Using Student Video Presentations to Develop Communication Skills

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Introduction

Communication skills continue to be one of the important professional skills that are required for engineering graduates [1] that pose difficulties for engineering educators. The issues around these skills include what to teach, how to teach them, and how to assess students' abilities[2, 3].

As part of a curriculum reform project that is a component of a larger department change effort, three required classes of the third year curriculum of an Electrical and Computer Engineering (ECE) program at Colorado State University have added a knowledge integration component that occurs approximately every five weeks. During these integration efforts, students are required to integrate knowledge from the three courses to evaluate aspects of the design of a cell phone. The goal of these efforts is to have the students connect the knowledge across the three courses using a practical real-world device. During the semester, the instructors of the three courses coordinated their core content into units referred to as Learning Studio Modules (LSMs.) After a couple of LSMs the students and the faculty from each course come together for a Knowledge Integration (KI) experience. Students receive a pre-KI assignment sheet to guide their learning heading into the KI session.

As part of the KI approach, it has also been decided to incorporate professional skills development experiences for the students. Previously, the college managed a Professional Development Institute (PDI) to develop students' skills. The PDI approach was structured as an extracurricular graduation requirement that involved periodic workshops [4]. With the start of this new curricular project the decision was made to integrate as much of the professional skills development into the curriculum as possible and move away from the previous PDI model. There are indications in the literature that students have a preference for professional skills being integrated into the curriculum rather than being presented in separate courses or workshops. [5]

As part of this project, one of the first areas of professional skills development included in the KI centered on communication skills. During the first year of the project, students were divided into teams for each of the KI components. The teams were then required to make in-class

presentations. This assignment did not go as well as hoped because the presentations tended to be more individually oriented rather than coordinated team efforts. For the second year of the project, the decision was made to have students work individually on the KI components. Developing communication skills remains important so a new approach was developed: students were required to produce short video presentations to demonstrate their ability to integrate knowledge from across the three courses.

Project description

As described above, it was decided to integrate the development of students' communication skills as part of the KI components of the coordinated third-year program. The KI sessions are initiated by giving the students a pre-work assignment. Typically this will include approximately 15 questions, five from each of the three courses. Students complete this assignment prior to the KI sessions. This assignment focuses on a common device, in this case a cellphone, to help students think about how the knowledge from the three courses are integrated into the design of a ubiquitous piece of technology. In preparation for this assignment, the three responsible faculty members share their questions and then coordinate their appropriateness for the goals of the KI session.

To reinforce the integration of learning by the students, a video-based presentation assignment has been added to the KI sessions. The video presentation assignment includes several components. To provide scaffolding for the assignment, a couple of graduate students that support the KI activities prepared high-quality example video presentations to share with the students. After the graduate students developed initial versions of their videos, they were critiqued by the faculty members teaching the three courses, along with the department head, and then finalized and made available to the students. Students were then required to produce their own videos demonstrating both their understanding of the KI-based knowledge and their ability to make professional presentations. A time limit of seven minutes +/- 30 sec. was given for each video. After producing and submitting the videos, students were then required to perform an anonymous peer review of three classmates' presentations. Additionally, one graduate student, not responsible for an example video, also performed an assessment of the videos. Finally, the students were required to provide guided self-reflections on their communication skills after they had completed their videos and performed and received peer reviews. It has been well

established that having students reflect on their own learning can enhance the learning process [6]. Self-reflection questions were chosen to encourage students to be critically reflective of their own performance and consider how to improve their performance for future video submissions. Here are the self-reflective questions –please note that question 4 is relevant to assignments subsequent to the first video assignment:

> If this is your first video presentation assignment:

1. What did you do well in your presentation, e.g., good graphics, professional appearance, clear articulation of ideas,
2. What did you not do well and would like to improve?
3. How will you work on improving your next video presentation

> If this is not your first video presentation assignment, also answer the following:

4. In what ways did you improve from the past assignment(s)?

The formal assessment of the video assignments also included nine areas in a rubric, Table 1, scored on a scale of 1-3 with 3 being the highest. This rubric was used by the TA and for the peer reviews. The nine areas for the rubric are included:

1. Sequence of information
2. Effectiveness
3. Use of Graphics
4. Text-Font choice and formatting
5. Spelling and grammar
6. Delivery
7. Technical content accuracy
8. Technical content depth
9. Technical content integration

Results

Herein we present results of the assessment data collected for this project. There are a couple of goals related to the assessment of the videos. The first item reviewed was the self-reflections from all the students in the class. We generated a word count on all the texts for the reflection submissions by the students. The methodology used to review these reflections for this work included collecting the text of these evaluations from each student. These texts were then coded for emergent themes based on word counts using NVIVO™. Table 2 & 3 provide a tabulation of the words used by the students in their reflections. This count is based on a review of all the

reflections in the class. Approximately 66 students responded to this portion of the assignment. Table 2 provides the words students associated with what they felt they did well. Table 3 then presents the words associated with areas students feel they need to improve. The most common word used by the students in both tables is "presenting" or some variation of it. This is expected, as the assignment is a video presentation.

Next, seven students from the class were randomly selected to perform an individual-based set of comparisons across the range of evaluations. The next set of tables refers to this subset of randomly chosen students. Table 4 provides a comparison between the words used by the students in their self-reflections and the words used in their peers' comments. Several engineers from our Industrial Advisory Board (IAB) also provided feedback on the video presentations. Table 5 and Figure 1 provide rubric scores and areas identified as being weaknesses in the presentations, respectively.

Discussion

This section discusses the results presented in the attached tables and figure. We posed a series of questions that provide the framework for our discussion that follows.

Question 1: What themes emerge from the students' self-reflections?

The first item of interest to us was the areas students would identify in their self-reflections when asked about their video performance. As mentioned earlier the students were given prompts to identify areas of strengths and weaknesses. Using the text from the reflections we did a text analysis to develop Tables 2 & 3, which provide word counts for areas identified by students that they felt they did well, and areas of improvement, respectively.

In Table 2 items of particular interest are given in bold, other items tend to be common words used in their sentences. The bold items refer to particular aspects of the videos. The responses appear to fall into two categories: 1) the communication aspects of the presentation and 2) the content of the presentation. A goal of this project is to integrate communication skills with content so seeing both categories in the assessment is encouraging. In terms of communication, students mentioned clarity of the presentation, appropriate times use, professional presentations, and their use of graphics and slides. The content aspects include the material covered, the information included and in general content. This preliminary analysis shows that students are conscious of the complimentary aspects of communication skills and content.

Similarly, in Table 3 we have highlighted in bold items of particular interest. The first thing

to notice is the much shorter list or words generated by the analysis in terms of areas for improvement. Students often express confidence in their abilities before they have received any constructive feedback. A longitudinal study in the future will help us see if this trend continues into future communication assignments. Again, the items can be seen to include both content (information) and communication aspects (time, video, graphics, slides, speaking). Here a shift has occurred with more focus on communication aspects instead of content. It is not surprising that juniors in an engineering program would express more confidence in their technical abilities than communication skills as the first two years have also focused on technical content over communication skill development. The benefit to the students is this growing awareness of their need to improve their communication skills –this is a major goal of the assignment.

In an attempt to get into more depth with the video presentation data, a random subset of seven students was created. The following questions were addressed with this limited number of students.

Question 2: How do students' self-reflections align with their peers?

As part of this project, each student was required to perform evaluations of three of their peers chosen at random by the learning management system. In Table 4 we have gathered phrases used by both the students in their self-reflections and by their peers' evaluations. In the table then, each student has a different, anonymous set of peers evaluating their video presentation. It is important to immediately note in Table 4 that peer reviews were more limited than the self-reflections, especially regarding comments about needing improvement –most of the blank comment sections fall under the 'need for improvement' rows. Students are less hesitant to be self-critical, as they understand the need to improve their skills. Openly criticizing peers is an area where students may be less comfortable without guidance.

In this table we have highlighted phrases in bold where there appears to be some consistency between the peer reviews and the students' self-reflections. There does seem to be some consistency between the responses indicating students are identifying common themes. The topic of graphics and slides is a common theme seen throughout. In a future longitudinal study we plan on tracking whether these themes remain, or the feedback results in perceived improvements in these areas.

Question 3: How do peer reviews compare with IAB reviews and teaching assistant (TA) reviews?

The next analysis performed was to compare the rubric scores produced by the peers, the teaching assistant, and the industrial advisory board members for our subset of students. It is important to note that each student's peer reviewers were unique so that the results indicate reviews from different students for each analysis. The results of this comparison are shown in Table 5. For the majority of students, student 3 being the exception, the industrial advisory board members consistently rated the video presentations lower than either the peers or the TA. This disconnect represents important information to share with the students as it indicates that expectations for communication skills will be more demanding when they enter the workforce.

Another view of the reviews was performed to look at what areas of weakness (scores less than a perfect 3) were identified via the rubric scoring by the different evaluator groups, i.e. peers, the IAB, and the TA. Figure 1 provides a plot of which areas of weakness were identified by each group of evaluators. In this figure the x-axis represents the rubric questions provided above, while the y-axis is the percentage of times each question was identified as a weakness as a function of the total weaknesses identified for all the videos by each reviewer group, as labeled. For example the IAB had identified a total of 32 instances of weakness across the seven student videos and nine questions: 19% of these they associated with question 2, effectiveness. For the first four questions, the IAB and peers had a similar focus while the TA's response tended to be lower –in fact the TA never identified question 1, sequence of information, as a weakness for any of the seven students in this group. It is interesting to note that the TA also never identified question 7, technical content accuracy, as being a weakness while both the IAB and the peers did identify this concept as a source of weakness. For questions 8 & 9, technical content depth and integration both received considerable attention from all three groups, with the TA having a greater emphasis on these. In general there is fairly good correspondence between the IAB and peer reviews, while the TA appears to have a greater focus towards the later questions related to technical content. It is encouraging that the students seem to have similar concerns as industry. As we saw above industry tends to provide lower evaluations than students but they appear to agree on what is important.

Summary and Conclusions

Summary

This paper describes a project to integrate professional skill development, specifically oral

communication skills, into a broader attempt to integrate knowledge across three junior-level electrical and computer engineering courses. The project initially required students to work in teams and make team presentations for the integration components of the integration project. The results were less than satisfying so a new approach was designed. The second round asked students to produce individual video presentations for each integration component. To support the students in this effort two example high-quality video presentations were developed by graduate students that provided guidance on quality presentations. The students' individual videos were submitted and evaluated by the TA for the class along with reviews from three randomly chosen peers who remained anonymous to the students. As part of our goal to incorporate feedback from working engineers, this paper describes the evaluations provided by IAB members, along with the evaluations from peers, the TA, and student self-reflections.

Conclusions

There is an indication in the literature [7] that students are not very good at assessing their own oral communication skills. Despite this potential problem we found that the self-awareness shown by asking students to assess both their own and their peers' oral communication skills is valuable. Students seemed to be consistent in the themes around what was done well and where improvements could be made. On the other hand, students do tend to numerically rank their peers' performances higher than industrial advisory board members. This points to a need in the future for the project to develop materials to scaffold the students' ability in doing peer reviews [8] –it may be unrealistic to ask them without showing them how to do it well. Others [9] have demonstrated the value of peer review for students' professional skills development. In this project the combination of self- and peer-review has enhanced students' awareness of the value of communication skills. This project has attempted to minimize the effort to students in these assessments while at the same time highlighting their value. These assessments will remain an important component of the larger intention of integrating knowledge both across the junior-level ECE courses and with associated professional skills development. It is also encouraging that students appear to value skills in a manner similar to external working engineers.

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Table 1: Video Scoring Rubric

CATEGORY	Excellent-3	Good-2	Needs Improvement-1	Score
Sequencing of Information	Information is organized in a clear, logical way. It is easy to anticipate the next slide.	Most information is organized in a clear, logical way. An occasional slide or piece of information seems out of place.	There is no clear plan for the organization of information.	
Effectiveness	Presentation includes all material needed to give a good understanding of the topic, including a clear introduction. The presentation is consistent with the driving question.	Presentation is lacking one or two key elements. Presentation is inconsistent with driving question some of the time.	Presentation is lacking several key elements and has inaccuracies. Presentation is completely inconsistent with driving question.	
Use of Graphics	All graphics are attractive (size and colors) and support the topic of the presentation.	A few graphics are either not attractive or do not support the topic of the presentation.	Several graphics are unattractive AND detract from the content of the presentation.	
Text - Font Choice & Formatting	Font formats (color, bold, italic) have been carefully planned to enhance readability and content.	Font formatting has been carefully planned to complement the content. It may be a little hard to read.	Font formatting makes it very difficult to read the material.	
Spelling and Grammar	Presentation has no misspellings or grammatical errors.	Presentation has 1-2 misspellings and/or grammatical errors.	Presentation has more than 2 grammatical and/or spelling errors.	
Delivery	Presenters spoke at a good rate, volume and with good grammar. They maintained eye contact while using, but not reading, their notes.	Presenters spoke at a good rate and volume, but sometimes used poor grammar. They relied heavily on their notes and did always maintain good eye contact..	Presenters demonstrated having paid little attention to rate, volume or grammar. They read nearly word for word from notes.	
Technical Content Accuracy	All content throughout the presentation is accurate. There are no factual errors.	The content is generally accurate, but one or more pieces of information is clearly inaccurate.	The content is confusing or contains more than one factual error.	
Technical Content Depth	The material presented is sufficiently detailed to enable full understanding of the technical problem and the challenges in solving it.	The material presented is almost sufficiently detailed to enable full understanding of the technical problem and challenges in solving it. Only 1-2 areas were not described in sufficient detail.	Audience members were unable to appreciate the technical problems due to the limited detail presented.	
Technical Content Integration	The material presented clearly indicated the integration of content across multiple courses, and the results clearly illustrated this integration.	Integration of content was mentioned but was missing some technical detail.	The material presented made no mention of the integration of content across multiple course.	

Table 2: Self-Reflection Areas Done Well

Word	Count	Weighted Percentage (%)	Similar Words
presenting	76	5.41	present, presentable, presentation, presented, presenting
good	39	2.78	good
well	34	2.42	well
video	**33**	**2.35**	**video, videos**
clearly	**32**	**2.28**	**clear, clearly**
graphics	**27**	**1.92**	**graphics**
material	**18**	**1.28**	**material, materials**
content	**17**	**1.21**	**content, contents**
understand	**16**	**1.14**	**understand, understandable, understanding**
information	**15**	**1.07**	**information, informative**
times	**14**	**1.00**	**time, times**
professional	**12**	**0.85**	**professional**
topic	12	0.85	topic, topics
explain	11	0.78	explain, explained, explaining
ideas	11	0.78	idea, ideas
points	11	0.78	point, points
slides	10	0.71	slide, slides
Tried	10	0.71	Tried, trying

Table 3: Areas for Improvement

Word	Count	Weighted Percentage (%)	Similar Words
presenting	51	3.76	present, presentable, presentation, presented, presenting
time	**43**	**3.17**	**time, timely, times**
video	**35**	**2.58**	**video, videos**
use	27	1.99	use, used, useful, using
improve	23	1.69	improve, improved, improvement, improving
graphics	**16**	**1.18**	**graphic, graphics**
need	16	1.18	need, needed
better	15	1.10	better
well	15	1.10	well
make	13	0.96	make, makes, making
slides	13	0.96	slide, **slidely**, slides
software	12	0.88	software
speaking	**12**	**0.88**	**speak, speaking**
information	**11**	**0.81**	**information**
little	11	0.81	little

Table 4: Peer comments comparison

Student	Self	peer 1	peer2	peer3
1 Positives	**good graphics** *voice quality*	Introduction was perfect communicated the key concepts	**visual aid** *Voice quality*	content was clear and correct
1 Need for improvement	better lighting professional background			more color in your graphs keep the box with your webcam input scaled to the same size with every segment
2 Positives	**Good graphics**	**use of graphics**	informative and well executed **graphs**	information needed
2 Need for improvement	speech patterns			camera angle
3 Positives	delivery was **clear visuals** technically accurate and professional	**Very good visuals**	**visual aids**	**graphics**
3 Need for improvement	more in depth **face in video**			**video of yourself**
4 Positives	format	includes everything that we learnt	Good video	Good integration of material
4 Need for improvement	picture and slides	Intro part seems missing		
5 Positives	**relevant information** clear understanding of the material	**thorough and informative**		presentation style is great for engaging audiences

5 Need for improvement	more presentable (dress, preparation, graphics)	unclear at times what key concepts from each individual class you were explaining	delivery	difficult to see your slides Improvising can be good because it shows a REAL understanding of the material. Don't give that up! Unfortunately it caused you to say a few things that didn't quite come out right
6 Positives	graphics balance of depth and brevity	Good video perfect presentation video	perfect presentation video	spoke slowly and clearly
6 Need for improvement	**more slides** balance between text and graphics			**slide for every topic**
7 Positives	organized the information well spoke clearly correct information elaborated well			
7 Need for improvement	**did not reach the time limit** did not elaborate on the 341 information enough	a little more in-depth **under the length we were supposed to go**		

Table 5: Rubric Scores

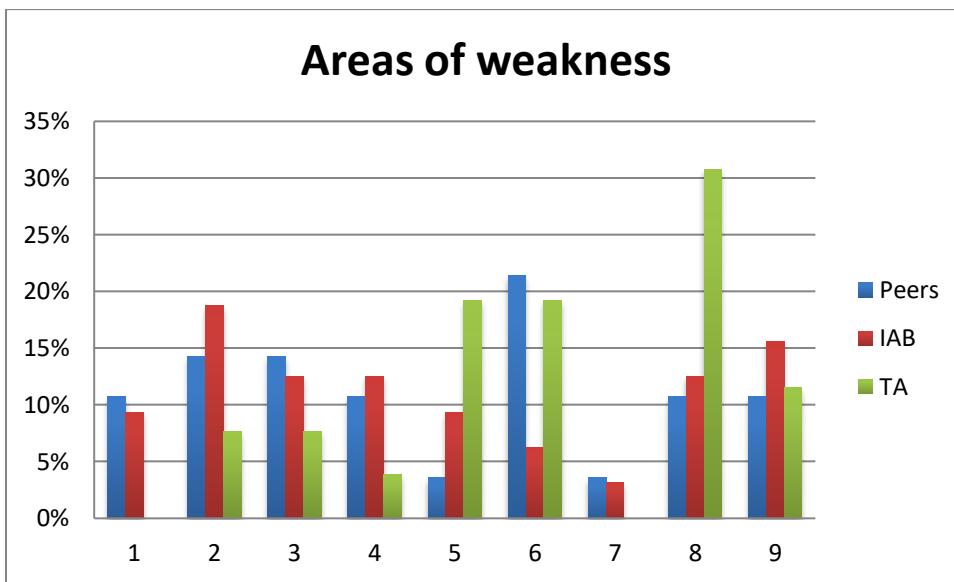| Student	Peer 1	Peer 2	Peer 3	Peer Ave.	IAB 1	IAB 2	TA
1	27	27	26	27	24		26
2	26	26	26	26	19		23
3	25	27	27	26	27		26
4	27	25	25	26	17	20	22
5	25	23	24	24	22		25
6	27	27	27	27	26		27
7	24	25.5	25	25	21		23

Figure 1: Comparison of Weaknesses