Effect of Student Model Presentations from a Speaking Contest on the Development of Engineering Students as Speakers

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Introduction

Because of TED.com, many high quality models exist of professional engineers and scientists presenting. However, high quality examples of students presenting are lacking. Such high quality models by engineering students are important because many engineering students cannot project themselves presenting in the same manner as TED speakers, who are experts in their fields [1]. For instance, engineering students simply cannot generate the same level of original content as TED speakers do.

At Pennsylvania State University, we have tried to address this void by introducing a technical presentations contest for engineering students. Called the Leonhard Center Speaking Contest, this speaking contest draws contestants from several engineering sections of a required presentations course. The final round of the Contest features eight engineering undergraduates making 10-minute presentations that describe an engineering solution to a societal problem. The engineering undergraduates in the contest took a required presentations course the previous semester and were selected in a competition by their peers for this contest. The timing of the contest finals is such that it occurs toward the beginning of the next semester, when a new crop of 150 engineering students are beginning to take the required presentations course. For that reason, many of the 200 attendees of the finals are students who are just beginning this course.

In addition, we have hired the local public television station to film the event, using production lighting and a three-camera set-up. The station also performs the editing of the films. Although perhaps not quite the quality of TED films, our films particularly in our last two contests have a studio-quality feel. Several presentations and montages of presentations are now posted on the web so that students have access to these examples throughout the semester.

We hypothesize that we can accelerate how quickly less advanced engineering students learn presentation skills by having those less advanced engineering students view strong models of presentations by other engineering students. To test this hypothesis, we had students who are in the first weeks of an engineering presentations course attend the finals of a speaking contest that consists of students from the previous semester's course. In our particular case, over two semesters, about 300 students in the early stages of their presentations course saw eight of the strongest presentations from the previous semester. Because we teach an uncommon approach to technical presentations (the assertion-evidence approach), we sought to determine whether the students noticed the approach, what they thought about the approach, and whether they would consider adopting the approach.

This paper first presents a literature review of universities and professional societies that have tried to highlight model presentations by engineering students to raise the level of presentations by other engineering students. Included at the end of this literature review is a description of our speaking contest as a means to expose the younger students to the strong presentation models from engineering students. Next we discuss two tests to determine whether the less advanced students learn presentation skills at a more accelerated rate than similar

students who did not see such models. Finally, we discuss the results of those tests and provide explanations of those results.

Literature Review

Various universities and institutions have posted model presentations by engineering students as a means to accelerate the development of other engineering students as speakers. This section discusses those attempts with the following criteria in mind: (1) strengths of the models, (2) limitations of the models, and (3) quality of the films. Table 1 summarizes the student models in this review.

Table 1: Summary of Relevant Literature on Student Model Presentations

Source of Models	**Student Population Affected**	**Analysis of Models**
British Columbia Institute of Technology: [2]	Speaking contest that complements a technical communication course	+ 40 students in initial contestant pool; question session at the end of talk; contest sponsored by companies and the university. ± Majority of students from civil, mechanical, and electrical engineering. − Single-camera viewing
Purdue: EPICS Course [3]	Posted films of course design projects	+ Detailed presentation on an entire project; question session at the end of talk; talks sponsored by companies. − Speakers are not visible − Single-camera viewing − Talks follow topic-subtopic defaults of PowerPoint
ASME: Old Guard Competition [4]	ASME's Student Professional Development Conference	+ Representation of students around the world − Difficulty accessing models on ASME's webpage − Single-camera viewing
Royal Academy of Engineering Global Grand Challenges Summit [5]	Student Day Presentations from the Global Grand Challenges Summit	+ Easy access on YouTube.com + Multi-camera view − Long-winded introduction by professor before student speakers begin
CART Showcase [6]	Biomedical engineering students	+ Easy access on Vimeo.com − Unsteady camera − Single-camera view
Construction Institute of ASCE [7]	Speaking contest for civil engineering students	+ Easy access on Vimeo.com + Double-camera view − Students reading from notes
Pennsylvania State University	Speaking contest for College of Engineering that complements a technical presentations course	+ Professional venue; many engineering disciplines represented; both individual talks and montage of talks easily accessed on Vimeo.com + Assertion-evidence approach to presentations + Multi-camera view

Model Student Presentations from Other Institutions. As a first source for student model presentations, British Columbia Institute of Technology (BCIT) has created a competition called "Presentation Idol for Engineering Students," informally known as Idol [2]. The initial

contestant pool consists of 40 full-time or part-time engineering students who have completed one BCIT communication course. After a preliminary round, eight student finalists compete in Idol by giving a 6 to 10 minute filmed talk, followed by a question session. BCIT then posts the winner's film on the Idol website as a model presentation.

The BCIT Idol competition produces strong student models. Because of the large initial pool size, the variety of topics strengthens the student models. With that being said, because the large majority of students study either civil, mechanical, or electrical engineering, the models lack a broad representation of other engineering disciplines. In addition to the learning that occurs during the competition itself, the contest films the model presentations, which adds to the effectiveness of the models. A single camera view captures the 6 to 10 minute talk, as well as a question session. The films not only benefit the students and faculty at BCIT, but their various sponsors as well.

As a second source of student model presentations, Purdue University has created student models through its Engineering Projects in Community Service, or EPICS, course. Students enrolled in the course design, build, and develop solutions to engineering problems that benefit the local community [3]. Upon completion of the project, each team presents their results, which are filmed and posted on the EPICS website. In general, the main strength of these presentations lies in the quality and interest of the design projects. In addition, the voices of the students reflect the enthusiasm that they have for the subject. Like BCIT, the EPICS models use a single camera view and include a question session in the film. One limitation of these models is that the speakers are not visible in the films. As a result, students cannot observe the speakers' nonverbal cues, which can be beneficial.

Perhaps the biggest weakness of these presentations, though, is that the presentation slides follow the topic-subtopic organization of PowerPoint. In other words, the slides do not follow the cognitive load recommendations of Sweller [8], who states that audiences suffer cognitive overload in the verbal portion of the brain when they try to process too much written text and spoken words simultaneously. Given the bullet-ridden slides of these students, that overload condition often occurs. In addition to having too much text, the slides suffer from not following the Mayer's multimedia learning principles [9], which states that people learn more from words (mainly spoken words) and relevant images than from words alone. More than 40% of the student slides at the EPICS web-site do not have any relevant images.

Another type of student model that is available is from ASME's Old Guard Competition at the Student Professional Development Conference (SPDC). The competition emphasizes the importance of clear and concise oral communication, as well as recognizes exceptional student speakers [4]. Because the SPDC has global venues, the models are diverse. However, the models are not easily accessible on ASME's website, making it difficult for engineering students to benefit from them.

While the student models mentioned previously are effective, accessing them can be a challenge for engineering students. In today's generation, students might look to more popular websites, such as YouTube.com or Vimeo.com to find student models. For instance, a simple search on YouTube for engineering student presentations will direct you to the Royal Academy of Engineering's presentation at the Global Grand Challenges Summit [5]. This high quality model consists of a multi-camera view, showing the speakers, slides, and audience. One

limitation of the model is that many students might not make it through the longwinded 6-minute introduction of the student speakers given by a professor.

Not only is YouTube.com popular among students, but Vimeo.com is also growing in popularity. Two student models that can be viewed on Vimeo.com are the CART Showcase and the Construction Institute of ASCE. The former model is a single-camera view limited by an unsteady camera [6]. The latter is a double-camera view, showing both the speakers and slides [7]. However, some of the students read from their notes, which is a practice frowned upon in engineering talks.

Our Student Model Presentations. At Penn State, the speaking contest, which originates in several engineering sections of a required presentations course, features eight engineering undergraduates who took the required presentations course the previous semester and who were selected in a competition by their peers. While the engineering sections of the course are distinguished by an emphasis of advanced presentation techniques such as the assertion-evidence approach [18], the fundamental objective of the contest is to create effective student models. The timing of the finals is such that it occurs during the beginning of the next semester, when a new crop of several hundred engineering students are beginning to take the required presentations course. For that reason, many of the 200 attendees of the finals are students who are just beginning this course.

Shown in Figure 1 is a scene showing a speaker on stage from the third contest, and shown in Figure 2 is a scene showing the speaker, the audience, and camera crew from the third contest. As can be seen from the view of the speaker and stage in Figure 1, the setting is professional. As can be seen from the view of the first contest's audience in Figure 2, the contest was well attended. The second contest had similar numbers of attendees.

Figure 1. View of a speaker on stage for the third speaking contest. In selecting the room, we wanted a venue that was professional and would accommodate at least 200 visitors.

Figure 2. View from the back of the room of third speaking contest. The room for this contest held 200, and several people viewed from the doorways. Seen in the back are two of the three cameras for filming the contest as well as the control board for the sound system.

In addition, because films of many of the presentations are posted on the popular web site Vimeo.com, students in the technical presentations course have access to these examples during the semester. These films use multi-camera views of the speaker, slides, and audience. In addition, the films are produced as a single talk or as a montage of multiple talks. The montages include teaching messages such as "Own your content—do not read from cards or slides." These messages were included so that the montages could be used as teaching tools in engineering courses. For instance, one montage communicates the principles of effective delivery (in an engineering presentation), while another communicates the specific principles of effective slides. For each message, one clip from the contest serves as supporting evidence. As a final note on the films, we have tried to locate the speaking contests in venues that look professional and that seat about two hundred attendees. In our first contest, the room's lighting relied on fluorescents, which lowered the quality of the films.

Methods

More than 500 students from a technical presentations course have attended three speaking contests that occurred: one in January 2013, a second in September 2013, and a third in February 2014. To determine the effectiveness of the student speaking contest on the acceleration of the development of students as speakers, we used two different methods: (1) surveys of 127 students attending the second and third contests, and (2) observations from faculty who taught the technical presentation course taken by those 500 students. These methods

provide both qualitative and quantitative data that can be analyzed to determine whether this speaking contest is a valuable tool for accelerating the learning of presentation skills.

Student Surveys. Our first method was a survey taken by more than 125 students who attended the contest in Fall 2013 or Spring 2014. In the survey, students were asked to analyze one talk from the Contest in general and to comment specifically on entry point, slide design, and delivery. From these analyses, we sought to extract whether students noticed three recognized features [21] of the assertion-evidence approach, which the contest speakers followed: (1) increased focus, (2) better audience understanding, and (3) more confidence. For each feature, the student responses were scored from 0 to 1—with a 0 representing no mentioning of that feature and a 1 representing a clear indication of that feature.

In addition, from these analyses, we intended to determine qualitatively what influences the contest had on the students. The goal of this review was to find what practices the students liked best in the talks and whether those practices lined up with the practices taught in the course. The rationale here was that if the students liked a practice, then they were more likely to try to incorporate that practice in their presentations during the rest of the semester. In addition, if the practice lined up with the practices that the instructors were trying to teach, then the Contest had aided the instructor in the teaching of those practices.

Using a course management system, we distributed the surveys to students enrolled in the technical presentations course. The surveys were completed during the three weeks following the contest, and the student survey results were reviewed by the course instructor and course assistant.

Faculty Observations: As a second source of evidence, we sought testimonies from four instructors who taught the technical presentations course taken by the 500 students who attended the contest. At Penn State, all students are required to take a 3-credit presentations course—the technical presentations course was an option for engineering students to fulfill that requirement. Two of these four instructors have taught the engineering presentations course for more than eight semesters, with six of those semesters occurring before the incorporation of the speaking contest. The main question to these instructors was how having the students view the presentations of the speaking contest has affected the rate at which those students learn the principles of the course. In other words, what principles of the course appeared to be learned more readily because of the contest? If the principles observed by the faculty matched the practices identified by the students in their surveys, it is logical that the contest influenced and possibly accelerated the student's learning of those principles.

Results and Discussion

The following sections present the results from the three perspectives pursued to determine the effect of the speaking contest on the acceleration of the learning of presentation skills by students who viewed those presentations. The three perspectives were (1) quantitative analysis of surveys of students who viewed the contest presentations, (2) qualitative analysis of surveys of students who viewed the contest presentations, and (3) responses from faculty who taught those students.

Student Surveys: Quantitative Analysis. More than 125 students enrolled in a technical speaking class completed a survey about the techniques used by students in the speaking contest. For each of these surveys, we derived scores (from 0 to 1) on the following three attributes: the talk had an appropriate scope and depth; the talk targeted the audience; and the speaker was confident. These three characteristics are the proclaimed attributes of assertion-evidence approach [21], which the Contest speakers were taught and which they followed. Table 2 presents the results of this scoring. As seen in this table, the talks scored very high, especially for audience understanding. While these results are positive, two limitations exist. First, the students being surveyed had the option of choosing which speaker to analyze. Given that, most students likely chose their favorite speaker in the contest. A better test would be to assign the students a specific speaker to evaluate (and preferably one outside the surveyed student's major). Second, we were extracting these qualities from the general analysis provided by the students. In some cases, such as the scope and depth, the students did not make comments—if asked directly about that quality, the score might have been higher. Nonetheless, the contest talks scored high on these three attributes.

Table 2. Quantitative Results of Surveys of Students Who Viewed the Contest (N=127).

	Talk had appropriate scope and depth	Talk targeted the audience	Speaker was confident
Percentage	79.5%	96.5%	86%

Student Surveys: Qualitative Analysis. More than 125 students enrolled in a technical speaking class completed a survey about the techniques used by students in the speaking contest. More specifically, the students were asked to analyze in general the presentation of a Contest speaker and to analyze in particular three aspects of that presentation: entry point, slide design, and delivery. Because the students analyzed one of eight presentations, the results were generalized by identifying three of the most frequently acknowledged practices for each of the three specific categories. The practices that the students identified for entry point to engage the audience, slide design, and delivery are discussed below.

Entry Point to Engage Audience. To begin, three of the most frequently acknowledged practices for the entry point were the use of relatable topics, emotional appeal, and statistics as a means to engage the audience. Regardless of the contestant's topic, students acknowledged that they were more inclined to listen to the rest of the presentation if they could relate to the entry point. For instance, an electrical engineering student began his talk [12] about TV white space zones by discussing the frustration that follows a Wi-Fi connection failure. While many students did not fully understand his solution at the start of the talk, they stated that they were more intrigued to listen after hearing about Wi-Fi connection failure, which occurs on a daily basis for many students. In addition to using relatable topics, the use of emotional appeal and statistics also resonated with the students. Depending on the subject of the talk, either practice could be used. Many students liked the use of emotional appeal, such as the appeal in one talk [14] about quality of life of an age-related macular degeneration patient, because it quickly created personal concern for the topic. On the other hand, students were influenced by the use of statistics, such as the statistic given in a talk [13] on number of children who will die from pediatric cancer in one

year. Because the course teaches all three of these entry points as options, the contestants served as strong models for creative and effective entry points.

Slide Design. In addition to entry points, the students also analyzed practices for slide design, such as blank slides, use of images (as opposed to bullets), and highlighting of key information in graphics. While slides can convey a great deal of information, the students thought that some of the most effective slides were blank ones. The use of blank slides forced the audience to listen to the speaker without any distractions. For instance, this technique was often used at the conclusion to draw in the audience's attention for closure. A second identified practice of the slides designed by the contestants was to outline the content of their talk by using pictures, as opposed to bullets, for each main point. In addition, as a way to keep the audience focused on the appropriate image, when the contestant began to talk about each topic, the corresponding picture would transition from grayscale to color. A third identified practice of visual aids was the emphasis of important information in graphics. In technical presentations, graphical representation of data can confuse the audience if not explained properly. The students frequently said that they appreciated the use of boxes to emphasize important information in slides, such as specific columns on a bar graph. All three of these practices are taught in the course and are part of an assertion-evidence approach to slide design.

Delivery. Lastly, the surveyed students identified the following practices for delivery: deft handling of equipment, not exhibiting distracting movements, and having a conversational tone. All contestants used a hand-held slide advancer during their presentation. The majority of students who completed the survey took note of the effectiveness of the slide advancer, because there were no technical difficulties or confusion when using the device. Second, a lack of distracting movements strengthened the delivery of the talks, because the audience could concentrate on the words and slides of the presentation. Many students noted the tall posture that speakers maintained, as well as their neutral hand positions, such as keeping their arms at their sides or holding the slide advancer in front of their bodies. Finally, the last practice of delivery identified by the surveyed students was the conversational tone that the speakers used. Most of the students noted that the talk was not memorized, and in fact, seemed very natural. Some students even noted that the conversational tone seemed to make the presenters appear at ease on stage, because they were comfortable and confident with the content of the talk. All three of these practices are practices taught in the course, with the practice of speaking extemporaneously (a practiced talk in which the speaker fashions words on the spot) being the most emphasized.

Summary. The results of the student surveys not only revealed frequently acknowledged practices for three distinct categories (the entry point to engage the audience, slide design, and delivery), but also the attention paid by the contestants to the details of the presentations and their advanced techniques. In the surveys, students conveyed a sense of awe in regards to the contestant's presentation skills, and many stated that they hope to emulate these techniques. Therefore, the qualitative analysis of student surveys revealed that contest has in fact influenced the students to add new techniques to their repertoire of presentation skills.

Faculty Observations. This section presents observations by faculty about the effect of the Speaking Contest on their students. Providing those comments four instructors who taught the technical presentations course from which the contestants came and for which students attended or watched films on the web [15]. Two of these instructors had much experience in this course having taught several classes before the Contest became a part of the course. Overall, all four

instructors asserted that the Contest significantly accelerated the learning of presentation skills by the students who attended. In particular, the instructors asserted that the Contest has affected the acceleration of learning in three ways: (1) acceptance of the assertion-evidence approach, (2) willingness to present without a script or note cards, and (3) appreciation for importance of narrowing the topic to achieve depth.

First, the Contest has affected the acceptance by students on the assertion-evidence approach taught in the course. In this course, the instructors challenge the common practice of creating a talk based on topic supported by subtopics. Instead, the instructors call for students to view their talks as a series of assertions that need strong evidence as support. The difference between these two approaches is most readily seen in the slides of the two approaches. In the ubiquitous topic-subtopic approach, the slides follow the defaults of PowerPoint: a topic-phrase headline supported by a bulleted list. In the assertion-evidence approach [16–17], the slide is characterized by a sentence headline that states the main message of the slide. That message headline is then supported by visual evidence: photographs, drawings, diagrams, films, and graphs. In this structure, bulleted lists do not appear. Because the structure is so different from what engineering students have seen, students are reluctant to adopt it. However, all four instructors asserted that having the students view the eight presentations of the Contest (all of which follow the assertion-evidence approach) has made the students much more receptive to this strategy.

Second, the instructors asserted that having the students view the Contest presentations has made the students more willing to present without notes. In engineering, the expectation in most technical presentations is that the engineer will speak to the audience rather than read a script or speak from note cards. Although speaking extemporaneously is the expectation in engineering, the delivery style taught in many high school speech classes and in the non-engineering speech classes of Penn State is to rely on note cards that the speaker carries.

Third, the instructors asserted that having the students view the contest presentations has helped the students select topics that are more focused. Often students (and professionals) try to cover too broad of a scope in their presentations. Doing so prevents them from achieving a depth that satisfies the audience [18]. The instructors contended that viewing the contest presentations gave students a better idea for what type of topic could achieve depth in a 10-minute presentation. Moreover, students who viewed the contest presentations were more willing to adopt strategies to limit the scope (such as defining limitations or making assumptions).

Conclusion and Plans for Dissemination

Overall, having students in a technical presentations course view the presentations of the Speaking Contest appears to have accelerated the learning of presentation skills by those students. As indicated in the student surveys, students were impressed by the ways in which the contest presenters delivered their talks in a confident manner (without notes), the assertion-evidence approach for visual aids that the student presenters used, and the entry points that the student presenters used to motivate interest. In addition, the instructors of those students asserted that having students view the contest presentations early in the semester made the students more inclined to adopt key principles in the course, including the assertion-evidence approach, which cuts against the current common practice in engineering and science.

A question arises whether contest at Penn State can affect the learning of presentation skills by students who are not enrolled in the technical presentations course. In other words, can students in other engineering courses who view the online contest presentations be influenced to adopt the best practices of those presentations? To address this question, we are incorporating the contest presentations into a class period to teach presentation skills for undergraduate courses such as first-year design. These class periods are being taught by a new undergraduate engineering organization (UTREE: Undergraduate teaching and research experiences in engineering) that consists of students who have excelled both in their technical classes and in the technical presentations course [19]. Because only 25% or so of the engineering students in the College take the technical presentations, teaching the main skills of that course to the other 75% is a desired goal. Beginning in the Spring 2014 semester, the class periods on presentations taught by UTREE will include example films from the speaking contest. Viewing these films will be part of the preparation assignment for the class period and the class instruction. Through surveys of students and faculty in those classes, we intend to discern the effect of viewing the contest presentations on the students' learning of presentation skills and adoption of best practices such as speaking to the audience, as opposed to speaking from note cards.

Finally, through the web, we are making available the contest presentations to engineering courses outside our institution. For instance, we have a web-site [15] that presents the most popular individual presentations from the Contest. Already a top Google.com listing for the search term *model presentations*, this Model Presentations web-site includes both the filmed presentations and the accompanying handout for each of those presentations. According to our web statistics, the Model Presentations web-site has been visited more than 2000 times from November 2013 through December 2013. In addition, according to statistics on Vimeo.com, one of those presentations [20] has been played more than 5000 times from February 2013 through December 2013, and another [14] has been played more than 4000 times from October 2013 through December 2013. The teaching montages are also receiving many views. For instance, the montage on slide design [11] was viewed more than 1000 times in January 2014, and the new montage on delivery [22] is already being adopted by engineering design courses as an instructional tool. These early statistics suggest that a significant number of people are showing interest in these films.

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