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Hands on Development of Communication Skills Within an Undergraduate Construction Materials Laboratory

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Abstract

This paper describes a construction materials laboratory that interfaces what are often less desirable activities for engineering students (i.e., writing, presenting) with physical experiments and calculations. The paper's primary objective is to present the recent incorporation of panel evaluations to expose students to presenting and to emphasize competition. Writing exercises have been part of the laboratory for years, and are described in some detail. Emphasis is on oral communication. As might be expected, student responses to these panels have varied widely, though overall assessments to date seem to indicate value added to the laboratory experience.

1.0 Introduction and Background

Technical communication (oral and written) is a formidable, yet rewarding, challenge within undergraduate engineering programs. Effective writing and presentation skills are valuable for any profession. Effective communication skills, however, don't just happen, especially for some engineering students as a strong preference to developing analytical and problem solving skills isn't uncommon. It can be difficult to develop communication skills that are likely to affect student's careers during a time where they often do not hold them in high regard.

The materials area within the Civil and Environmental Engineering department at Mississippi State University (MSU) repeatedly experiences the situation described in the aforementioned paragraph. For example, it is much easier to motivate many students to calculate volumetric properties of an asphalt concrete mixture than it is to get them to write a report regarding the same mixture and related concepts. When assignments contain words such as calculate, design, or draw students tend to have approving body language while the assignment is being handed out. Replace one of those words with format, write, or present, and body language often changes to indifference, concern, or overall lack of interest/approval.

Laboratories are an opportunity to interface what are often less desirable activities (e.g. writing and presenting) with physical experiments and calculations. Laboratories can also be an excellent venue to maximize active learning opportunities, as it is well known that active learning can be beneficial to students. As such, this paper's primary objective is to present details of a construction materials laboratory that has included a notable writing experience for several years, but recently incorporated panel evaluations to expose students to presenting and emphasize competition.

The laboratory compliments CE 3313: Construction Materials, a lecture course which is a required part of an ABET/EAC-accredited curriculum leading to a Bachelor of Science in Civil Engineering (BSCE). The laboratory was taught in a non-credit producing manner as part of CE 3313 (3 total credit hours) until the 2014 spring semester, and thereafter the laboratory was a 1 credit hour producing laboratory (4 credit hours for lecture and laboratory) with the CE 3311 designation. An eight year period (2007 through 2014) is considered, where the lead author taught CE 3313 seven times with a total enrollment of 439 (some applicable information is also provided about 2015 planned panel activities). The course is taught once per year in the spring.

It should be understood that the need to emphasize writing and presentation skills to engineering students is not a new concept, though it is very important as expressed in the references that follow. It should also be noted that, as discussed in these references, providing exposure to writing and presenting without sacrificing technical content is challenging. The panels concepts presented herein provide presentation skills without decreasing technical content.

Larson et al.[1] recently discussed ABET's Criterion 3, and how curricula were expanded to include items such as teamwork and communications. The authors noted some have recommended refining Criterion 3 from eleven to five outcomes, with one of the refined outcomes quoted as follows: "*D. Demonstration of professional behaviors through teaming skills, communications, and ethical responsibilities.*" A recent interview in a magazine of the American Society of Civil Engineers (ASCE) noted communication as a beneficial nontechnical skill, but also noted it is very difficult to integrate many nontechnical skills into engineering curriculums since so much technical information is required (Hill[2]). Just prior to the completion of this document, a magazine article by Benderly[3] discussed career paths of engineers and provided information on a workshop titled *Pathways for Engineering Talent*. According to Benderly[3], participants repeatedly stated that engineering education too often fails to provide all needed skills to prosper in the workforce (especially the so-called professional or soft skills such as communication and collaboration).

2.0 Materials Laboratory Layout

The layout of MSU's CE 3311 laboratory has several parallels to that described by Hall[4]. The primary educational outcome for materials students is to produce a bachelor's graduate that is well grounded in fundamental concepts, and the CE 3311 laboratory is a key component of that outcome. The laboratory is modeled more after a professional laboratory than a traditional academic laboratory. One example is use of professional specifications (e.g. ASTM) as opposed to laboratory manuals. Secondly, multiple field trips to commercial facilities (e.g. Figure 1a) provide students with context for laboratory experiments. A third example is writing assignments closely aligned to professional reports, since most practitioners submit fewer, yet more comprehensive, reports to clients. Four reports are submitted for all laboratory exercises performed (soil/soil stabilization, aggregates, concrete, and asphalt) that also include content related to applications and design.

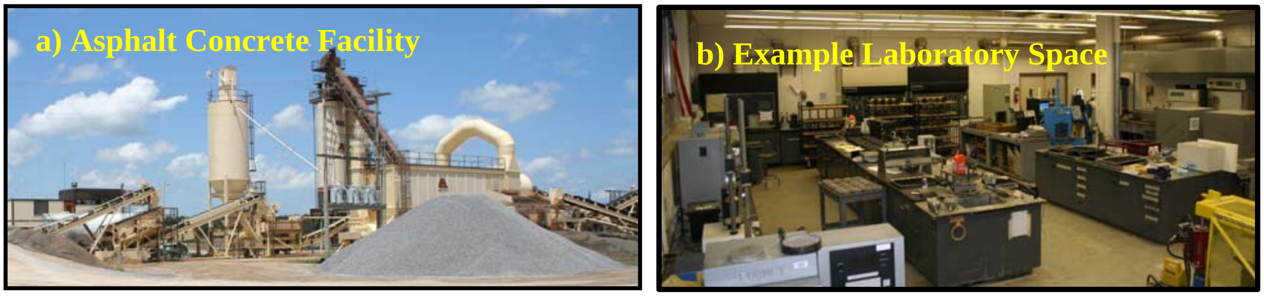


Figure 1. Example Photographs of: a) Facility Tour, and b) Laboratory Space

Approximately 20 to 25 experiments are performed each semester by students in laboratory spaces exampled by Figure 1b (three different laboratory spaces are typically used throughout the semester). It is important to note that the scope of MSU's undergraduate laboratory experience is made possible by a notable emphasis on hands on experiences, and a variety of research and service activities using the same equipment and spaces.

Each of the four reports cover more than one week of laboratory activities. A typical concrete lab activity for a semester is used as an example in the remainder of this paragraph (2014 offering details have been provided with a few changes, such as materials used, occurring from semester to semester). Each laboratory section meets one afternoon per week and typically has 20 to 30 students (three sections per semester is typical). Six groups of 3 to 5 students are formed (4 student groups are the most common) and they work together for all weeks of, for example, the concrete laboratory. Students design and produce a concrete mixture generally following American Concrete Institute guidelines. Thereafter they perform fresh mixed property testing (e.g. slump, air content, unit weight), and hardened concrete property testing (e.g. compressive and flexural strength). Once the laboratory experiments as described in this paragraph have been performed, a written report is prepared as described in Section 2.1 (written reports have been required throughout the eight year period described in this paper). For the 2013 and 2014 offerings, panels were also required as described in Section 2.2.

In 2010 and again in 2013, the CE 3313 laboratory was updated using informal assessments of recently completed students. These students mostly came from the lead author's undergraduate or graduate research assistants, though some of the students were still on campus for other purposes. Informal meetings were held to discuss experiences with emphasis on feasible learning improvements. No documentation occurred to encourage open dialogue, other than noting changes to implement in the next course offering. Relevant 2010 changes were related to written reports (e.g. length requirements, specific grade percentages for each section). The primary relevant 2013 change was beginning the panels as the student discussions indicated they could be useful.

2.1 Written Laboratory Reports

Table 1 describes the overall layout and relative worth of a typical laboratory report. Information in Table 1 is provided to students alongside general guidance on content to provide in each section. Some reports are written individually, others are written as a group (concrete report is a group report). A typical concrete lab report is usually around 20 total pages.

Table 1. Summary of Written Laboratory Reports

Section (Each Begins on a New Page)	Grade Percentage	Allowable Pages
Front Matter (Title Page, Table of Contents, …)	5%	3 to 5 Typical
Introduction and Background	10%	≤ 3
Materials Used	5%	≤ 1
Test Results	15%	≤ 4
Discussion of Results	25%	≤ 4
Conclusions, Recommendations, References	10%	≤ 1
Sample Calculations	10%	≤ 2
Supplemental Questions	20%	≤ 3

Writing assignments emphasize minimal length, yet comprehensive documentation of what was performed. They also emphasize the ability to convey information to the reader in a fairly expedient fashion and that proper presentation of reports is important (e.g. don't staple something if pages may come off; spiral bind instead). Directions given to students emphasize third person writing, adherence to margins, and the vital nature of referencing anything taken from another's work. A minimum of two outside references are required, and students are encouraged to compare their results with typical or expected values and to recommend possible applications for the materials tested. Students typically analyze all data taken by each of the six groups on a given laboratory day to provide enough data for statistical assessments.

Before laboratory experiments, students are provided with supplemental questions to be addressed. Examples include: 1) do the behaviors observed with your cementitious blend match expectations based on their properties; 2) how might the properties of the mixture produced be enhanced with admixtures? These questions are intended to lead to focused evaluation, whereas the remainder of the investigation in the report is intended to originate with the student group.

2.2 Panels

The panels require a group of students (e.g. three to five) to present results of an assigned topic from laboratory experiments (e.g. a concrete mix design) to a relatively small group of panel members (e.g. Figure 2 with students standing and panel sitting). The first few iterations of the panel concept have differed in specific parameters, but the key component has remained that student groups present their work for a few minutes to a panel who ranks them relative to other groups. Criteria for being on the panel is usually to have completed the CE 3311 laboratory, or have equivalent experience obtained elsewhere. All panel members have a reasonable knowledge about construction materials. The grade assigned is largely a function of a group's performance relative to other groups. Table 2 summarizes how the panels have been adjusted in the first two offerings and the plan for their administration in the third offering in 2015. Changes have occurred due to assessment information presented later in the paper and judgment of the instructor.

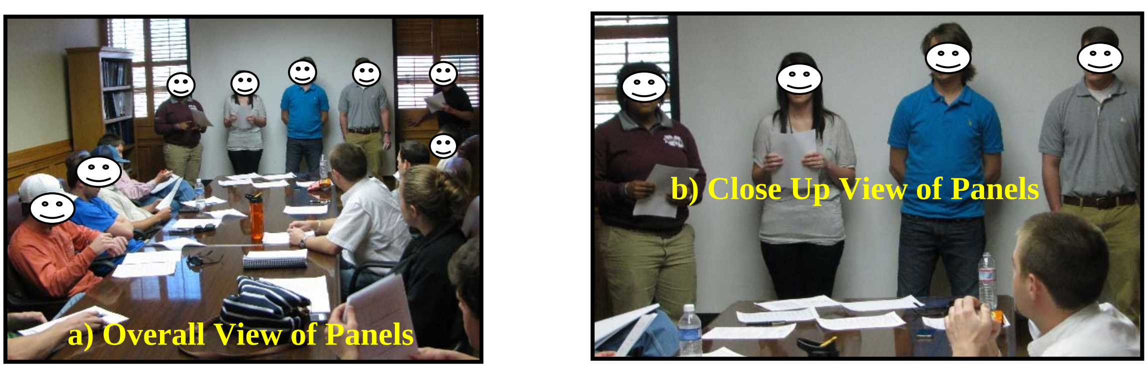


Figure 2. Example Panel Photographs

Generally, each panel member has a score sheet for the six groups for a lab day, and they each assign a score for the categories shown in Table 2 (e.g. 1 to 10 rating). Each panel member's score has equal value, and the weighted average scores from all panel members allow ranking of the groups when combined with all Table 2 factors. The highest ranking two groups get a perfect score, the next two groups get an intermediate score, and the lowest two groups get the lowest score. Students can present content any way they like, use handouts, and similar. All details associated with the panel's make up and scoring is known to students ahead of time.

Table 2. Factors and Weights Assigned to Panels

Component	Evaluated by Panel?	Spring 2013	Spring 2014	Spring 2015
Professionalism	Yes	10%	25%	33.3%
Technical Competence	Yes	10%	25%	33.3%
Group Cohesiveness	Yes	10%	25%	33.3%
Answers to Questions	Yes	20%	0%	0%
Lab Report Grade	No[1]	50%	25%	0%
Panel Topics	---	Aggregates Rep. Concrete Rep.	Aggregates Rep. Concrete Rep.	Fine Aggregates Chip Seals-Emulsions
Value	---	3.5% of 3 CA	10.7% of 1 CA	14.3% of 1 CA

1: Lab report grade determined only by instructor and teaching assistant (TA) and was not part of panels.
--CA = credit hour and Rep. = Report

Panels took place during regular laboratory time, and required around two hours per day for the six groups to give presentations and be evaluated. The 2013 offering was more informal and occurred in the laboratory, whereas the 2014 offering occurred in a conference room for a more professional atmosphere (the 2015 offering also plans to utilize a conference room). Students were provided a schedule ahead of time with their group's time slot, and a few extra minutes were allotted per group to ensure no rushed emotions felt by students (presentation times were 10 to 15 minutes depending on the semester with around 5 to 10 minutes between presentations). Panels were scheduled on a day with light laboratory activity, which provided a few minutes between laboratory activities and panel presentations to allow students time to relax, plan, gather thoughts, and so forth. Only the students presenting were in the room (i.e. all remaining students waited at another location to come in and present to the panel).

A difference between the 2013 and 2014 offerings was that in 2013, questions were a large portion of the total time, whereas in 2014 no questions were asked by the panel. In 2015 a balance between these two is planned where students give a brief uninterrupted presentation, followed by panel questions. A second key difference between past offerings and the planned offering in 2015 is the 2015 offering does not consider report grades as part of the panel grade, and gives a narrower focus for the panel topics, as opposed to students trying to present everything from a topic (e.g. several aggregate laboratory exercises lasting for more than one week). As an example, the directions given to students for the 2015 offering as part of their aggregates lab is provided below. A third difference is practitioners plan to serve as panel members in 2015, and a fourth difference is in 2015 some guidance is planned to be given regarding how to give a presentation to a panel and how to prepare handouts. A fifth difference is students were allowed to pick their own groups in 2015. Note the assessments provided in the next section provide some rationale for these changes between offerings.

- *Panel 1-Fine Aggregates (2015 Offering):* The goal for this panel is to demonstrate understanding of fine aggregates by first presenting how to conduct fine aggregate test methods, and then by presenting data on the two fine aggregates tested in laboratory exercises. The data presentation should include properties of these two fine aggregates, comparisons of their properties, and discussion of suitable applications for each material.

Two noteworthy activities occurred with the panel members utilized in 2014. The first was the MSU department underwent program changes resulting in the phasing out of two credit hours, which allowed the creation of CE 3311 as a separate course from the lecture. This change left a few students who had already taken the non-credit producing laboratory as part of CE 3313 that needed an additional credit hour. Options were discussed within the department, and the decision was made to allow those that took CE 3313 in the spring 2013 to take CE 3311 in spring 2014 to obtain credit for the course material. However, they were allowed to forego the laboratory and writing assignments since course content had not changed sufficiently. Rather, these students were tasked with an additional assignment of being a student panel member (SPM). Affected students were free to choose to take CE 3311 as normal, or be a SPM (most eagerly chose to be a SPM).

In the department's assessment, being a SPM was as useful as other alternatives. The SPM was able to participate in the evaluation process, and were also tasked with providing the instructor a write up with discussion on their views on how to improve CE 3311. The second noteworthy activity was the ASCE student chapter used the spring 2014 panels as a service project as a chapter officer served as a member of the panel voluntarily, not for credit in CE 3311. The student chapter participated by drafting the survey given to students (survey was reviewed by the instructor and adjusted slightly) that is presented later in this paper, administering the survey, and providing the results after grades had been submitted to the instructor.

3.0 Assessments

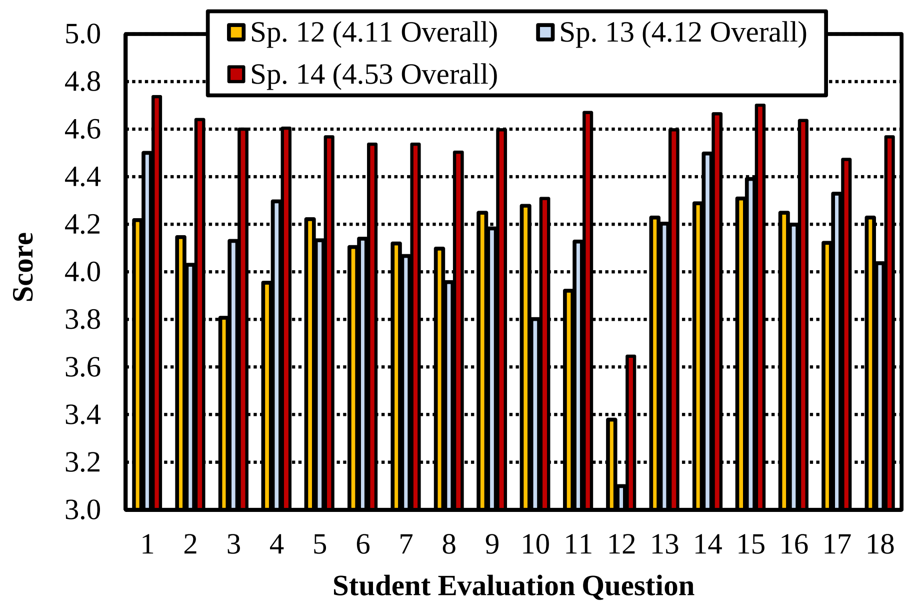
Schilling et al.[5] describes a taxonomy based approach (i.e. to assign a given written comment into one or more categories) to qualitatively assess written comments on student evaluations. A similar approach was used in a few instances for the assessments that follow.

3.1 Student Evaluations

Figure 3 provides a summary of three years' worth of student evaluations for the construction materials laboratory. These three years are the year before panels were instituted (2012), first year of panels (2013), and second year of panels that was also the first year the laboratory was credit producing (2014). Note that 42 to 75 responses were available for each question each year in Figure 3. Also, the bulleted list below is a taxonomized set of written student evaluation comments as they relate to the panels from the 2013 and 2014 offerings (no written comments were available from the 2012 offering). Five and nine students provided written comments in 2013 and 2014, respectively.

- Expression of dislike for panels, expressed they were burdensome, but also noted their intentions were good (1 time-spring 2013)
- Expression of general support for panels but did not agree with grading (1 time-spring 2013)
- Suggestion on changing timing of panels (1 time-spring 2014)
- Suggestion on more specific scenario for panels (1 time-spring 2014)
- Pick own groups (3 times-spring 2014)

There aren’t many clear trends that can be directly attributed to the panels alone, though there are some potentially useful observations that can be made from these student evaluations. First, the overall laboratory evaluation did not change a meaningful amount upon initial incorporation of the panels, which is encouraging considering they are an activity that is not expected to be well received by students. Second, the combination of the laboratory being credit producing and more formalized panels in a conference room occurred in 2014 where the student evaluations increased around 0.4 relative to the previous two offerings. As a reference, the department, college, and university student evaluation average scores ranged from 3.7 to 4.3 over a fifteen semester period from spring of 2007 through spring of 2014. Third, multiple students expressed a desire to choose their own group members, which was the only item mentioned more than once.



1. The instructor created high expectations for the class.
2. The instructor conveyed the course content in an effective manner.
3. The instructor made the class interesting.
4. The instructor was enthusiastic about the subject matter.
5. The instructor was accessible outside of class time to respond to my questions or concerns.
6. I learned a great deal in this class.
7. The presentation of course content helped me to learn this class.
8. The tests were fair.
9. The tests reflected material presented in lecture and/or assigned reading.
10. Tests and/or assignments were graded in a reasonable period of time.
11. I would recommend this instructor to other students if they wanted to learn this subject.
12. The lecturer for the course also taught this lab.
13. The lab sessions related to the lectures and improved my understanding.
14. The lab sessions were properly supervised for safety.
15. The lab instructor provided assistance when needed.
16. The lab instructions and exercises were fair.
17. The lab was properly equipped.
18. The amount of time scheduled for the lab was appropriate for the amount of work required.

Figure 3. Student Evaluation Summaries for Construction Materials Laboratory

3.2 Student Surveys

3.2.1 Spring 2013 Student Surveys

A voluntary survey was distributed to students, and it was made known the survey had no impact on grades and that responses would not be viewed until after grades were submitted. Students were informed that the purpose of the survey was to assess the effectiveness of the panel discussions, and a drop box was used to collect surveys. Table 3 summarizes numerical results of the survey, filled out by 6 of the 76 enrolled students (8% response rate). In additional to the numerical questions, students could provide written comments.

Table 3. Survey of Spring 2013 Construction Materials Students

Question	n	Avg.	Range
Did requiring groups to give competitive panel presentations seem to encourage uniform distribution of effort within the group?	6	4.0	2 to 7
Did requiring groups to give competitive panel presentations seem to encourage competition between groups?	6	5.5	1 to 8
Did panel presentations help improve your subject matter understanding?	5	7.0	2 to 10
Did panel presentations help improve your oral communication skills?	5	6.0	5 to 9
Is the laboratory better when it includes panel presentations?	5	5.0	2 to 8

--1 = very poor (or strongly disagree) and 10 = excellent (or strongly agree)
-- n = number of responses, Avg. = average of responses, Range = range of responses

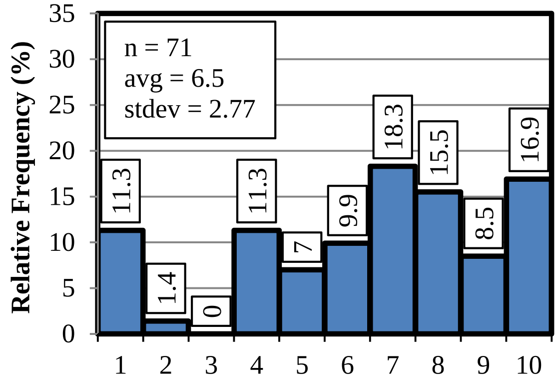
There weren't many clear findings from Table 3 or the corresponding written comments. There were a few written comments suggesting that the panel asking questions about the overall report (or the types of questions being asked) may not have been the best learning experience from the student's perspective. Another recurring theme were critical comments related to group work (e.g. poor effort of other group members, better group members were needed, needed accountability in groups, groups didn't promote competition). Some comments were favorable to the concept of competitive panel presentations (e.g. panels helped improve reports as semester progressed, professional criticism helped improve skills, idea is good, helped overall understanding). The primary finding was there was a wide spread of perspectives related to almost every question asked; the possible exception being if panel presentations helped improve oral communication skills as the lowest response was a 5.

3.2.2 Spring 2014 Student Surveys

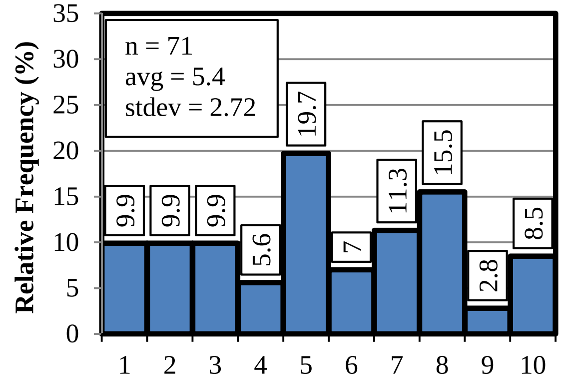
The aforementioned surveys administered by the ASCE student chapter had 100% participation. Students were informed that surveys were voluntary and administered anonymously with results being returned to the instructor following the submission of final grades. Students were asked to be as honest as possible, and numerical survey results are summarized in Figure 4. Written comments were received from 34 of 71 students (48% response rate) and taxonomized into categories as provided below.

- Resistance towards panels (e.g. "Panels are not useful since we are only presenting our reports.") (6 times-spring 2014)

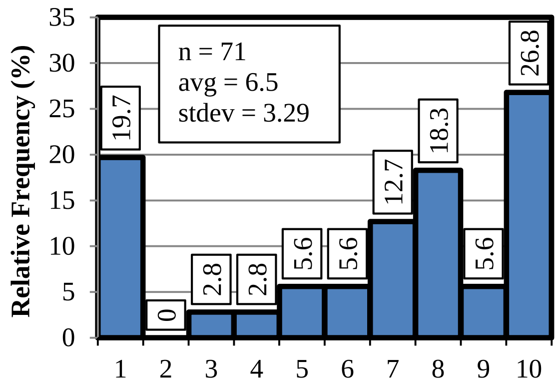
- Support towards panels (e.g. “They [panels] are not enjoyable, but are a necessary evil.”) (10 times-spring 2014)
- Requests more feedback or questions from panel (e.g. “… I did not get much of a critique of my oral communication.”) (7 times-spring 2014)
- Requests more guidance on panel requirements (e.g. “Maybe explicitly say what we need to talk about for panels.”) (5 times-spring 2014)



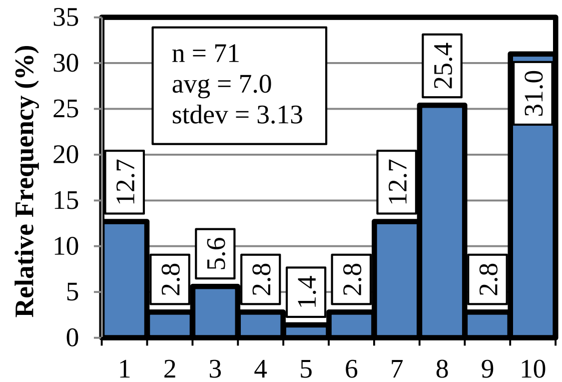
a) Panels helped improve communication skills.



b) Panels facilitated competition and decreased information sharing between groups.



c) The panels helped improve your understanding of construction materials.



d) CE 3311 is better with the panels as opposed to without them in the context of career preparation?

e) Would being asked questions by the panel improve experience?	Yes:27(38%)	No:44(62%)
f) Did putting the number of hours each member worked on the report and making each member sign for those hours help to distribute the work load?	Yes:38(54%)	No:33(46%)

Figure 4. Spring 2014 Student Survey Results (1 = very poor, 10 = excellent)

Reviewing the data presented in Figure 4, and assuming an answer of 7 or higher suggests a level of support for the question as proposed, it would appear that a large portion of the students felt the implementation of a panel review process was beneficial. A significant percentage felt the panel facilitated a better understanding of the material and that the experience would be beneficial to them in their intended careers. Over half indicated the process has a positive impact on communication skills. However, most did not feel the panel review process instilled a greater sense of competition (the lead author’s perception from 2013 to 2015 offerings is that competition is not being instilled in the undergraduate students).

3.3 Panel Evaluator Feedback

3.3.1 Spring 2013 Panel Evaluator Surveys

Six individuals served as panel evaluators (i.e. as SPM's) in the spring of 2013; instructor, three undergraduate TA's, and two materials engineering graduate students (course instructor was their major professor). Three to five of these individuals were present for each panel. Table 4 summarizes survey responses for the five panel evaluators who were students. The survey also allowed evaluators to write in comments, and the consensus of the comments received was that there was not a competitive spirit between groups, that there was not a uniform work distribution between team members, but that the experience was good for the students.

Table 4. Survey of Spring 2013 Panel Evaluators Who Were Students

Question	n	Avg.	Range
If you took this lab with the same instructor, did the panel presentations improve understanding of the laboratory experiments and writing experience relative to when you took the course?	4	8.3	7 to 10
Did requiring students to work in groups and give competitive panel presentations seem to encourage uniform distribution of effort within groups?	5	6.8	5 to 8
Did requiring students to work in groups and give competitive panel presentations seem to encourage competition between groups?	5	4.6	2 to 10
If you were an evaluator for both panels, did the quality of presentations, comfortableness presenting, and quality of answers seem to improve?	3	9.0	8 to 10
Is the laboratory better when it includes the panel presentations?	5	8.4	8 to 9

--1 = very poor (or strongly disagree) and 10 = excellent (or strongly agree)
-- n = number of responses, Avg. = average of responses, Range = range of responses

3.3.2 Spring 2014 Panel Evaluator Feedback

Thirteen individuals served as panel evaluators in the spring of 2014; instructor, ten undergraduates (all had completed this laboratory), and two materials engineering graduate students (course instructor was their major professor and they had a materials background). Nine to twelve of these individuals were present for each panel. In lieu of filling out a survey, feedback was collected in two manners: 1) meeting of student panel members after the laboratory had ended where instructor was not present; and 2) subsequent meeting with instructor (lead author of this paper) where the findings of the first meeting were presented and additional items were discussed.

The general consensus of the student only meeting findings can be summarized by the two items below. Additionally, there was some discussion about merits of having undergraduates on the panels (inferred to mean undergraduates who had passed the CE 3311 laboratory the year before), and of grading professionalism on an individual basis, but nothing especially tangible.

1. Questions should be asked by the panel to help distinguish who is and isn't learning, and also as a tool to correct incorrect information presented by students during panels.
2. Students would benefit from some direction on how to give presentations to a panel, and also from feedback on their panels besides ranking/numerical scores; e.g. how to prepare

reasonable handouts (the panel disapproved of several handouts used and indicated a page limit should be present), how to convey information professionally, and so forth.

When the students who served on the panel met with the instructor, the group went over the survey given to the students (summarized in Figure 4) and discussed the panel's view of each pertinent question, with the summary below being a consensus of the group (SPM's only). Interestingly, SPM's (a subset of peers of the CE 3311 group represented by Figure 4 but who observed the panels), had a higher assessment of the panels oral communication skills improvements, and disagreed with the majority of those that indicated questions would not be useful. SPM's agreed that competition between groups was not occurring to any meaningful level, but that panels were good for career preparation.

- Panels helped improve communication skills (score: 8 to 10)
- Panels facilitated competition and decreased between group information sharing (score: <5)
- Would being asked questions by the panel improve the experience (score: 10)
- Is the lab better with panels as opposed to without them for career preparation (Yes)

The panel indicated they benefitted from participation, with a common theme being it was useful to be on the evaluation side rather than the evaluated side of the process (as noted previously, these students had already been through the panels as students the year before). Other comments relevant to this paper were to: continue to conduct two panels per semester to allow students an opportunity to improve, reduce size of panel to 5 members or less, increase the amount of individualized grading of panel experiences (e.g. have the second panel experience be a shorter individual presentation on a pre-defined topic). It is interesting to note that the overwhelming theme of all discussions related to individualized grading revolved around grades being negatively affected by a lesser performing group member, but it was never mentioned the other issue being grades being positively affected by a better performing group member.

4.0 Discussion

The impact of underperforming group members was a repeated concern for students; either directly or when expressing a desire to form their own groups. There are examples in the education literature related to dealing with underperforming group members. For example, Dennis[6] paired three or four students together in a senior level geotechnical engineering course for a multi-component semester-long scenario-based design experiment. With the approach reported, Dennis[6] noted, "*As the client, the instructor can fire members from groups and cause them to become a group of one if peer evaluations indicate that there is a severe problem and that they are not pulling their load.*" In lieu of implementing an approach of this nature, the plan for the 2015 offering is to allow students to select their own groups. In this way, collaborative team environments should be promoted and individuals with a reputation for underperforming should be more readily isolated.

A key instructional component of the panels has been encouraging work that is of high enough quality to desire showing it to others as opposed to feeling obligated to show it to others. Also, requiring small groups of students to present to a panel encourages them to be more hands on during experiments, and helps facilitate active learning (in particular leading up to and during the panels). An indirect goal of the panels was to remove some of the "plug and chug" practices to completing assignments that can occur. Bella[7] and Truax[8] describe issues associated with "plug and chug" behaviors and how they can, for example, prevent exposing a student's limited knowledge of a subject.

The panels were intended to allow creative solutions to presenting information and generate understanding by avoiding a "plug and chug" approach to laboratory exercises and reports. Examples of creative approaches observed to date include use of a poster and stand where materials were adhered to the board, rapid set up of a computer for use of a slide presentation, and presentations absent slides or posters where students made good use of external references to frame their presentation. A variety of presentation styles have been observed to date.

5.0 Summary

Findings from two years of data where the panels have been incorporated indicate the concept is promising, but also indicate there is additional room for enhancement. It is believed by the authors that the enhancements planned for the 2015 course offering are likely to achieve an overall framework that address most of what was learned during the first two years of implementing the panels. As of the writing of this paper, one of the two panels had occurred for the 2015 offering. In 2015, students were given guidance on good handout preparation and presentation practices, allowed to pick their own groups, asked questions, and given a summary of strengths and areas of potential improvement after doing their panel. Overall, the panels seem like a worthwhile component of MSU's CE 3311 laboratory, and are planned to remain for the foreseeable future. Specific items that were clear from the data presented in this paper are presented in the following list:

- The laboratory was able to incorporate a fairly notable presentation experience without sacrifice of technical content or a drop in student evaluations, with a notable amount of positive feedback
- Students appear to have a very strong preference to selecting their own groups due to concerns of poor effort from some group members
- The experience is enhanced when a fair amount of direction is provided regarding what to present in the panels
- Students have mixed perspectives on being asked questions during panel presentations
- Many of the students who have experienced the panels indicate a potential for them to positively impact their oral communication skills and subsequently their careers
- There are a wide range of student perceptions about the panels, and this is unlikely to change
- Creating competitiveness between students is difficult and that these panels seem to have failed in that endeavor

6.0 Acknowledgements

Thanks are due to the individuals who served as panel members alongside the authors of this paper. Dr. Dennis D. Truax is also owed thanks for helping to facilitate several items associated with the 2014 CE 3311 offering, and for working toward a solution allowing SPM's.

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