



Implementing and Evaluating a Peer Review of Writing Exercise in a First-Year Design Project

Dr. Kathleen A Harper, The Ohio State University

Kathleen A. Harper is a senior lecturer in the Engineering Education Innovation Center at The Ohio State University. She received her M. S. in physics and B. S. in electrical engineering and applied physics from Case Western Reserve University, and her Ph. D. in physics from The Ohio State University. She has been on the staff of Ohio State's University Center for the Advancement of Teaching, in addition to teaching in both the physics department and college of engineering. Her research interests address a broad spectrum of educational topics, but her specialty is in how people learn problem solving skills.

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Context and Rationale

As part of a 10-week “cornerstone” design project in the second semester of Ohio State’s first-year honors engineering sequence, student teams must submit a complete documentation package, including a thorough technical report. During the approximately twenty-year history of the program, teams have submitted drafts of each half of the report earlier in the term for feedback. This recursive approach is in line with recommended best practices in writing.¹⁻² In spite of the heavy emphasis on technical writing in the prior semester, these drafts were often disappointing and time-consuming to grade. Also, it sometimes seemed that feedback on the first half draft had little impact on the quality of the second half draft; instructors often felt that they were seeing the same problems with the second half draft that they had on the first.

Peer review of writing was identified as a possible technique for helping students improve their writing more quickly. Use of peer review has been common in other areas of academia,³ and is growing in popularity in engineering.⁴ It was hoped that through the peer review, the students would address some of the minor writing problems, such as grammatical and typographical errors. It was also hoped that the peer feedback would address other general points that had been emphasized in the first semester of the course sequence, such as making appropriate person and voice choices. Further, two areas where past drafts had consistently been identified as lacking were in the appropriate citations for relevant sources and the clear incorporation of figures (in terms of selection, placement, and in-text references). If the students were effective in addressing these issues, it would allow the instructional staff to focus their feedback on larger communication issues, such as content, audience awareness, and flow. This study appears to be unique when compared to the existing literature, in that it examines peer review focused on team writing in a first-year engineering course.

Design and Implementation of the Assignment

For the peer review exercise, teams were instructed to write a high-quality draft of the first two sections of their report (the introduction and description of initially brainstormed ideas). They then turned in four copies of the report. These copies were distributed to four different teams in their class. Each of the four members on a given team received a different report for which to provide feedback. They were encouraged to write directly on the draft and were also given a feedback form to complete. The questions on the feedback form are shown in Figure 1. The complete instructions are Part 1 of the assignment, found in the appendix.

1. In general, what are the strengths of this draft?
2. In general, what are the weaknesses of this draft?
3. Does the draft fit within the guidelines of the assignment? If not, explain how it does not.
4. Could you understand what the authors were trying to say? If not, what made it confusing?
5. Was the authors' use and structuring of references appropriate? Were there places where references should have been made, but were not?
6. What other constructive suggestions do you have to help the author improve this draft?
7. What was your general impression of the draft? (We are not asking you to "grade" the assignment, but rather give your overall thought. Good? Bad? Somewhere in between?)

Figure 1: Questions asked on peer review feedback form

The exercise was structured such that each member of a team (typically composed of four students) reviewed a different team's draft, so they could see how several other groups approached starting their reports. After the team members completed the reviews of their classmates' work, but before they received feedback on their own, they engaged in a reflective discussion, prompted by a handout. Suggested questions for starting the conversation are shown in Figure 2.

1. What about the draft you read was better than the draft you submitted?
2. What about the draft you read was not as good as the draft you submitted?
3. Were there any errors in the draft you read that you realized were also in the draft you submitted?
4. What changes would you recommend be made to your draft as a result?
5. Do you have any new questions for the instructional staff about the requirements and/or expectations for the final report?

Figure 2: Prompts for team discussion portion of peer review

Teams were asked to identify aspects of their draft that were better than those they read, as well as describe modifications that they would make to their report based upon what they saw from their classmates. The complete instructions of the team portion of the exercise are Part 2 of the assignment in the appendix. The reflection was turned in, along with the feedback they provided to their classmates. Credit for both parts of the assignment was essentially effort-based. Teams then received the peer feedback and began working on the subsequent first-half draft of the report. This draft included the two sections that were the subject of the peer review, plus a few others. The total time for the peer review exercise was about one week.

Assessment Methods

While on the surface it appeared that students were getting helpful feedback from their peers and using it in their further writing, no real conclusions could be drawn without doing a structured analysis. It was possible that the students were not really taking the assignment seriously. It was also possible that they were earnest, but giving poor advice to their classmates. Further, it was not known if the students even read, let alone used, the peer feedback in preparing subsequent drafts. In the spring of 2014, a qualitative analysis was conducted to answer a few basic questions about the assignment:

- 1) What types of advice do the students give to each other?
- 2) Is the advice in line with good technical communication practice?
- 3) What areas for improvement in their own writing do teams identify as a result of reviewing others' drafts?
- 4) Do the teams use the advice from their peers in subsequent report drafts?

The sample was one section of the course (35 students on 9 teams). Copies were made of the marked-up drafts of the peer reviews, the completed feedback forms, and the group reflections. First the drafts and the feedback forms were analyzed using a qualitative emergent analysis. The resulting coding structure was then used to analyze the group reflections. This was intended to address questions 1 through 3 above. To investigate question 4, the first drafts turned in after the peer review were compared against the peer feedback to see if any modifications could be traced to the exercise. Usable data was collected for 34 peer reviews, 8 group reflections, and 7 first drafts.

Analysis and Results

First the marked-up drafts were analyzed. The drafts ranged in length from 5 pages (double-spaced) to 15, with an average draft being 9.4 pages. A total of 1054 comments and markings were made on the drafts, which means that an average draft received 31 notations. This seems to indicate that students were taking this part of the assignment seriously. These markings fell into five categories:

Content: These were comments that indicated content should either be added or removed.

Organization: These comments tended to focus on the sequencing of ideas, as well as how the ideas were broken into sections in the report, along with formatting.

Style: These were suggestions about the way the ideas were presented, such as sentence structure.

Visuals: These addressed the quality, content, location, and number of figures and tables, along with various mechanical elements of visual use, such as captioning and references in the main text.

Grammar: These markings called attention to grammatical, as well as typographical, errors.

The distribution of the marked-up feedback within these categories is summarized in Figure 3. Note that this coding scheme accounted for 99% of the comments, with only 11 of them being marked as “other.”

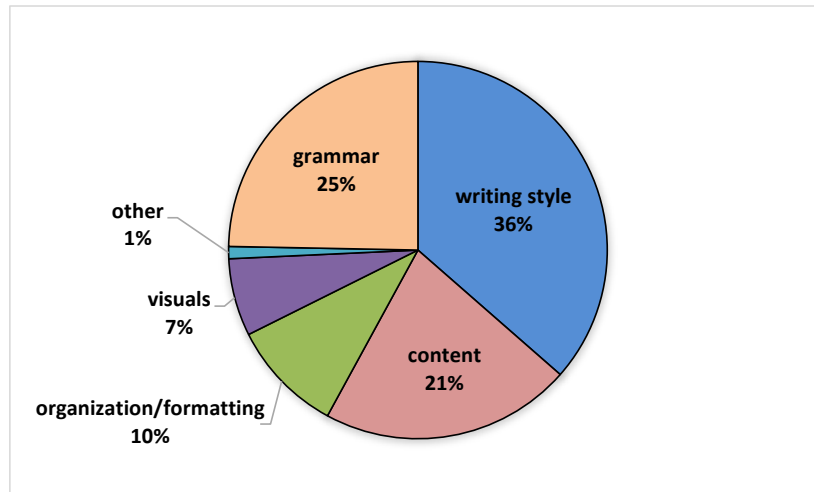


Figure 3: Distribution of peer-review comments written on drafts

These categories do align well with principals of effective technical writing, which is encouraging. Overall the student feedback appeared to be helpful. Roughly 99% of the markings directly on the drafts contained what the researcher considered good advice for improving the draft. Almost all of the 1% that was bad advice addressed visuals. Figure 4 shows the breakdown of the aspects of visual usage identified by the students.

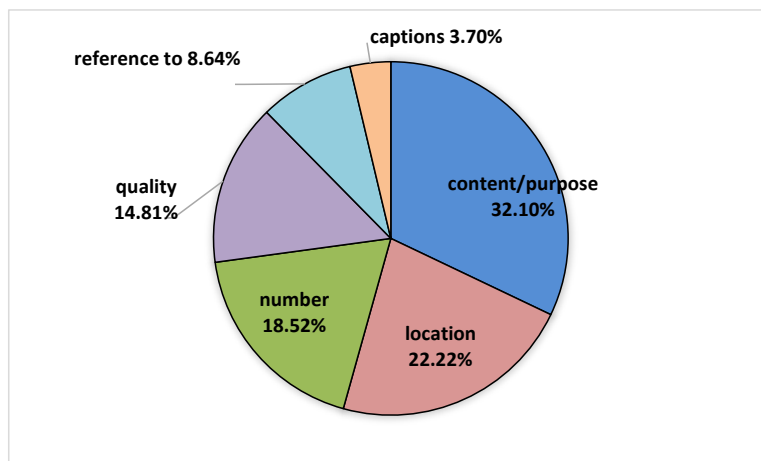


Figure 4: Peer-review comments regarding figure/table usage

Again, these are important considerations in effective incorporation of visuals in a report. The students gave each other excellent advice regarding the quality of chosen photos, the reasons for using a figure, or the way they explained the figure in words. All of the bad advice came in the category of figure location, which had been noted as an area of concern by the instructional staff when designing the exercise. In past years, students had tended to put almost all of the figures and tables into appendices, rather than inserting them in the main body of the report near the text they related to. The instructors thought that during the review process, students would find it

enough of a hassle to flip through the pages looking for figures to make their peers aware of it. This did not happen at all. In fact, the couple of groups that did utilize in-text figures were told repeatedly by their classmates that they “belonged in an appendix.” Possible reasons for this behavior will be presented in the discussion section.

Recall that another area of concern that the instructors hoped would be satisfactorily addressed through the peer-review process was appropriate referencing. Unlike the figure placement issue, the instructors did not think most students would pay attention to it without some prompting, so a specific question was placed on the feedback form. (See Figure 1.) Since there were no comments about this aspect of the reports spontaneously written on the drafts, this belief in the need for a specific prompt was supported. The responses to this prompt on the feedback sheet were broken into 58 different ideas. Each idea then was coded according to whether the advice in it was considered correct and/or on target versus being incorrect or missing the intent of the prompt. Some examples of feedback that was considered good included comments such as, “There were no references to outside sources,” or “The scenario document [written by the instructional staff with all of the specifications and rules in it] should have been referenced.” Feedback that was not on target included items like, “[The team’s] decision matrices should be included and referenced,” “There were no appendices,” and “Due to lack of visuals, no references to figures, pictures, or tables [were made].” These results are summarized in Figure 5.

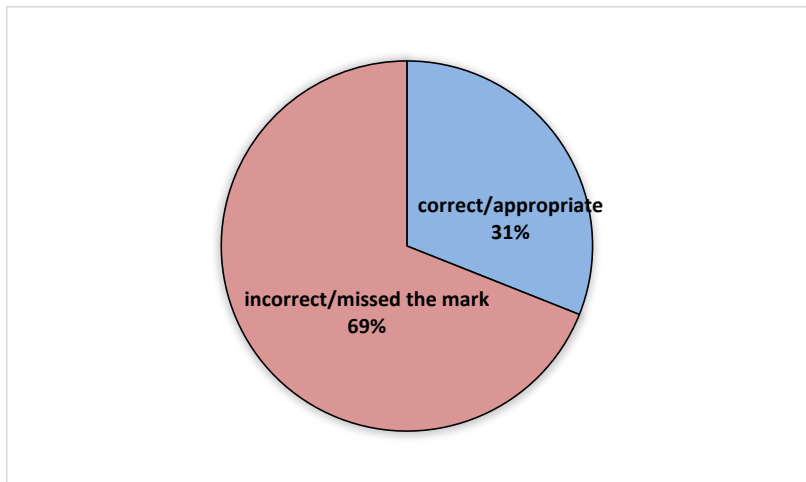


Figure 5: Peer-review comments on reference usage

The results show that even when specifically prompted to look at and comment upon references, the students did not tell their peers what the instructional staff was hoping they would. Reading through the feedback, the reason for this became clear. The instructors had used the word “references” as being synonymous with “citations,” but the students did not read it that way. In fact, the majority of the class interpreted it as a phrase referring to a visual element, such as “Please see Figure 7.” This finding has led to a rephrasing of this particular question, along with some other changes to the assignment, described below.

The analysis described to this point shows that the students did take the first portion of the assignment seriously and that, for the most part, they tended to give good advice. To see whether the second part of the exercise was effective or not, the researcher read the peer review

draft, noting which of the five areas from the emergent coding scheme required improvement. Next the summaries of the team reflection sessions were coded to see which of the five areas each team self-identified as needing improvement, and they were compared. This comparison is summarized in Figure 6.

Team	Original Issues					Reflection Discussed				
	writing	content	formatting	visuals	grammar	writing	content	formatting	visuals	grammar
A	■			■	■	■	■	■	■	■
B				■		■	■	■	■	■
C	■	■		■		■	■	■	■	■
D		■		■		reflection not available				
E		■		■	■	■	■	■	■	■
F	■	■		■	■	■	■	■	■	■
G	■		■	■		■	■	■	■	■
H		■		■	■	■	■	■	■	■
I	■			■		reflection not available				

Figure 6: Comparison of issues identified in peer-review draft

The group reflections showed that most teams identified at least three major aspects in which they could improve their writing. The majority of the teams discussed improving their writing in all of the five categories, even in ones that were not identified by the researcher as being in need of significant attention. Keep in mind that these reflections were written after the teams had written feedback for their peers, but before they had seen the comments on their own report draft. The process of looking at other teams' writing had indeed spurred them to think about their own and ways to improve it. As one team put it, "After reading the reports...our group was able to edit and improve other's [sic] reports as well as find faults that need correcting in our own." This is consistent with results of peer review reported elsewhere.⁵

The final piece of the analysis was to determine if the peer review had any impact on the subsequent drafts. To ascertain this, the marked draft from the peer review was compared to the same sections in the draft of the first half of the report that was turned in about two weeks after the peer review experience. The number of changes between the drafts was recorded, along with the number of changes that were directly related to the peer comments. These results are summarized in Figure 7. Note that the first-half drafts were not available for teams H and I.

Team	# changes	# from P.R.	%
A	68	52	76%
B	78	5	6%
C	13	5	38%
D	5	5	100%
E	132	127	96%
F	78	8	10%
G	108	39	36%

Figure 7: Changes made to drafts after peer review

The number of changes made to the drafts varied greatly, as did the significance of the changes and the degree of peer-review influence. For instance, team E made the most changes and almost all of them were suggested by their peers. On the other hand, the peer reviews only led to 10% or less of the modifications by teams B and F. Team D did not make many changes at all, but all of them were influenced by the peer review. Regardless of the degree to which they agreed with the feedback, it appears that all of the teams read the feedback and used some portion of it. The “grain size” of the revisions varied, too. Many of team E’s modifications were small grammatical corrections or word choice changes. Team F made large-scale content changes throughout the report.

Figure 8 portrays the overall influence of the exercise by combining the information above with a coding of the nature of the revisions made in the first half draft.

Team	Original Issues					Reflection Discussed					Changes Made							
	writing	content	formatting	visuals	grammar	writing	content	formatting	visuals	grammar	# changes	# from P.R.	%	writing	content	formatting	visuals	grammar
A	■			■	■	■	■	■	■	■	68	52	76%	■				■
B				■		■	■	■	■	■	78	5	6%		■			■
C	■	■		■		■	■	■	■	■	13	5	38%	■			■	■
D		■		■		reflection not available					5	5	100%				■	
E		■		■	■	■	■	■	■	■	132	127	96%	■			■	■
F	■			■	■	■	■	■		■	78	8	10%		■	■		■
G	■		■	■		■	■	■	■	■	108	39	36%	■		■	■	■
H		■		■	■	revisions not available					revisions not available							
I	■			■		reflection not available					revisions not available							

Figure 8: Summary of report revisions and peer-review influence. Lighter gray areas indicate changes that were not improvements.

The overall quality of all reports improved as a result. However, as alluded to earlier, the recommendations regarding visuals were usually not in line with what was desired. Three teams, indicated by the light gray boxes above, moved many key images from the main body of the text into appendices, lowering the quality of that facet of their report. Team C, in particular, had moved several well-chosen CAD models of their robot out of the preliminary ideas section and into an appendix.

Discussion and Implications

The results indicate that the students provide useful feedback via the peer review mechanism. The addressed sections in the drafts of the first half of the report were improved over the peer-review submissions, and clear links were seen between the peer feedback and the changes that were made. In this respect, the assignment was successful and the results are in line with what previous literature has described.

There were two significant areas in which the students were unable to provide the quality of feedback that was desired. Students did not spontaneously realize that in many cases it is most advantageous to insert a relevant figure in the text that it helps illustrate. Indeed, the majority of the time they advised their classmates to move figures from the text to appendices. There are at least two possible factors that could explain this. First, the peer review draft is generally quite short, averaging around 9.5 pages of text, plus a few pages of front matter and some small appendices. It is not difficult to flip to the back and find the relevant appendix. Since this is the first time students will be writing anything as long as their final report, they do not have enough experience at this stage to realize just how large their final document will be, nor how time-consuming it will become to page through to locate the proper location in the correct appendix. Second, even though they wrote some formal lab reports in the previous semester and included some figures, the figures were different in nature. Those figures tended to be data tables or computer code, the sorts of figures that would indeed be appropriate to place in an appendix. Yalvac, *et al* also report a need to focus on “visual thinking” in writing, though some of the issues they uncovered in their study were different than those found here.⁶

The second area where the students failed to meet expectations was in providing feedback on appropriate citations to outside resources. This appears to be a consequence of the word choice in the prompt regarding this on the feedback form. Results may improve simply by changing the word “references” to “citations.” Again, this is not an area that was significantly addressed by writing lab reports in the first semester. While students have had experience with writing citations in previous schooling, it is unlikely that this experience was in a technical class.

In looking through the feedback forms, it was also found that students did not provide any useful information in response to question 3, which asked whether the submission fit within the guidelines of the assignment. This question is admittedly vague.

A limitation on this study is that it did not analyze the second draft or the final submission to see if there were any further effects from the peer review. It is definitely possible that some of the teams did not choose to implement all of the changes suggested by their peers in the first set of

revisions for any of a number of reasons, including time constraints at a busy time of the semester. They may have decided to address those suggestions at a later date.

As a result of this analysis, several small but important changes have been made to the peer review materials for implementation in Spring 2015. Since question 3 provided no useful feedback, it has been eliminated. It was replaced with a new set of questions about figures: “Was the authors’ use of figures appropriate and helpful? Are there places where additional figures would help clarify their points? Are there any figures that seem excessive? Were the figures placed in the best locations to communicate their points?” The references question has been re-worded for improved clarity: “Was the authors’ use and structuring of citations appropriate? Were there places where citations should have been made but were not?” It is hoped that these changes will not only improve the quality of the feedback the students provide each other, but will better prime the students for the self-reflection portion of the exercise.

The instructions for the second half draft have also undergone a minor revision. In the past, the instructions implied that the students should rework the first half of the report while writing the initial version of the second half of it. However, the grading rubric, which is available to students, had no points associated with the first half of the report. This may have downplayed the intended role of the peer review. The instructions have been re-written to specifically refer to a re-writing of the first half, and the rubric has been revised to associate points with that re-working. All of these changes will be implemented in the Spring of 2015.

Summary and Conclusions

A peer-review of writing exercise was implemented to assist first-year engineering students as they began drafting final technical reports for a substantial project. Analysis of the work submitted for this assignment showed that the students provided a reasonable amount of well-thought-out feedback. Most of the feedback could be categorized in one of five broad areas: content, style, visuals, formatting, or grammar. Generally, students commented on aspects of writing in which they gave good advice, in line with recommended technical writing practices. Students benefitted, not only from the feedback they received from their peers, but from the practice of critically evaluating the work of their classmates. As one team summarized in their reflection, “As a team, we found that this objective evaluation of other teams’ work was a great way to look at our own work in a different light. We found the areas we did well in as well as the ones that need improvement. Using this knowledge, we plan to go forward and write an even better draft, or even drafts, void of the problems it has now.”

There were two areas in which the feedback was not what the instructors desired. Students were not able to determine the best locations for figures and tables in their documents. Also, they misunderstood the question asking about references. In response to these deficiencies, the assignment has been revised. Another question that did not produce useful feedback has been eliminated.

The student teams incorporated the feedback from their peers in revisions of their work, as measured by an analysis of the next draft of the report they submitted. Future work will analyze the effects of rewording the assignments and also pull all report drafts into the data analysis.

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Appendix 1: Peer Review Assignment

This assignment consists of two parts, detailed below.

Part 1:

- a) As a team, write a good draft of the Introduction and the Preliminary Concepts & Ideas sections of your final report. Be sure to follow the final report formatting guidelines and include supporting figures as necessary.
- b) Prepare 4 copies of this draft. Staple each copy.
- c) On the day indicated in the daily assignment list, turn all of the copies in at the beginning of class. Also submit the rubric for this part of the assignment, but **DO NOT STAPLE IT** to the rest of the assignment.

Part 2:

- a) Each member of the team will receive a draft from another team. Read the draft and provide meaningful feedback to the team about their writing (not about their design or team name, or anything like that.) by filling out the Peer Feedback Form and by making marks on the paper itself.
- b) After each of you have prepared your individual feedback, meet as a team to discuss what you read and what you learned from the experience that will help improve your own final report. Some questions that might help start the conversation include (but are not limited to) what about the draft you read was better than the draft you submitted? What about the draft you read was not as good as the draft you submitted? Were there any errors in the draft you read that you realized were also in the draft you submitted? What changes would you recommend be made to your draft as a result? Do you have any new questions for the instructional staff about the requirements and/or expectations for the final report?
- c) As a team, prepare a short document (1 to 2 pages) that summarizes your conversation in part 2b. Attach the rubric for this part of the assignment and turn one copy of this document, along with the individual feedback from each team member, in at the beginning of the class indicated on the daily assignment list. Do **NOT** staple the individual feedback forms together, though you should staple the two pages of each feedback form together.