EVALUATION OF STUDENT REFLECTION AS A ROUTE TO IMPROVE ORAL COMMUNICATION

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Development of effective communication skills is of critical importance for STEM education programs due to the correlation of communication ability with graduates' employability[1] and sustained career success.[2] Communication is usually split into two major areas: written and oral, both of which are a necessity for any successful engineer or scientist.[1,2] Here we direct our focus toward oral communication, which a number of authors have highlighted as important via a variety of tactics. For example, various authors[3-5] contend that poor communication in presentations by Morton Thiokol and Boeing engineers to NASA led identified equipment problems to go uncommunicated, eventually culminating in the 1986 Challenger and 2003 Columbia space shuttle disasters. These resulting accidents stress that poor communication can lead to de-emphasis of critical data in the financially and socially important situations for which engineers are regularly responsible. Other authors, such as Tapper and Cole[6] and Trevelyan and Tilli,[7] take more subtle approaches in expressing the value of effective oral communication in engineering by surveying engineers' opinions on its importance. Their results identify oral communication as the third most important trait for a successful, practicing engineer[6] and that engineers spend approximately 60% of their time at the workplace communicating with others.[7] The message is clear: Successful engineering graduates will value effective oral communication!

Clearly, ChE programs have a responsibility to develop students' oral communication skills in order to effectively prepare them for the modern workforce. An effective strategy to improve students' oral communication skills is to identify common pitfalls and poor habits. Wilkes[8] claims that nearly all poor oral presentation habits relate to fear, which can be overcome through confidence, preparation/practice, and feedback. The aspects of confidence and preparation/practice can be tackled in part by providing students with an abundance of oral presentation opportunities. However, providing effective feedback on oral presentation performance to individual students can be challenging for a busy faculty member, especially in large classes. This is unfortunate since instructor

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feedback not only helps students identify opportunities to improve their technical work and communication skills, but can also lead to increased student confidence through positive remarks. Frequently, presentation feedback consists of a rubric or grading sheet that the instructor fills out during the time of presentation and then subsequently provides to students, perhaps with a handful of written comments and suggestions. Instructors may also offer some verbal commentary immediately following presentations, or if plausible, in one-on-one follow-up discussions.[9] However, recent literature indicates that utilizing self-assessment and/or peer feedback may add to the benefits of student growth.[10-15]

Self-assessment is a practice where students reflect on their own presentations, most commonly by viewing a recording of their "performance."[16] Clearly, video recording is optimal due to its ability to capture both verbal and nonverbal characteristics. The cited advantages of self-assessment include enhanced carry-over of material outside of class[11] and students taking more responsibility in their own learning.[12] Reitmeier and Vrchota[17] applied self-assessment to a single set of presentations given by students in two sections of an elective Food Science course, finding that students' self-assessment scores closely resembled those given by the instructor, and students self-identified strategies to improve future presentations. It is important to point out that student self-scores do not always agree with instructors; in fact, other studies have found that students either underrated or overrated their performance.[18]

Conversely, peer feedback consists of students viewing others' presentations and providing evaluation scores and/or critique comments. The prescribed benefits of peer feedback are that (i) the presenters gain the perspective of more than one individual in the audience when seeking improvement due to the typical accuracy of aggregate evaluations[10,19] and (ii) the instructor can utilize peer scores to aid in assigning quantitative grades.[13,15] Heun[10] found that peer influence had a significant impact on student self-awareness over the period of one course, but instructor influence did not. Students are also able to identify major weaknesses based on the frequency of comment occurrence, which is not possible from a single instructor's critique. In terms of a grading aid, student peers tend to assign higher numerical scores than the instructor (as might be expected), but normalization of instructor and peer scores can be used to overcome this factor.[13] An additional benefit of peer feedback is that the exercise of assessing speakers leads peer reviewers to comparatively evaluate their own oral communication strategies.[14]

The objectives of the current study are to: (i) implement and assess presentation reflection activities in a large ChE classroom (~100 students) and (ii) evaluate the investment of instructor time needed to implement the activities. Past work within the engineering disciplines has provided a number of excellent accounts and resources[20] including the implementation of reflection activities within student e-portfolio creation[21] and team-based student design assignments.[22,23] The current study contributes to the literature through administering and observing the impact of short-answer reflection activities over the course of multiple presentations in a ChE classroom large enough (n = 98) to provide statistically significant results. The tracking of student presentation improvement with time provides unique insight into students' oral communication skill enhancement. Finally, to our knowledge no studies are available that indicate the necessary investment of instructor time to implement reflection activities in oral presentations in the ChE classroom.

DESCRIPTION OF STUDY

The efficacy of student reflection methods in improving student oral presentation skill was assessed in a required junior-level unit operations laboratory course (CHE 330) consisting of 98 students. The course consisted of three presentations given throughout the semester with the first two consisting of 15-minute oral presentations utilizing slides and the third being a 5-minute poster presentation. As mentioned above, the large class size creates unique challenges such as making one-on-one feedback time-consuming for the instructor. On the positive side, the large number of students enables data obtained during the observed semesters to be statistically representative.

Implementing student reflection methods relied on the use of different pieces of technology, all of which were available at no cost through the authors' university. First, student presentations were recorded using a digital video camera on a tripod stand, eliminating the need for a dedicated camera operator; both items were available for check out from the North Carolina State University library. Following recording, student presentation videos were transferred to a "typical" Lenovo laptop computer. Windows Movie Maker (WMM) was used to trim the videos to appropriate lengths and save them in a convenient format. WMM is a fairly user-friendly program available to Windows users, and tutorials on its use are available online.[24] An equivalent option for Macintosh users, iMovie, is available and other free software for any operating system can be found online (*e.g.*, Avidemux, Free Video Editor).[25] Next, edited videos were disseminated to students for viewing through the online video channel YouTube. Other video sharing websites are available, but YouTube was found to be most accessible. There are two important considerations that should be accounted for if YouTube is used for this purpose. First, it is vital to change YouTube video settings so that videos are private and only students can view them, rather than the general public. Second, free accounts are limited to video uploads that are less than 15 minutes long so single presentations often must be trimmed into two or three parts.

The final stage of activity implementation was to monitor student responses to gauge participation and collate/redistribute

TABLE 1
Questions prompted to students on the end-of-course evaluation

Question	Text
Q1	Do you feel this experience helped you improve your presentation skills?
Q2	Which presentation feedback method did you find most helpful?
Q3	Is it worth it to continue recording student presentations and provide videos in the future?

TABLE 2
Selected examples of student critique comments deemed as valuable and vapid for two of the critique form prompts

Valuable	Vapid
Do you find anything about the way you presented distracting?	
"I would start sentences and then interrupt myself…"	"… nothing major."
"I said 'um' 15 times…"	"Used hand movements in presentation but not distracting."
"I did not maintain eye contact with the audience…"	
What is one improvement that you plan to make for the next presentation?	
"Be more confident…"	"… the only way to improve our performance would be to just continue what we are doing."
"I plan to speak louder and with more enthusiasm."	"The video camera didn't show [everyone]!"

group comments for students to review. Comments were gathered from students using Google Forms, which is a free polling service available to any Google account. In the Appendix, figures show the instructor's grading rubric and tables contain short-response prompts created to address targeted improvement. No effort was made to collect numerical assessment scores from students based on informal student feedback during the authors' planning of the study; students felt they did not have the mastery of the topic needed to accurately quantify their fellow students' performance, but were comfortable providing qualitative feedback.[26]

The objectives of the study are to evaluate: (i) the impact of self-reflection and peer feedback activities on students' oral communication improvement and (ii) the investment of instructor time necessary to implement the activities. Student participation, presentation grades across the semester, and student end-of-course evaluation comments were used as metrics of student oral communication skill and improvement. Student grades across the duration of the experimental semester were compared with two previous control CHE 330 semesters (n = 99 and n = 40) in which the reflection method was not implemented. Since the experimental/control groups are large and sampled from the same population (NCSU students admitted to the department under similar criteria), it can be assumed the samples of students in the experimental and control semesters had similar levels of scholastic ability. The presentations for the control and experimental semesters were identical in regards to their form, accompanying instruction, and instructor. The grading rubric for oral presentations was also similar between the control and experimental semesters, with the exception that a small participation score was included in the rubric for the experimental semester (as shown in the Appendix). Students in the experimental semester were made aware that reflection activities were being investigated by the instructor in an effort to improve student learning in the course. The three end-of-course evaluation questions asked of students are shown in Table 1. The time required by the instructor to complete each stage of the method was tracked on a per-group basis.

RESULTS

Student participation in reflection activities

The first metric used to probe the impact of reflection activities was student participation. Students were provided with minimal explicit incentive (~2% of each student's presentation grade was assigned to participation in reflection activities) to complete the reflection activities. Therefore, participation grants a reasonable indication of students' desire to improve their oral communication. The first presentation utilized self-reflection and student participation was monitored as either *response* or *no response*. The response classification was further discretized into either *valuable* or *vapid* feedback based on the quality of comments. Valuable comments included any statements that were constructive or identified weak areas in presentations. Conversely, comments characterized as vapid either lacked any significant content or were entirely unconstructive. In the second presentation, students were asked to address similar critique prompts with a focus on their group members instead of themselves. The comments provided by peer feedback on the second presentation were characterized similarly to the self-reflection comments. Specific examples of valuable and vapid critique comments are provided in Table 2. No critique comments were requested after the students' final presentation in the course.

Figure 1 shows the results for student participation in self-reflection and peer feedback exercises. The majority of students provided valuable comments during both forms of reflection, but the quantity of valuable responses for peer feedback was considerably less than self-reflection. It should be noted that the majority of non-valuable participation in the peer feedback results from students that did not submit a response (24%); this is a larger rate of non-participation than for the self-reflection exercise (4%). We hypothesize that this change in participation may result from students' discomfort with critiquing others versus themselves, whether due to passive-aggressive behavior or the perception that students

can't give "correct" feedback to their peers. This notion is supported based on vague or avoiding language many students used in reference to the speaker in their critiques (*e.g.*, "the presenter" or "the group" instead of "Mary"), and student comments on end-of-semester course evaluations such as:

- *"[My] teammates were too nice and did not give enough constructive criticism."*
- *"[Students] simply don't have the experience presenting to appropriately evaluate [presenters]."*

These results may offer an explanation for previous findings[16] that indicate peers give higher scores than self- and instructor assessment. However, while these identified factors may account for the decline in participation in the peer feedback activity, it is also possible that students may have been less willing to participate in the peer feedback method due to factors outside of control of the study, such as the peer feedback activity's deployment at a later date in the semester than the self-evaluation method.

Student presentation grade improvement

In order to assess the reflection methods' efficacy in improving student oral presentation skills, each student's three presentation grades were compared to two previous control semesters in which reflection methods were not implemented. Figure 2 presents the distribution of student grades for the combined control semesters. The three presentations scores were fitted to a line for each student and the slope of the line was used as a comparison of student communication improvement over the course of the semester. The control semesters' 139 students (n = 99, Spring 2014 and n = 40, Fall 2014) had an average increase in presentation score (slope) of 1.4%/presentation with a standard deviation of 2.6%/presentation. Student scores in the control semesters were expected to increase with time due to increased confidence and practice/preparation[8] as the semester progressed, as well as students' adaptation to the instructor's rubric and expectations.

Figure 3 (next page) shows the presentation grade distribution for students (n = 98) that were in the experimental semester (including reflection activities). The same analysis as described for the control semesters was conducted and resulted in an average presentation grade change (slope) of 3.0%/presentation with a standard deviation of 2.6%/presentation. Comparing this result with that of the previous two control semesters indicates that the reflection method enhanced student oral communication ability at a statistically significant level (two sample t-test, $p < 0.001$). The semester containing the reflection activities can be further broken down into the impact of self-reflection (slope between scores on Presentations 1 and 2) and peer feedback (slope between scores on Presentations 2 and 3). Evaluation of these data sets indicates that there is no significant difference (two sample t-test, $p \approx 0.89$) in efficacy of the self-reflection or peer feedback activities with regards to students' oral communication skill improvement.

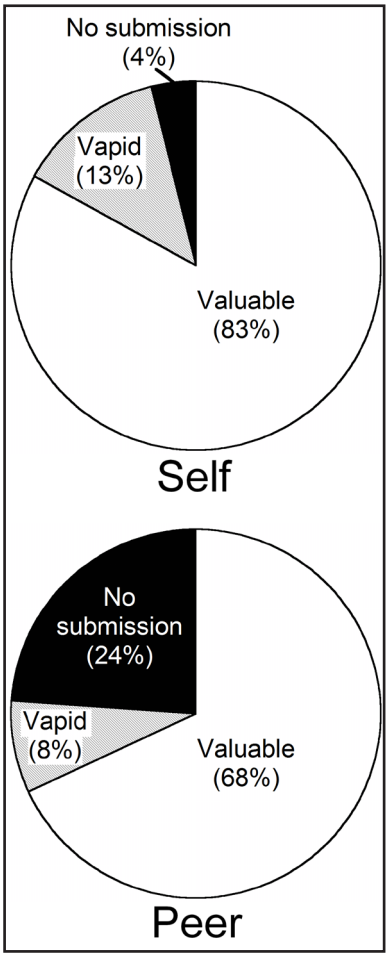
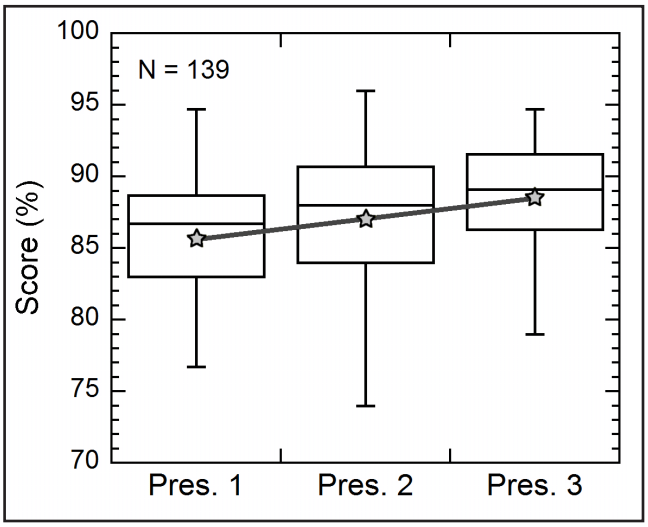


Figure 1, left. *A summary of student participation in the self-reflection activity (first) and the peer feedback activity (second).*

Figure 2, below. *Presentation scores for students taking CHE 330 in the Spring and Fall 2014 semesters in which the reflection method was not implemented. The distributions of student scores are depicted through display of the maximum and minimum, first and third quadrant, and median scores (high and low error bars, top and bottom of the box, and middle line of the box, respectively). Stars represent the average score of each presentation and are fit to a linear trend (gray line).*



Student perception of the reflection method

The final metric utilized to probe the efficacy of the described reflection method is student perception. Student opinions were gathered using a university-administered end-of-course evaluation for the experimental semester and

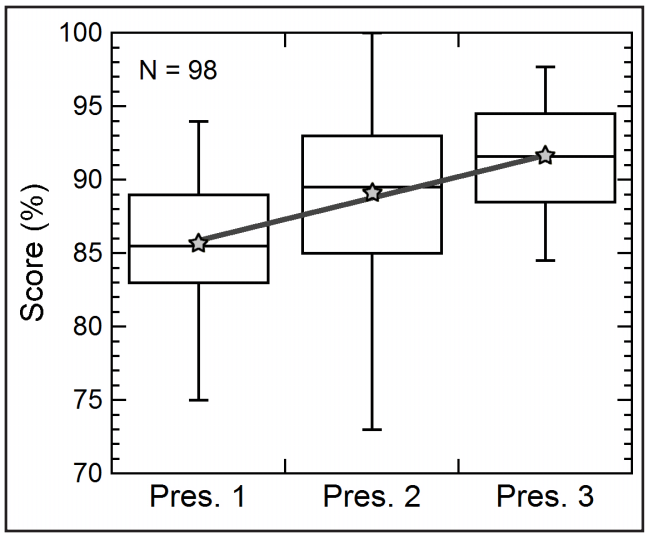
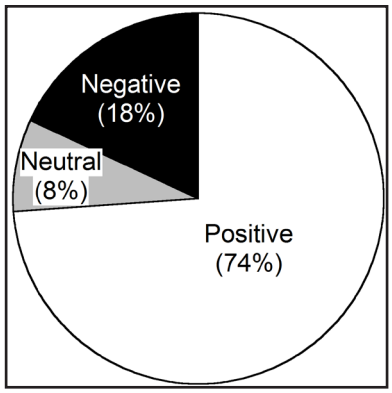


Figure 3. *Presentation scores for students taking CHE 330 in the Spring 2015 semester in which the reflection method was implemented. The distributions of student scores are depicted through display of the maximum and minimum, first and third quadrant, and median scores (high and low error bars, top and bottom of the box, and middle line of the box, respectively). Stars represent the average score of each presentation and are fit to a linear trend (gray line).*

Figure 4. *The tone of student comments regarding Q1 (Do you feel this experience helped you improve your presentation skills?) on the end-of-course evaluation.*



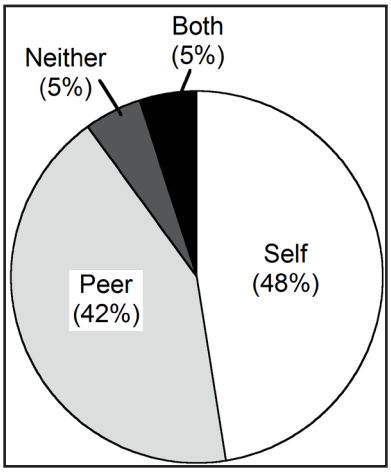


Figure 5. *Student response breakdown for Q2 (Which presentation feedback method did you find most helpful?) on the end-of-course evaluation.*

consisted of three questions, which are presented in Table 1. A total of 38 students (out of 98 enrolled) answered the evaluation questions.

Student responses to Q1 were categorized by their tone—positive, neutral, or negative—and the resulting breakdown is shown in Figure 4. Students generally thought the reflection method aided them in improving their oral communication ability. A number of students who did not think the method supported their growth offered some constructive feedback, including "…the evaluation form was redundant" and "I don't think we were given enough opportunities to improve our presentation abilities." These constructive comments will be discussed further in the Recommendations to Instructors section.

The next evaluation question, Q2, probed which method of critiquing students preferred. As is shown in Figure 5, the percentage of peer feedback and self-reflection supporters was fairly equal even though the peer feedback method saw a marked decrease in participation. It is possible that the students filling out the evaluation form were mostly students that participated in both reflection methods, which would explain this result. Regardless, the relatively even split in preference is not entirely surprising considering students have different perspectives and learning styles[27,28] and will prefer one method to the other on an individual basis. For example, one student wrote, "I am my toughest critic," whereas another stated, "My teammates could pick up on what I could have missed." Ultimately, a plurality of students (48%) that provided feedback preferred the self-reflection method corroborating the findings from the participation analysis above.

Finally, Q3 asked students whether they thought guided reflections should continue to be used in future offerings of the course or should be retired. In agreement with both of the above findings, 80% of students suggested that reflection activities should continue to be used. One student even went as far as saying, "Yes, [use of reflective methods was] one of the most helpful things I had this year." Other students, in both the for and against camps, offered suggestions to enhance reflection methods such as:

- *"…it is worth it but change the evaluation forms"*
- *"Unless there is more incentive, [don't use the methods]"*
- *"[Reflection activities] just increased the fear factor"*

These comments will all be addressed further in the Recommendations to Instructors section below.

Required instructor workload

The second objective of this study was to evaluate the amount of instructor time needed to implement reflection activities for oral presentations. The time required for each of the instructor's tasks (recording, editing, and disseminating student presentation videos and reviewing student comments) was broken up into an active and a passive component as

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shown in Figure 6. Active components require the instructor's undivided attention on tasks related to the reflection activities, whereas passive components of the reflection activities can be completed with minimal oversight. For instance, during the actual presentation session, setting up the camera and tripod are the only active components related to the reflection activity; once the camera is recording, the instructor's commitment to the reflection activity is passive and so he or she can instead focus on watching and technically assessing student presentations. The instructor's active commitments to reflection activities were to set up the camera and tripod (Record), modify the resulting video into individual group presentations (Edit), specify the proper details when placing the videos online (Upload), and organize, assess, and redistribute student comments (Comments). Conversely, the passive components include starting the video camera (Record) and the computer background time required to rewrite video files (Edit) and upload them online (Upload). The time spent in the video-recording stage of the tested methods was nearly entirely passive. In editing and uploading presentations, the majority of instructor time spent also falls into the passive category while waiting for files to transfer on the computer. The specific duration of each editing and uploading task may vary based on the characteristics of computing resources, but will inevitably include the passive tasks of video transfer, file writing, and internet upload. The only active requirement during the editing/uploading stage is to ensure that videos are trimmed to the proper start and end point (< 2 minutes/group) and uploaded to YouTube with proper settings (~3 minutes/group). Finally, the instructor must review student comments. In an attempt to reduce time commitment, the utilized grading system requires the instructor to simply deem whether student reflection is valuable or vapid. As for peer feedback, slightly more time must be spent to ensure that no critiques are unprofessional or unnecessarily harsh and to organize and redistribute them. This stage, however, has no passive component. The time requirement of comment review was determined to take on average 3 minutes per group for either self-reflection or peer feedback activities.

The total time (passive and active) required to implement the described reflection activities is approximately 70 minutes per group. However, only 8.5 minutes per group of this time requires active participation by the instructor. For specifics pertaining to a large course, the evaluation semester consisted of 98 students who were divided into teams of four to five resulting in 20 student teams. Implementation of these reflection activities required that an additional 170 minutes (~3 hours) per presentation, or ~8.5 hours over the course of the semester, was obligatory for the instructor.

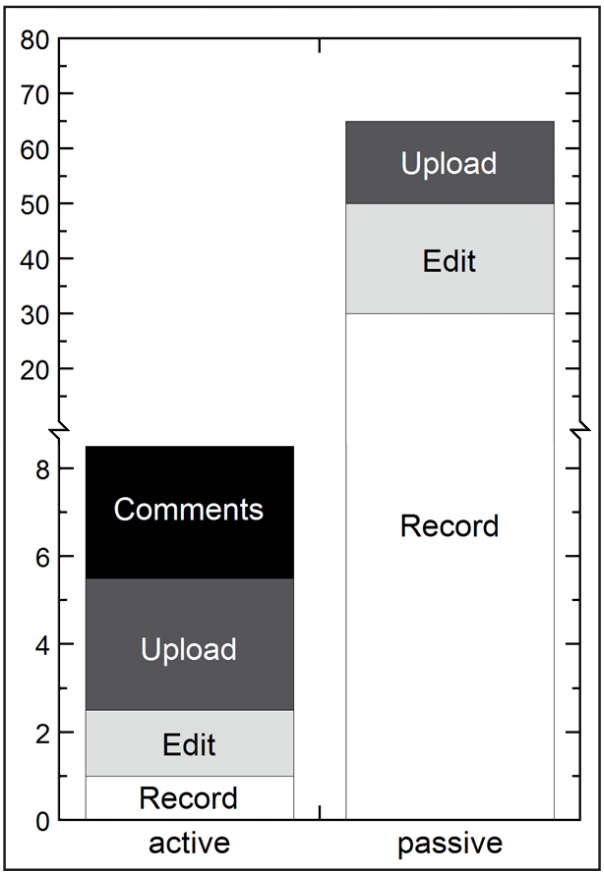

Figure 6. *Active and passive time required by the instructor for implementing guided reflection methods in student oral presentations. See section on "Required instructor workload" for specific details regarding each stage's active and passive tasks.*

RECOMMENDATIONS TO INSTRUCTORS

Based on the findings of this study, there are a number of recommendations that we would make to future instructors considering reflection activities as a route to improving student oral communication:

- *Try it! Using reflection activities appears to accelerate students' oral presentation skill development and improve their implicit confidence/comfort with presenting, as well as reinforce faculty feedback/suggestions.*
- *Ensure that guided reflection prompts are concise and, if multiple reflection activities are used, take care to avoid redundancy. Exercise caution to avoid overly simple prompts that may lead to increased vapid responses.*
- *Provide incentive to motivate student participation. Here, we used 2% of students' presentation grades as a motivator for participation and multiple students suggested a higher percentage would increase their likelihood to participate. It may be fruitful to either increase this value or offer alternative methods of motivation.*

- *Host an in-class discussion to highlight appropriate ways to offer and receive feedback and the importance of growing as a presenter, self-assessor, and team player. The NASA Space Shuttle examples[3-5] offer a terrific discussion starter for why engineers should care about oral communication and provide a strong implicit incentive. A formal in-class discussion may also help students overcome the "fear factor" associated with delivering presentations. If utilizing peer feedback activities, it is also worth clarifying that it is impossible to guarantee true anonymity of peer feedback in teams consisting of only a few engineers.*

CONCLUSIONS

It is clear that oral communication is a crucial part of every successful engineer's career toolbox. In extreme cases, the quality of communication can determine the fate of projects and even human lives. Here, we have presented evaluation of student reflection methods that rely on both student-reflection and peer feedback as a means to aid student growth as oral communicators.

Students were asked to self-reflect on their own performance in the first presentation given during a semester and to provide their fellow group members with feedback in a second presentation. Reflection was enabled by recording student presentations and providing these videos along with guiding prompts for their critiques. The two objectives of this study were to (i) determine the impact of self-reflection and peer feedback activities on student oral presentation skill development and (ii) identify the additional time required by an instructor to implement the activities. The first objective was addressed by monitoring student participation, tracking student presentation grades across the course of one semester, and collecting and analyzing student evaluation comments regarding this method. The second objective was addressed by tracking the amount of time the instructor spent on each stage of the process.

We found that a greater number of students participated in self-reflection than in peer feedback activities (83% vs. 68%, respectively), which may be due to students being more comfortable critiquing themselves than others. Students using reflection methods improved their presentation grades more than twice as quickly over the course of the semester (3.0%/presentation) compared to a cohort of students who did not participate in reflection methods (1.4%/presentation). Additionally, we found both self-reflection and peer feedback were similarly effective in accelerating student improvements in oral presentation skills. Based on responses of end-of-semester course evaluations student perception of the reflection method was also generally positive. The majority of students responded positively when asked about whether they thought the reflection method helped them to improve (74%) and whether it should be implemented in future semesters (80%). A plurality of students selected self-reflection over peer feedback (48% vs. 42%) as their preferred method of feedback on presentations, which agrees with student participation data. Finally, the active time requirement for an instructor to implement either reflection method was determined to be approximately 8.5 minutes per student group per presentation.

Based on these findings, it is recommended that instructors use reflection methods consisting of qualitative self-reflection and peer feedback for engineering classes involving oral presentations. Instructors considering implementation of reflection methods should consider spending time in class discussing expectations and addressing student concerns. The learning objectives of this in-class discussion should include communicating appropriate ways to give and receive critiques from others, the benefit of self-assessment and peer feedback, and why becoming a good communicator is important for students' future engineering career success.

NOTICE

Some overview and detail of the student reflection methods utilized in this paper were previously included in the Proceedings of the 2015 ASEE Annual Conference.[29]

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APPENDIX

Short-response prompts (Table A1-A2) were created to address targeted improvement areas from the course instructor's grading rubric (Figure A1-A3) and included on peer feedback forms (pages 183-185). ❐

TABLE A1
Short-answer prompts provided to guide students in self-reflection

Prompt	Text
SR1	Did you make your main points clearly? Can you hear and understand yourself well?
SR2	Do you find anything about the way you presented distracting?
SR3	List one or two items that you felt you did well during the presentation.
SR4	What is one improvement that you plan to make for the next presentation?

CHE 330 / 331 Oral Presentation Grade Sheet

Experiment:				
Date:				
Presentation	**1 (Poor)**	**2 (Satisfactory)**	**3 (Excellent)**	**Weight**
Technical Accuracy / Depth	Many technical errors / Lack of conceptual depth	Some technical errors / misconceptions	No technical errors / good conceptual depth	4
Delivery	Inaudible and/or poor pace	Acceptable clarity, interest, pace, eye contact	Very clear, dynamic, good pace	4
Professionalism	Lacking in more than one of dress / language /style	Lacking professionalism in one of dress /style	Presenter professional in dress, language and style	4
Feedback / Participation	No / vapid / rude feedback	Less-than-constructive feedback	Thoughtful, constructive feedback	3
Poor Habits	More than 5 "uhs"; multiple distracting habits or hestiations	Less than than 5 "uhs." Very few distracting habits.	No hesitations or "uhs." No distracting habits	4
Question	No / duplicate / unprofessional question (-3)	Satisfactory question (-0)		--
			Total (60 maximum):	
Comments:				

Figure A1. *Instructor's grading rubric for individual student presenters (oral presenter).*

CHE 330 / 331 Oral Q&A Grade Sheet				
Experiment:				
Date:				
Q&A	**1 (Poor)**	**2 (Satisfactory)**	**3 (Excellent)**	**Weight**
Readiness to Answer Questions	Does not voluntarily participate in Q&A session	Provides few answers or dominates Q&A session at expense of others	Readily answers questions while allowing others to participate	7
Technical Accuracy / Clarity of Response	Multiple mistakes / rambling or off-topic responses	Minor errors or clarity issues	No techncial errors and clear responses	3
Feedback / Participation	No / vapid / rude feedback	Less-than-constructive feedback	Thoughtful, constructive feedback	4
Sufficiency	No depth of explanation in answers	Moderate depth in explanation, but missing key points	Explanation shows depth of understanding	3
Brevity	Very long answers or short answers lacking explanation	Responses moderately too short or long	Appropriate brevity	3
Question	No / duplicate / unprofessional question (-3)	Satisfactory question (-0)		--
			Total (60 maximum):	
Comments:				

Figure A2. *Instructor's grading rubric for individual student presenters (question answerer).*

TABLE A2
Short-answer prompts provided to guide students in peer feedback

Prompt	Text
GF1	What are the presenters' main points? Could you understand the speakers (volume/clarity)?
GF2	Do the presenters have any distracting body language or speaking habits (filler words: 'uh', 'um'; awkward pauses; monotone voice; etc.)? Or does their body language and speaking style add positively to the presentation? How?
GF3	Do the visual aids match the presenter's discussion? Are there distracting animations? Can you read the text on all of their slides and figures?
GF4	What primary recommendation would you make to the entire group for your next presentation?

CHE 330 / 331 Oral Presentation Grade Sheet - Presentation Slides				
Experiment:			**Date:**	
Group	**1 (Poor)**	**2 (Satisfactory)**	**3 (Excellent)**	**Weight**
Technical Accuracy (Slides)	Numerous serious errors / omissions	A few minor errors / omissions	Very few or no errors / omissions	5
Technical Depth	Much missing discussion	Modest room for more technical depth	Thorough technical depth	3
Error Analysis	No error analysis presented	Uncertainties missing from some values	Uncertainty explicitly presented	3
Clarity	Unclear message	Minor clarity issues	Easy-to-understand presentation	5
Visual aids / graphics	Poor or no graphics	Graphics that moderately support presentation	Attractive graphics that support slides	3
Presentation Aesthetic	Difficult to read, distracting color scheme	Fonts, margins, etc. are not consistent (and other small distractions)	Pleasing colors, consistent fonts, legible	3
Timing	Longer than 20 minutes	Presentation too short	Completed within 20 minutes but not exceptionally short	2
Question Handling	One person dominates Q&A session	One or two Q&A people answered most questions	All Q&A people readily participated	1
Hard copy	No hard copy provided	Hard copy doesn't match presentation	Hard copy provided	2
Citations	Mulitple missing citations	One missing citation	All citations present	3
			Total (90 maximum):	

Figure A3. *Instructor's grading rubric for group assessment.*