertations, textbooks, and the endless number of articles prepared for proceedings, magazines, conferences, and collaborative efforts have forced these professors to be at the forefront of text producers. It is probable that few if any professors talk about the amount of writing that they do, or the difficulties that arise as they produce text. It is also currently unlikely that many faculty members will discuss with their students the number of revisions required to make their text ready to be considered publishable material. Here is the point at which a faculty member can step in and become a critical part of the communication skill acquisition simply by being a good role model for that communication. Role models exist everywhere in the real world so why not put engineering faculty in that same category. "A role model is a person who others look up to and admire. A role model provides inspiration and motivation to seek out accomplishments. Role models send messages about their beliefs by what they do and say."¹ If you ask engineering students many will respond that that is what their instructors are. The effort should be then to convince faculty of their role (model) in the everyday action of teaching.

When you think about it, do any of these faculty ever mention the response that they receive when sending material into journals for review? With the amount of writing that is done, the amount of presenting that goes on, and the level of intellectual thinking that goes into the text produced; it would seem natural that this kind of information would be enlightening to students in every engineering course. This then fits in quite well with comments by individuals who believe in the intrinsic value of role models when people like engineering faculty, "Lead by example. Act the way you want other people to act. Think about what you are doing and how it will affect other people. Make good decision that can be passed on. Do you say things that someone might repeat? If yes, than make it something good."²

By the time students reach the junior and senior levels they have become engineers. They are listening to their instructors as mentors to the challenging careers that lie ahead. The captivating

quality of the engineering curriculum lends itself to be the base upon which communication skills are presented to engineers. Professors would not have to spend great amounts of time discussing the communicating that they do. But knowing that professors experience the same kinds of problems that students do would open up the dialogue to a better awareness of communication skills. Students would learn from and with their professors about the ways that communication develops. By talking about the individual ways that each creates text, all could benefit and learn. This is not a one-way street. Professors, too, could gain from the experience. Questions directed to them about particular communication problems might also enlighten the faculty into problems that they might be having. This in itself would promote the purposes of communication. Communication would become for students something that would allow them to learn more about what they know. Professors while teaching would also be involved in the learning process. All involved would benefit. As one writer put it, "I think mentors should be role models, BUT a role model who hasn't forgotten where s/he came from, how s/he got to where s/he is now and always looking back to see if s/he can help those that came from the very same place."³ Everyone has had to write and engineering faculty continue to have to produce text throughout their careers. By taking their own travels through communication as a means to get engineering students to look at their own tasks, a bond can form that allows for the improvement of student text.

Procedure

How does one approach a situation where the faculty is to be asked to perhaps open up to students in an area that they may not be totally comfortable? How do you get faculty members to talk about an area in which they may have problems themselves? Here the need exists for concerned members of a department to begin the process. Much like creating a text, select faculty members must become the catalyst to encourage other members to talk about communication and how they approach it in their own writing and in their courses. Discussion among faculty members will help to bring the communication issue to the forefront. As discussion continues, the particular methods used to include communication tasks in one's course will become evident. These approaches may be minimal. They may include only formal reports with little communication skill comment or simply lab write ups. But each assignment discussed will provide a connection to other engineering courses. The dialogue will allow faculty members who may be uncomfortable with the communication process to listen to others who may provide concrete help in the area. As the discussions continue among the faculty members, the links between courses can be drawn.

A continuum of communication skills awareness can be plotted over an engineer's entire course structure. Certain types of less complicated text, like the memo, can be emphasized at the beginning levels of engineering expertise, so as to allow the engineer to create the texts without being overwhelmed by them. As the student engineers progress, the degree and amount of text production can increase along with their knowledge. Professors can talk about the similar kinds of writing that they do and the ways in which they handle the writing tasks. Students should also be required to begin the process of oral presentation early in their academic careers. Professors should give their students every chance available to speak of the technical knowledge that they are learning. As interest grows, planned seminars and workshops can be provided that will emphasize the importance of the engineering faculty as the catalyst for improvement.

The structure of unified technical knowledge and communication skill can be accomplished through a concerned engineering faculty speaking about communication, not preaching about it. By

involving students in the work that they themselves do, the faculty of every engineering department can stimulate a massive movement in the production of improved engineering text. Along with the discussion on the need for a greater awareness of how text is presented the assignments that are given by each instructor can allow the students to speak their minds through short one- minute write ups at the end of class, quick 1 or 2 sentences comments about previous lectures or assignments, or memos. These short assignments combined with longer formal reports can provide the student engineer with ample ground upon which to want to improve their communication skills. Small steps in creating text and placing that text in the forefront of engineering courses can be a simple way to make of engineering students a force in the world around them.

The structure of the courses within a department could expand to all required courses as in the following. The communication elements in each course are shown below.

Fresh. Year	EGR 100 – Intro to Engineering Design Resumes, email, short engineering focused reports, engineering writing demands, problem solving, speaking, ethics, and orientation to the university/college/majors	
Soph. Year	ME 201 – Thermodynamics Student communication survey, refresher for past grammatical expertise Tools: MS Word, Email, WWW	
Junior Year	ME 302 – Fluid Mechanics Laboratory Reports: (Approx. 9 @ 4-6 pages each) Brief narrative of procedure, measured data, deduced and analyzed data, plotted results with discussion and conclusions.	ME 371 – Machine Design I Short Technical Reporting Design Analysis Reports (2 @ 4-6 pp. Individual); Technical Analysis, Economic Analysis, Recommendation for Action Tools: EES.Powerpoint
	ME 391 – Mechanical Engineering Analysis Reading, thinking, and teamwork Tools: Matlab	ME 412 – Heat Transfer Design Project Documentation: Formal Report (1 @ 10 pp. + App., Individual) Memo Reports (X @ 2 - 5 pages App., Individual) Tools: MS Word, Excel

Senior Year	<p>ME 451 – Controls</p> <p>Laboratory and Project Reports: Laboratory Experiment Written Reports (2 Formal Reports, Individual); Abstract, Nomenclature, Introduction, Analysis, Results, Discussion, and Conclusions – Teamwork (3-5 students/team), 9 short form reports, individual Tools: MS Word</p>	<p>ME 461 – Vibrations</p> <p>Laboratory and Project Reports: Laboratory Experiment Written Reports (2 Formal Reports, Individual); Abstract, Nomenclature, Introduction, Analysis, Results, Discussion, and Conclusions – Teamwork (3-5 students/team), 9 short form reports, individual Tools: MS Word, Excel, Matlab</p>
	<p>ME – 471 Machine Design II</p> <p>Design Project Documentation: Formal Design Reports Tools: C Programming, Excel, Matlab, WWW</p>	<p>ME 481 – Senior Capstone Design</p> <p>Problem Definition, Progress report, Project Report (1 @ 35- 200 pages) Detailed description of design approach, results, and conclusions, with supporting documentation Teamwork 3-5 Students/Team Multiple industry interactions, small group presentations 1 Formal presentation to industry, faculty, and student audience Tools: MS Word, Excel, Matlab, WWW, Powerpoint</p>

Conclusions

Industry is voicing its concern to all colleges and universities that students must learn to communicate more effectively. The pressure is growing from the outside to improve the performance of graduates. With that discussion can come the ways to at least inform students of the importance of communication skills in their lives. The gulf between the sciences and the humanities must be bridged and the need for communication skill expertise must be an integral part of every engineer's existence. Every faculty member must approach the following points with an open mind.

1. The importance of communication skill expertise must come from the faculty in order to create a lasting impression upon engineering students.
2. An equality between what is known and how it is presented must be created in order to make communication skills valuable.
3. The Faculty must see itself as a vital link in the communication process.

As the faculty takes its place as the leader in communication skill direction, the engineering student will become more and more compatible with the needs of the world.

References

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3 http://www.techup.org/mentor/mn_rolemd.html