

Introducing Presentation Skills in Freshman Engineering

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Mastering the art of technical presentations is critical for engineers and scientists. Teaching these skills presents certain challenges: How do we provide authentic subject matter and authentic presentation conditions with real audiences in an academic setting? How do we avoid instilling the bad habits that have become the norm for this genre? How do we provide students with enough opportunities to present so that they can practice the skills they are learning? These and other issues are being addressed in our introductory engineering course, EG 1004 *Introduction to Engineering and Design*.

This paper offers suggestions for introducing presentation skills early in the engineering curriculum. ABET Criterion G, an ability to communicate effectively, includes the ability to communicate orally. This criterion has often been met by offering a traditional speech class. While these courses are very effective in providing an opportunity to practice and master the skills needed for competent public speaking, the set of skills required to deliver an effective technical presentation is very different. They include: audience analysis, research, organization of material, the selection of appropriate media, and the creation of effective graphics. In addition, emphasis must be placed on successful strategies for dealing with the presentation of numbers and other technical data.

The paper concludes with a discussion of the differences in teaching presentation skills in a dedicated technical communication course, and in a technical course that requires weekly presentations. The advantage and disadvantage of each strategy will be explored. Suggestions for introducing this material in other courses will be offered.

Introduction

There are a number of strategies that can be employed to teach technical presentation skills. The merits of the different approaches are open to debate; the necessity of addressing these skills early in the engineering curriculum is less controversial. ABET Criterion 3: Program Outcomes and Assessment, describes what students are expected to know or be able to do by the time they graduate. Criterion G, an ability to communicate effectively, has often been met by an introductory technical writing course and a speech class. We know that our students will have to present information orally throughout their careers. We also know that the accurate presentation of complex technical data is difficult. The set of skills required is not the same as the one addressed in a typical speech class. It is therefore important to develop a curriculum specific to the needs of engineers and scientists. Audience analysis, research, organization of material, the selection of appropriate media, the creation of effective graphics, and understanding useful

strategies for dealing with the presentation of numbers and other technical data are critical steps in designing successful presentations.

Introducing these skills early in the engineering curriculum has proven successful at Polytechnic. By building the study and practice of technical presentations into our introductory design course, we have emphasized their importance and provided the foundation necessary for the development of these skills as our students advance in their academic careers.

Background

EG 1004, Introduction to Engineering and Design, is Polytechnic University's introduction to selected aspects of the history, philosophy, methodology, tools, and contemporary topics in engineering. It includes a weekly lab component that introduces basic engineering experimentation and data analysis. Lab reports provide an opportunity for the written assessment of engineering data and designs. Weekly presentations allow for the oral presentation of this analysis. In addition, there is a team design project. Three milestone presentations and a final written proposal and oral presentation are required for the successful completion of this semester-long project.

The course is composed of a weekly three hour lab, a two hour recitation and a one hour lecture. Each week, during Recitation, our students are required to present the data they collected in the previous week's lab. They present in teams of two, using Microsoft PowerPoint to prepare their presentation slides. These talks are typically 5 or 10 minutes long. There are 9 reports in all.

For the final project, our students are asked to either build a robot to accomplish one of three complex tasks, to design and program a guidance system using digital logic to safely direct trains along a section of track, or to design a supermarket, with power, heating, and refrigeration specifications, including a scale model and a three dimensional drawing using AutoCAD. During the course of the semester, the student teams present three milestone reports documenting their progress, and a final presentation, during which they pitch their project to a prospective buyer. Unlike the lab report presentations, these are persuasive in nature and are designed to provide another perspective on the techniques critical to a good technical presentation.

Findings

A design course with lab work is an ideal venue for the introduction of technical presentation skills. There are real results to report and real data to be interpreted and discussed. Each week, our students are required to present the information they collected in lab and explain its significance. This allows them to avoid the canned nature of many presentations delivered in academic settings. They present to their classmates and instructors, a live audience of about 20, and are critiqued as soon as they are finished.

The opportunity to present often is another key to the successful mastery of presentation skills. Each of our students prepares and delivers 13 presentations over the course of a 13 week semester. By the time they deliver their last one, they feel like experts. Our returning students tell us that this experience has alleviated the stress that is typical when preparing to give a talk. In EG 1004, mastery is achieved through repetition.

Avoiding Bad Habits

The wider genre of technical presentations has received some justified criticism lately. The complex nature of many technical subjects makes discussing them difficult. Strategies for dealing with the presentation of numbers and other technical data must be developed or the presentations will obscure rather than enlighten.

Michael Alley, in his excellent text, *The Craft of Scientific Presentations*, says that often scientists "present their results without preparing the audience enough for those results. What occurs then is that the audience does not understand or fully appreciate what has been presented."

Our experience in EG has borne this out. Over the course of the semester, the instructional team stresses the critical nature of audience analysis and the development of a narrative arc that prepares the listeners for the results and provides the much needed context in which to place those results. The importance of transitions and orienting the audience to changes is also stressed. We discuss what to leave in and what to leave out, (in the beginning, they include everything) and the creation of effective graphics.

Throughout the semester, we focus on delivery issues. When our students present for the first time, they are sometimes inaudible, or speak so quickly as to be indecipherable. They jam their hands in their pockets, or stand in the front of the room with the hoods of their sweatshirts up. Almost all of them read their PowerPoint slides word-for-word, and never look out at the audience; avoiding eye contact at all costs. They block the screen, and repeat "um," and "basically," so often that these place holder words become like tics.

As the term progresses, we dissuade them of these bad habits. The number of presentations they perform allows us to focus squarely on organization, transitions, and delivery, so that by the time they are presenting Lab 10, they have added expertise as we've moved along.

Rethinking the Design of Presentation Slides

Is there anything so deadening to the soul as a PowerPoint presentation? Critics have complained about the computerized slide shows, produced with the ubiquitous software from Microsoft, since the technology was first introduced 10 years ago.¹

This excerpt from an article in the New York Times effectively sums up what all of us know about technical presentations: that they can be deadly dull.

Edward Tufte, Professor Emeritus at Yale and renowned author of, *The Visual Display of Quantitative Information*, in his essay, *"The Cognitive Style of PowerPoint"*, says:

PowerPoint is entirely presenter oriented, and not content oriented nor audience oriented...The PP slide typically shows 40 words, which is about 8 seconds worth of silent reading material...Many true statements are too long to fit as a bullet on a PowerPoint slide, but this does not mean we should abbreviate the truth to make the words fit. It means we should find a better way to make presentations.³

He complains about, "the deeply hierarchical single-path structure as the model for organizing every type of content, breaking up narrative and data into slides and minimal fragments"³

How do we help our students to avoid the preoccupation with style over substance that the use of presentation software like PowerPoint seems to encourage? And how do we avoid turning even the presentation of data and its analysis into the kind of sales pitch Tufte warns against?

By focusing our student's attention on a tool for creating presentation slides: PowerPoint, we undermine our ability to introduce the basics of considering audience and purpose, creating an outline, organizing information, deciding what to leave in and leave out, creating graphics, and delivery issues.

Michael Alley suggests a better approach in Chapter 4 of his book, *The Craft of Scientific Presentations*. Rethinking the design of presentation slides suggests two features that deviate from traditional slide work. The first is a sentence headline, rather than the more common phrase headline. He suggests that sentence headlines are able to both identify the topic and make an assertion about it. They naturally segue into the second feature, a visual representation of the subject that allows the presenter to avoid the dreaded bulleted list. Sentence headlines and key images go a long way toward avoiding much of what Tufte and others have warned against.

It is our plan to develop a PowerPoint style guide to help our students master the fine points of technical presentations. By specifying fonts, type faces, spacing, and suggesting color schemes, among other recommendations, we hope to simulate the specifications technical professionals use in industry. We also created a lecture on technical communication to be presented to the entire cohort of EG students. This presentation highlights the communication breakdown that occurred between NASA engineers and their managers during the last flight of the shuttle Columbia. While many factors led to the tragedy, the final report on the crash included a failure to communicate as a contributing factor.

Teaching Technical Presentation Skills

I (Linsky) teach presentation skills in a dedicated technical communication course called Technical Presentations, in an introductory technical writing course called Writing for Engineers and Scientists, and in a technical course, EG 1004, that requires weekly presentations. Each strategy has advantages and disadvantages.

Teaching these skills in a dedicated course allows for the complete development of each relevant topic and the ability to practice lots of different kinds of technical presentations. The distinct disadvantage is the lack of real data and analysis to present.

Teaching these skills as a unit in an introductory tech writing course allows me to set up the fundamental concepts needed to prepare a good technical presentation, and give my students a chance to prepare a talk. The advantage is that they think the whole thing is great fun. They dedicate themselves to doing a terrific job the one chance they'll have to present. But since they present only once, they don't have an opportunity to practice what they've learned.

Teaching these skills in a technical course that requires weekly presentations is an excellent model. My students have real data to analyze. They have many opportunities to present, and therefore many opportunities to apply what they are learning. They have an interested audience of their peers that offers constructive criticism as soon as the presentation has been completed. And they have a chance to try their hand at a presentation that is persuasive in nature at the end of the term.

Conclusions/ Future Work

We understand anecdotally that during the semester, as they practice the skills necessary for a successful technical talk, our students develop the ease and comfort required to become more adept at preparing and delivering presentations. After all, we watch them present 13 talks over the course of the term. It is not hard to see how much better they become. But it is critical that we attempt to measure this improvement.

Recently, an assessment program was added to EG 1004 to measure the progress our students make in their technical writing skills. In the future, we plan to modify the survey we use in this program to quantify their improvement in designing and delivering presentations.

To do this, we plan to prepare questions that will be added to our Entry Skills Survey that are intended to determine our student's familiarity with the fundamentals of an effective technical presentation. After establishing a baseline, our Midterm and Final Surveys can be modified in order to gauge what our students are learning as the semester progresses. An analysis of the responses will provide concrete data on their progress. It is important to find out how student understanding advances so that we can fine-tune our instructional methods.

Ideally, we would also like to measure our student's progress over the course of their academic careers. We see them as freshmen. It would be very instructive to evaluate how their abilities develop (or erode) as they advance. This is necessarily more difficult than a semester long assessment, but it should remain a goal as we move forward.

Citations

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