Using Peer Review in Engineering Courses

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Abstract

Incorporating student peer review in some engineering technology courses can help students improve collaboration and work ethic as well as become better readers, better writers, and better presenters. The data collected from such experiences can be used later on to satisfy the ABET student outcomes g. (an ability to apply written, oral, and graphical communication in both technical and non-technical environments, and an ability to identify and use appropriate technical literature), and i. (an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity.

Introduction

This work details the authors' experience introducing peer review in courses such as Introduction to Engineering Technology, Thermodynamics, and Senior Technology Capstone. For example, during the Senior Technology Capstone course, the students were recorded during the proposal presentations and asked to self-evaluate their performance and to evaluate their peers. Significant improvements in presentation skills were observed during the final presentations. Our students showed criticism to their own performance, which is an important step towards self-improvement. In addition, tips and suggestions are provided based on the students' feedback and instructors' personal experience. Especially when started during the freshman years, the peer review can be an excellent tool to increase the student communication skills and self-awareness.

According to the National Society of Professional Engineers (NSPE) Legislation adopted on March 2017[1], NSPE supports the enactment of professional engineer peer review and NSPE believes that professional engineers participating in peer review should be protected by

appropriate legal immunity and legal privilege. According to reference[1], peer reviews include in-house post-project reviews of completed projects….". It is believed that this type of reviews will lead to improved practices.

According to NSPE, peer review is defined as "a process through which professional engineers evaluate, maintain, or monitor the quality and utilization of engineering services, prepare internal lessons learned, or exercise any combination of such responsibilities." Furthermore, according to the same source, "peer reviewer must not be an employee, coworker, partner or sub-consultant of the professional engineer whose design is being peer reviewed".

The principles of the peer review process can be also applied to our engineering courses, and this paper herein details our efforts to raise awareness to the ethical responsibility we have as engineers. Furthermore, the peer review projects described below satisfy the ABET Criterion 3, *Student Outcomes*, for accrediting baccalaureate degrees in Engineering Technology Programs[2], especially the outcomes:
(g) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;
(i) an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity; and
(j) a knowledge of the impact of engineering technology solutions in a societal and global context.

This work describes the authors' experiences in tackling peer review in several engineering technology courses, emphasizing the benefits of using such experiences, especially from the point of view of using the assessments as tools towards satisfying the accreditation programs requirements.

Applications

Three examples of peer review application are shown below, at three different stages during the engineering curriculum.

Example #1

Our Applied Thermodynamics course, MET 3100, is a 4 credit hour (ch) sophomore year course, containing a lecture component (3ch) and a laboratory experience (1ch). For the lab component our students meet for 110 minutes once a week in either the thermo-fluids laboratory for a hands-on laboratory experience or in a computer laboratory for a simulation type of activity, all under the direct guidance of the faculty teaching that course.

As part of these laboratory exercises is the project#1, started in spring 2014 semester, namely to investigate current applications of the Stirling Engine. The project requires the students to write a short paper, no more than 2 pages in length, about the impact of Stirling Engine in today's economy. The project is graded as a group project, with each group containing no more than 4 students. At the time this project is assigned in class, the students have already learned about the Carnot cycle, but have no other theoretical knowledge of power cycles. After the instructor collects all the articles and posts them on BlackBoard, the students are asked to blind peer review

and to grade their peers' articles from 0 (lowest) to 50 (highest) not including their own paper. They were instructed to include both the content and the style in their evaluations. The average of the peer review grades counted for half of the grade with the remaining half provided by the faculty.

During the spring 2014 semester, out of the 42 students enrolled in the course, making a total of 11 working groups, only 32 (76%) submitted their peer review evaluations. Out of these students, three assigned maximum scores to all papers.

Overall, the class average for this project was of 43.8/50 as given by the peers versus an average of 45.5/50 as given by the professor. The authors were impressed to see the level of commitment of those students who submitted their peer review, and the fact that vast majority took their job seriously. This is particularly visible using the standard deviation parameter to evaluate the grades given by each student to each project. Furthermore, the peer review average closely matches the one provided by the professor.

A sample of such data collected from the spring 2014 semester is presented in Table 1.

Being the first time this project was launched, no points were subtracted from a student who did not submit his / her evaluation. However, this first experience determined the instructor to use some incentives for the students to finalize their reviews, in the form of penalty points if no report is submitted.

During the fall 2014 semester, out of the 30 students enrolled in the course, making a total of 7 working groups, only 24 (80%) submitted their evaluations. Overall, the average for this project was of 43.8/50 from the peers versus an average of 46.8/50 as given by the instructor. The standard deviation per student ranges from 0 (two students awarded the maximum to all articles) to 5.48. To incentivize the students to submit their peer review, the students were informed that 5 points will be deducted out of their own final project grade if they don't submit the reviews. This measure increased the peer review submission rate by 4% compared with the previous year.

During the spring 2015 semester, out of the 40 students enrolled in the course, making a total of 11 working groups, 37 (92.5%) submitted their evaluations. One student awarded a grade of 40/50 to all projects. In this semester the students awarded lower scores than in the past, lowering the average peer review to 40.4 /50. This lower average was also consistent with the instructor grading, which was 43.4 /50. Overall, this denotes an overall lower quality papers from the student body but emphasize the students' dedication to be truthful / honest in their peer evaluations.

Table 1 – Spring 2014 Grade Distribution

	Paper #1	Paper #2	Paper #3	Paper #4	Paper #5	Paper #6	Paper #7	Paper #8	Paper #9	Paper #10	Paper #11	Average	St.Dev.
Student 1		40	45	50	45	40	40	45	45	45	45	44	3.00
Student 2		30	30	40	35	40	35	35	40	35	45	36.5	4.50
Student 3		45	45	50	40	45	40	45	40	35	45	43	4.00
Student 4		25	35	35	45	35	35	25	45	45	50	37.5	8.14
Student 5	25		40	35	35	40	30	25	40	40	45	35.5	6.50
Student 6	45		45	45	50	45	45	50	50	50	45	47	2.45
Student 7	45		45	50	50	40	45	50	40	45	50	46	3.74
Student 8	40		35	45	40	45	40	35	35	40	45	40	3.87
Student 9	50	50		30	30	35	45	35	40	40	30	38.5	7.43
Student 10	30	45		30	35	35	40	40	35	45	40	37.5	5.12
Student 11	40	45		35	50	50	45	35	35	40	50	42.5	6.02
Student 12	45	40	40		45	40	40	40	40	40	45	41.5	2.29
Student 13	45	45	50		50	50	50	45	50	45	50	48	2.45
Student 14	45	50	50	45		50	50	45	45	50	50	48	2.45
Student 15	50	50	50	50		50	50	50	50	50	50	50	0.00
Student 16	50	40	35	45	40		40	40	45	40	45	42	4.00
Student 17	25	35	30	45	50		30	35	35	45	40	37	7.48
Student 18	35	30	25	30	30		30	35	35	35	45	33	5.10
Student 19	50	50	50	50	50	50		50	50	50	50	50	0.00
Student 20	50	50	50	50	50	50		50	50	50	50	50	0.00
Student 21	50	50	45	50	50	50	40		45	45	45	47	3.32
Student 22	50	50	45	50	50	50	45		45	45	50	48	2.45
Student 23	50	40	40	45	45	45	45	45		40	40	43.5	3.20
Student 24	50	50	45	45	45	50	50	45		45	45	47	2.45
Student 25	45	50	40	40	40	35	40	45		35	50	42	5.10
Student 26	45	50	50	50	45	45	40	40		40	40	44.5	4.15
Student 27	50	50	50	50	45	50	50	50	50		45	49	2.00
Student 28	50	50	50	50	50	45	45	50	45		45	48	2.45
Student 29	50	50	50	50	45	50	50	50	50		50	49.5	1.50
Student 30	50	50	50	50	50	50	50	45	50		50	49.5	1.50
Student 31	35	35	40	35	45	40	40	35	40	45		39	3.74
Student 32	50	50	45	45	45	50	45	40	45	45		46	3.00
average	44.46	44.46	43.10	44.00	44.17	44.83	42.33	41.83	43.39	43.04	45.83	43.77	

Similar investigations were conducted for Fall 2015, Spring 2016, Fall 2016, and Fall 2017 semesters. In spring 2016, it was observed that a very large number of students awarded full credit to their reviews. The authors believe that the majority of these students did not read the papers, but submitted their score to avoid the grade penalty. To discourage this type of behavior, during the next semester the students were asked to submit beside the grades, a paragraph explaining their reasoning behind the grading.

Table 2 details the centralized data showing the average peer review grade vs. the average professor grade, each semester, as well as the standard deviation for the data averaged herein. Note that a value of 50 is maximum grade.

Based on the data shown in Table 2, the large majority of students are conscientious and treat the blind peer review seriously.

Table 2 – Centralized data collected between spring 2014 and fall 2017

		Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Fall 2017
Average Grade	Peers	43.9	43.8	40.4	44.1	46.6	44.5	46.1
	Instructor	45.5	46.8	43.4	43.9	45.9	46.9	49.1
Standard Deviation	Peers	3.7	3.4	5.2	3.8	2.5	4.2	2.7
	Instructor	1.2	1.2	3.4	4.9	2.5	1.7	1.1
Students participating (%)		76	80	93	93	90	70	91
# of teams		11	7	11	7	10	11	7

This project that started in Spring 2014 provided us a good opportunity to use the assessment data to fulfill the ABET student outcome criteria i) and j), and be part of the student outcome g) where it is considered together with other technical laboratory reporting.

Example #2

Our Introduction to Engineering Technology, ENGT 1000 is a 1 credit hour first year course. As shown in the general course description, this is an introduction to academic success strategies within a community of university learners, identifies the key strategies needed to support the transition from high school to the university, and introduces campus resources, self-responsibility, academic policies and procedures, study strategies, and other topics foundational to campus life. The course culminates with final presentations of the students describing their own "black box" and their own "engineering brain", by applying all the resources presented to them during the semester and focusing on how they can use these resources to become better students and in the future better engineers.

During the fall 2017 semester there were 84 students enrolled in one section of this course. Due to time scheduling constrains, the students were asked to present as a group, with each group made of no more than four students. The 84 students enrolled were assigned to 22 teams. To keep the students interested in attending the last four days assigned to presentations and keep them engaged during these presentations, they were asked to peer review their colleagues' presentations.

Furthermore, to encourage discussions between members of each group with respect to the presentations they attended, the peer grading was done in groups, not individually as presented in Example 1. Typically, the presentations were about 10 minutes, with an additional 5 to 10 minutes for questions and answers, discussions between members of the same group, and final peer grading. Each group received the presentation grading rubric shown in Table 3.

Table 3 - Final Project – Presentation grading rubric

Criteria	Needs Improvement (0-6 points)	Developmental (7-13 points)	Proficient (14-19 points)	Advanced (20-25 points)
Support Materials	No visual aids used.	Visual aid is used but detracts from the presentation.	Visual aid adds to the presentation.	Visual aid shows considerable work and creativity and adds to the presentation.
Volume/ Clarity	Volume often to soft to be heard by all audience members. Often mumbles or cannot be understood and/or mispronounces many words.	Volume is loud enough to be heard by all audience members most of the time. Speaks clearly and distinctly most of the time. Mispronounces no more than three words.	Volume is loud enough to be heard by all audience members at least 90% of the time. Speaks clearly and distinctly, but may mispronounce a word or two.	Volume is loud enough to be heard by all audience members throughout the presentation. Speaks clearly and distinctly. Does not mispronounce any words.
Preparedness	Presenter does not seem at all prepared. Reads directly from presentation or notes.	Presenter is somewhat prepared, but it is clear that rehearsal was lacking. Reads directly from presentation or notes most of the time.	Presenter seems pretty prepared, but could have used a couple more rehearsals. Reads directly from presentation or notes some of the time.	Presenter is completely prepared and has obviously rehearsed their presentation. Does not read directly from presentation or notes.
Professional Demeanor	Lacks confidence; sloppy or inappropriate dress; no eye contact; tense; leans on table or wall or sits down; stays in one place for entire presentation.	Presenter does two of the following actions: Makes eye contact; professional and appropriate dress; confident; adjusts to audience response; relaxed; moves freely around presentation area.	Presenter does 3-5 of the following actions: Makes eye contact; professional and appropriate dress; confident; adjusts to audience response; relaxed; moves freely around presentation area.	Makes eye contact; professional and appropriate dress; confident; adjusts to audience response; relaxed; moves freely around presentation area.

Since these presentations and reviews were conducted in class, the peer review was not blind. After the last presentation was conducted, the peer review data was collected, as shown in Table 4 below. The different colors shows the day in which the presentation was given. The data collected from the first day is represented in orange, the second day in green, the third day in purple, and the dark blue represents the last team to present in day 4.

Table 4 – Final presentation peer review data

	Team #1	Team #2	Team #3	Team #4	Team #5	Team #6	Team #7	Team #8	Team #9	Team #10	Team #11	Team #12	Team #13	Team #14	Team #15	Team #16	Team #17	Team #18	Team #19	Team #20	Team #21	Team #22
Team #1		100	100	100	100	100	100	100	100	100	100	100	100	100	100	95	95	100	100	95	100	100
Team #2	90		94	87.5	88	95	90	90	87.5	90	98	87	87	86.7	85	80	90	86.7	86.7	85	86.7	85
Team #3	100	90		90	95	95	85	90	85	95	90	90	100	92	90	95	91	95	100	89	87	85
Team #4	100	100	100		100	100	95	100	100	100	100	90	100	94	90	93	95	95	92	90	93	95
Team #5	72	92	83	82		88	84	81	85	86	87	89	85	90	95	85	90	90	85	87	88	85
Team #6	95	100	95				95	96						90	92	87	93	91	90	88	92	91
Team #7	95	85	95	85	95	80		90	90	85	90	95	85	85	90	85	90	100	95	80	85	100
Team #8	80	90	95	90	91	80	85		90	92	98	90	87	90	95	88	91	90.5	90	89	89	93.5
Team #9	100	100	100	97	98.5	100	99	98		100	99	99	98	96	97	97	98	98	97.5	98	97	96
Team #10	100	100	100	100	80	100	100	100	100		90	100	100	100	100	100	100	100	100	100	100	95
Team #11				87	90				83	95		87	84	85	90	83	78	87	75	88	90	80
Team #12	97	95	100	93	100	100	87	87	95	98	99		97	85	92	80	81	89	89	72	100	91
Team #13	95	95	100	85	90	95	92	90	88	95	85	95		90	82	85	90	80	95	80	95	87
Team #14	95	96	96.5	93	90	95	98	90	92	97	95	98	99		92	94	83	93	94	97	96	99
Team #15	92	90	90	80	96	87	90	86	87	95	90	98	81	90		93	98	80	85	90	92	
Team #16	100	95	100	100	100	100	100	100	100	95	100	100	100	100	100		100	90	95	90	100	89
Team #17	95	95	95			95	95	95						95	95	95		95	95	95	95	95
Team #18	90	81	80	87	87	95	85	85	80	90	100	80	85	90	85	80	80		92	90	85	95
Team #19	97	90	90	90	92	93	90	97	95	95	92.6	96	90	100	98	99	99	99		99	100	100
Team #20	88	90	94	97	99	95	87	91	94	98	100	95	97	96	97	91	98	97	80		93	88
Team #21	82	95	85	84	85	95	75	87	95	90	100	83	90	89	100	90	91	95	100	83		100
Team #22	100	95	100	91	93	100	100	98	97	99	80	95	95	97.5	95	95	99.9	96	90	98.23	99.69	
AVERAGE	93.15	93.7	94.63	90.45	93.13	94.4	91.6	92.55	91.76	94.47	94.4	93	92.63	92.44	93.33	90	91.95	92.72	91.72	89.68	93.49	92.48

As shown Table 4, teams 1 and 10 were more generous than others, giving the maximum score to 18 teams, while team 17 gave a score of 95 to all others.

In addition, a comparison was made to see how the average grades given by one team to all others compare to their own grades. Data is presented in the Table 5 below.

Table 5: Comparison between own scores and assigned scores to other teams

	team #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
average grade	to others	99.29	88.29	91.45	96.10	86.85	92.31	89.25	90.20	98.15	98.25	85.47	91.50	89.70	94.38	89.37	97.70	95.00	95.23	95.23	93.85	90.60	95.72
	received	93.15	93.70	94.63	90.45	93.13	94.40	91.60	92.55	91.76	94.47	94.40	93.00	92.63	92.44	93.33	90.00	91.95	92.72	91.72	89.68	93.49	92.48
standard deviation	to others	1.75	3.79	4.59	3.83	4.57	3.33	5.75	4.20	1.28	4.71	5.00	7.53	5.48	3.63	5.20	3.75	0.00	5.60	3.77	4.80	6.84	4.60
	received	7.49	5.11	6.00	6.02	5.64	6.06	6.81	5.70	6.08	4.43	6.02	5.81	6.67	5.05	5.14	6.18	6.65	5.80	6.56	6.99	5.22	5.91

As a first year experience, since the students were never introduced to the notion of peer review, the authors consider this process a success, especially since at least 90% of students submitted the peer review reports.

Example #3
Peer review is used as an integral part of the course ENGT 4050 Senior Technology Capstone. This is intended as a last-semester course in which students, working in teams, utilize acquired knowledge and skills to formulate and execute a solution to a design problem.

The ENGT 4050 capstone course is required of all students in Engineering Technology, which is a multidisciplinary department. Thus, in any semester, the course contains students in the following degree programs:

- Computer Science and Engineering Technology
- Construction Engineering Technology
- Electrical Engineering Technology
- Mechanical Engineering Technology
- Information Technology

During the course, students are required to make two presentations and produce a final written final report. Peer review is used in evaluating both of the presentations and is a critical element in assessing performance on the first presentation in order to make a plan for improvement for the second presentation.

For each of the presentations, those students who constitute the audience are asked to use a common evaluation form to assess the presentation. Thus, at any one time, each student is either a presenter or an evaluator. Evaluators are asked to assess each presentation in five categories, as shown in Table 6, by completing a table on a common evaluation form.

Table 6: Common Evaluation Form

Category	**Score**
Delivery	
Content/Organization	
Enthusiasm/Audience Awareness	
Visual Aids (PowerPoint)	
Dress/Physical Appearance	
Total	

Each of the five categories is evaluation on a scale of one to five (1-4) with the following guidelines:

- 4 - Excellent/Exemplary
- 3 - Good/Accomplished
- 2 – Fair/Developing
- 1 – Needs Improvement/Beginning

The use of fractions or decimals in the evaluation is permissible and encouraged. A total score is produces which is the sum of the individual category scores. In addition to identification of the team making the presentation and the subject of the project, space is provided on the form for written comments.

Prior to the first presentations, there is a classroom presentation on what is expected from each team in making the presentation to the class. A rubric is presented with regard to the evaluation of the scoring of the viewed presentations in each of the designated categories. The course focuses on providing students with a mechanism to hone both their presentation and their evaluative skills.

Following the presentations, the instructor collects and summarizes the evaluations. One example of evaluation, together with all written comments received in the fall term 2017 are shown in Figure 1. An Excel spreadsheet has been designed to organize and summarize the assigned numerical scores. A summary report is produced for each of the teams, indicating both the aggregate score in each of the categories and the total score, again using a scale of one to four (1-4). A final composite score is then formed from the total (combined) score on a more standard 100-point scale.

ENGT 4050 Composite: **96.1**
Senior Technology Capstone
Spring Semester 2017 – 2/15/2017
Proposal Presentation

Team: **A-1** Project Topic: **Engineering Campus Re-Design**
Evaluate the presentation with regard to the indicated categories. Use a scale of:

4 – Excellent/Exemplary 2 – Fair/Developing
3 – Good/Accomplished 1 – Needs Improvement/Beginning

Category	**Score**
Delivery	**3.8**
Content/Organization	**3.9**
Enthusiasm/Audience Awareness	**3.8**
Visual Aids (PowerPoint)	**3.9**
Dress/Physical Appearance	**3.8**
Total	**19.2**

Comments:

- Some issues with not knowing who would talk
- Good job! Sounds like a big project.
- Visual aids such as top-down views of campus were a little confusing and could have been explained more.
- Great idea, and nice work.
- Too much detail on their PPT. Font is small.
- Great idea. Makes for better social/study environment. New drainage – good observation. Rails to trails = good source of possible shared funding. Materials – well thought out. Detailed. Google SketchUp – imaginative. Trees = color change; I never thought of that. Great idea! Gantt chart – unusual.
- Excellent work!
- Eye contact with audience. Careful with the "ums". Lasers pointer is useful . . . one was sitting on the table in front. I liked the detail with calculations and appreciate the sample being passed around. Really like your project and plan. Campus needs more color!
- Jumping around way too much; interrupting the flow skipping to someone new each slide. Overall volume – okay. Try to project a little more. Use the laser pointer instead of standing in front of the screen. Wording on the pictures was very small and fuzzy. Start passing out the samples in the beginning.
- Impressive amount of research and calculations already done. Really liked how they brought samples to pass around. Excellent visuals.
- Delivery: monotone speaking by a few presenters. Content: good content; covered a lot of good material. Enthusiasm: "delivery". Visual: PPT had full slides each click; my eyes tried reading ahead as they were talking. Dress: looked professional.
- Went in deep on certain things, skimmed others. Button-down shirts.
- Great slide design! Use the laser pointer! Be sure to face and address the audience. Watch the hands-in-pockets posture.

Figure 1: Completed Form and Examples of Written Comments

As a means of further assessing the scores in each of the categories, each team is provided with a histogram of the category scores. This assists the students in interpreting the results as it indicates the range of the scores as well as the mode and distribution (see Figure 2).

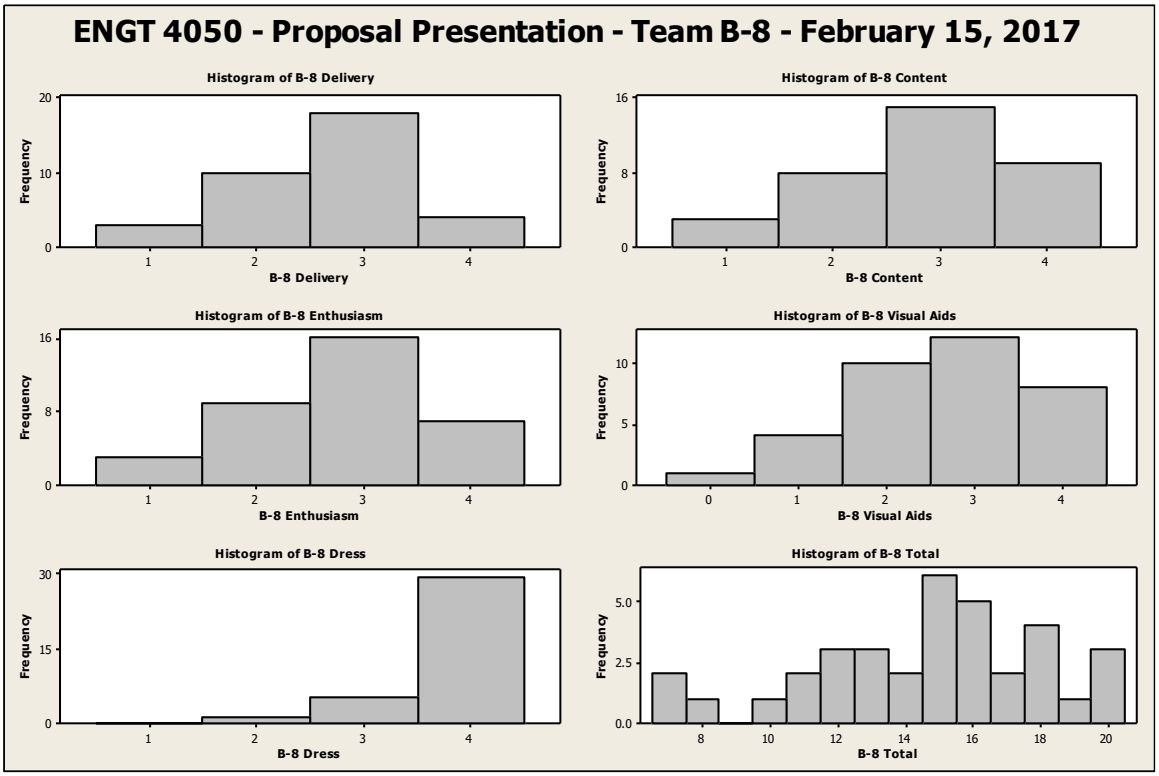

Figure 2: Graphical Presentation of Evaluation Scores

A video recording is also made of each team's presentation. The video is posted to the course website for easy access. Following the completion of the first round of presentations, a discussion is held in class to elicit those techniques and mannerisms which were found to be both positive and negative with regard to the impact on the overall message of the presentation.

The first presentation is considered the "Proposal Presentation" and is delivered early in the semester. The second presentation is considered the "Progress Presentation" and is delivered about two-thirds of the way through the semester. Before making the second presentation, each team is asked to produce a memo outlining steps that are planned in order to improve their team's second presentation. Thus, they have at their disposal the following information:

- Evaluation of the first presentation
    - Scores in individual categories
    - Histograms of scores in individual categories
    - Composite score (based on 20 points)
    - Composite score (based on 100 points)
- Video of their own presentation
- Videos of other presentations
- Review of their own PowerPoint presentation
- Results of classroom discussion on presentation technique

Overall, this gives the team the benefit of review of a wider range of audience than merely their own team members. They are able to view their own presentation from the standpoint of being an observer. They can also review the presentations of other teams for comparison or alternate style and/or techniques. Access to all teams' presentations for the purpose of review is facilitated by the use of a classroom website. This also provides a platform upon which to house reference documents and handouts pertinent to the class.

The peer review of the individual team projects provides perspective beyond that of the inherent discipline of the team. This often proves useful in assisting the teams in presenting their project in a style, language and format that is more easily understood by a wider range of audience. In watching and assessing the presentation of other teams, the students are forced to focus more closely on techniques employed by others with a different or more varied background. Often they are introduced to new or unique ideas that had not been considered within their own design team.

The process of reviewing the first presentation as a means of forming a constructive plan for improvement is judged to have worked well. While there are several components to the review process, the peer review is deemed to be the most critical element in making a positive contribution to improvement.

Peer evaluation is also used in ENGT 4050 as a means of assessing the performance of the individual students on the design teams. This occurs at the end of the course and is a mechanism that helps separate the individual effort within the team. One element of the course is to promote team work and foster the contribution of the individual to the efforts of the team. The instrument used to do this is a form (see Figure 3) on which each member of a team rates the other members of the team in five distinct areas:

- Dependability in attending group meetings
- Willingness to accept responsibility
- Positive contribution to the group effort
- Ability to work with others
- Quantity and quality of work

Evaluation is made in each of those five categories on a scale of zero to five (0-5) with the following guidelines:

- 5 – Very good effort; little room for improvement

- 4 – Good effort; above average, but room for some improvement
- 3 – Average effort; identifiable room for improvement
- 2 – Fair effort; not a true team player; improvement needed
- 1 – Poor effort; contributed little to the team; improvement necessary
- 0 – No effort at all; contributed nothing to the group's project

An overall score for the individual is provided by the sum of the scores in the five categories (a total possible score of 25). This can then readily be converted into a score on the basis of 100 for ease in interpretation and inclusion into a grading scheme.

When students work in teams to execute a design project, many of the graded elements are attributable to the team rather than to individual effort. While the majority of the teams are able to overcome any internal conflicts to function successfully as a team, there is always a question of differences in the division of effort or the acceptance of responsibility. The peer evaluation within the team helps to overcome this disparity the evaluation is incorporated as an element of the final course grade. It also contributes to a sense of ownership to the individual team members when they have a voice in the awarding of grades. Additionally, this provides the students with some experience in the evaluation of others within their peer group.

ENGT 4050 Team _____
Senior Technology Capstone
Fall Semester 2017
Team Member Evaluation Name _____

Project Topic _____

In the space provided, insert the names of your team-mates. Then evaluate each person on your team, including yourself, with regard to the categories shown. Use a scale of:

5 – Very good effort; little room for improvement
4 – Good effort; above average, but room for some improvement
3 – Average effort; identifiable room for improvement
2 – Fair effort; not a true team player; improvement needed
1 – Poor effort; contributed little to the team; improvement necessary
0 – No effort at all; contributed nothing to the group's project

Fractional scores may be assigned.
Complete your evaluations independently without group discussion or consultation. Evaluations may be submitted on Blackboard or folded in half and returned to the Capstone instructor.

	Yourself					
Dependability in attending group meetings						
Willingness to accept responsibility						
Positive contribution to the group effort						
Ability to work with others						
Quantity and quality of work						
Overall Score (Sum of above)						

Comments:

Figure 3: Team Member Evaluation Form

Conclusions

As shown from the three examples above, numerous and important benefits for students and for program evaluation objectives that can be achieved by incorporating peer review as an integral part of various courses at all levels:

- Increased critical self-awareness related to report writing and public presentations by knowing that own work will be evaluated by peers and by knowing in detail the criteria used for evaluation;
- Improvement in the style, language and format for technical presentations, adapted to specific audiences due to peer feedback;
- Exposure to another, usually less experienced, component of team work, related to peer reviewing;
- Increased sense of ownership for the submitted work;
- Exposure to ethical decisions related to peer evaluation, both as members of the same team and between different "competing" teams;
- Improved course attention and motivation;
- Documentation related to ABET student learning outcomes g, i, and j

References

[1] https://www.nspe.org/resources/issues-and-advocacy/position-statements/peer-review-legislation
[2] http://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-technology-programs-2018-2019/