

Evaluating and Improving Students' Technical Presentation Skills

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Abstract

Faculty members in the Department of Electrical Engineering at the U.S. Air Force Academy have been experimenting with methods to evaluate and improve our students' technical presentation skills without sacrificing excessive class time or subject content. Three specific techniques and the observed results are discussed.

1 Introduction

Just as technical writing differs from other forms of writing, presenting technical subjects to an audience requires specialized skills, different from other forms of public speaking. Many engineering curricula require some sort of speech class, typically administered by the English Department, which usually doesn't address this form of verbal communication. Therefore, this important skill for successful engineers can be lacking in many graduates.

The following sections describe three methods to improve and evaluate students' technical presentations. Each of these methods gives the students an opportunity to formulate a technical presentation and present it to an engineering audience.

The first method requires the student to make impromptu presentations of example problems given in class. Students are divided into small groups and asked to work on a particular problem. A representative is chosen from each group to present part of the solution to the problem. This method tests the linkage between quick thinking and verbal skills.

The second method requires students to derive and present solutions to selected homework problems. This method allows the student to research a particular problem and develop an informal presentation following a logical problem-solution format. Presentations are evaluated for technical content and clarity. Fellow students provide critiques of each presentation. This method tests both technical presentation skills and the ability to logically organize complex information.

The third method involves the students in a design competition and formal solution presentation. Three teams of students are each given the same design problem, with the scenario that each team is a “company” bidding on an engineering “contract.” The teams have approximately one week to design a solution to the problem and assemble a formal presentation by the entire team which describes their solution. All three teams will present their solutions on the same day, and a panel of faculty members decides which “company” is awarded the “contract.” An unusual aspect of this method is that each team is required to give their solutions and specifications of their design to the competing “companies” 48 hours before the presentations are to be made. Each team is encouraged to critically evaluate the competing designs in their presentation. In addition to testing technical presentation skills, this method also tests engineering analysis and synthesis, critical thinking, framing and resolving ill-defined problems, ability to function as a team, and many other traits that are valuable to an engineer.

Efficient implementation of each of the three methods, various advantages and disadvantages of the methods, and the observed benefits to the students are described, with recommendations for faculty who wish to try these methods.

2 Impromptu Presentations

Concepts presented in engineering courses are often better understood by the students through examining case studies and example problems. An effective implementation of this technique is to require the students to work on in-class examples in small groups. The following procedure describes how such an in-class exercise might be administered.

After covering an engineering concept, the class is presented with an example problem. The exercise is designed to touch on the main points of the material and illustrate how the particular concept may be applied to a “real world” situation. If the concept is particularly difficult for the students to understand, the problem may be fairly well defined. In this case, the set up is more directive and the students would work through a well defined sequence to arrive at a solution. Otherwise, the problem may be ill defined and require the students to spend more time framing and defining the problem before applying specific problem solving skills.

Once the problem is presented and explained, the class is divided into groups of three to four students each and given a certain amount of time in which to work on the problem. If desired, the professor can assign a leader for each group, or the students can be left to organize themselves. It is helpful to select different combinations of students for each exercise. This allows the students to exercise teamwork skills and allows the professor to observe how well individuals work in each group.

At the end of the allotted time, a representative from one of the groups is chosen to present at least part of the solution to the problem. Keeping a log of presentations would ensure that each student has the opportunity to make a presentation to the class, during the course of a term. This presentation would not be graded, but would be evaluated by the professor and students for both technical content and presentation skills. Compliments and constructive criticism are encouraged. Representatives from each of the groups would be chosen to present various parts of the solution to the problem.

This method is best suited for smaller class sizes. The length of time allotted for the in-class exercise, including student presentations, can be based on the importance of the concept and

the scope of the problem.

Since the students are required to make their presentations with a limited amount of preparation, this method tests the linkage between quick thinking and verbal skills. When properly administered, this exercise is a “low threat” for the students and should be a fun interaction.

3 Homework Presentations

Some topics are too involved to allow a student to make a good technical presentation with little time to prepare. In this case, the students are given time to work through a solution and prepare a formal presentation, utilizing an appropriate problem-solution format.

A list of homework problems is given to the students, and each student is required to choose one of these problems to solve. Problem assignments are made a week or more ahead of the scheduled presentation times to allow students adequate time to research and develop a complete solution to the problem. Each student is given a different problem and required to generate and present a solution.

No solutions or answers are provided to the class, except for those developed and presented by the students—the students are entirely responsible for generating homework solutions. Each student becomes the “expert” on their particular problem and leads the class in understanding a logical problem-solution approach. Students are allowed to check their work with each other and with the professor to ensure a correct approach and answer.

Student homework solutions are evaluated on technical content and presentation. Students are encouraged to use available multimedia resources in their presentations (viewgraphs, computer generated slides, spread sheets, mathematical software, etc.) and provide hard or soft copy materials to the class. For each presentation, one or two students are selected to provide an evaluation. The evaluation includes comments on the technical content and overall presentation, as well as a suggested grade. Each student will have the opportunity to evaluate at least one of the homework presentations.

Typically, each presentation is allotted about ten minutes (depending on the complexity of the problem) with about two minutes for questions and answers. At the completion of the course, each student should have made at least one homework presentation.

This method evaluates both technical presentation skills and the ability to logically organize complex information. Once again, this should be an enjoyable activity for the students, with much interaction between the class and the student presenter.

The main disadvantage to this method is the class time required for the student presentations. The course director will have to evaluate the feasibility of this approach based on the class size and the amount of required course material.

4 Design Competition

The method most enjoyed by both faculty and students is the design competition. This is a formal design process where the faculty acts as a customer and the students are arranged into design teams competing for a contract with the customer.

Approximately one week before the design competition is to be held, the students are divided into three teams, and each team is given the same design problem. The problem is posed by the faculty acting as a customer soliciting bids for a contract from the student teams. The students are encouraged to set up each team as a company, with a name, logo, slogan, officers, etc. The students seem to enjoy this aspect of the exercise.

Each team is given one week to design a solution to the posed problem. Since the time is relatively short, the solution is only a “paper design.” The teams need to produce functional diagrams and schematics, but no actual hardware is implemented. Mathematical analyses of pertinent performance parameters, cost of production and operation, size and weight, and other “figures of merit” are used as a basis for comparison.

One of the unique aspects to this competition is that each team is required to provide their design solution to the other teams approximately two days before the teams present their designs to the faculty. From this point, the teams are only allowed to make “minor” changes to their designs. Each team is encouraged to compare their design with those of their competitors and develop a strategy for “selling” their design. This strategy includes comments on why they think their design is better and where they think the competing designs are weak.

On the day of the competition, each team is given approximately 15 minutes to “pitch” their design to the customer and explain why they think their design is better than those of their competitors. These are formal presentations in which the teams are encouraged to use audio/visual aids. Competing teams are allowed to ask questions at the end of each presentation.

Once all of the presentations are complete, the faculty determines which team is awarded the contract. Specific comments are provided to each team on the technical merits of their design and presentation. An overall evaluation is also provided to the class with general comments for all students.

The class time required for this method is relatively minimal, compared to the benefit for the students. This method provides the faculty with an evaluation of the students’ technical presentation skills, as well as their ability to perform engineering analysis and synthesis, critical thinking skills, ability to frame and resolve ill-defined problems, ability to function as a team, and many other traits that are valuable to an engineer.

5 Conclusions and Recommendations

Faculty should feel free to customize these ideas to suit their own situations. There is certainly room for further innovation along these lines. One idea we have yet to implement is to video tape the presentations; use an audio feed from the professor (inaudible to the class at the time) to “annotate” certain techniques, words, gestures, etc., of the presenter; and have the presenter

review the tape individually at a later time.

The ability to solve various engineering problems is of little value to today's engineer if the solution can't be translated into a coherent presentation and communicated effectively. The three techniques outlined above provide powerful and efficient methods to assess and enhance students' technical communication abilities. By choosing to focus part of the class time on technical communication, the professor sends a powerful message to the students which does not go unnoticed. We have found these methods highly beneficial to the overall development of our students—give them a try!

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