

Using the Peer Review Process to Implement Writing Assignments in an Engineering Technology Course

Andrew T. Rose
University of Pittsburgh at Johnstown

Abstract

Implementation of writing across the curriculum is intended to improve the communication skills of engineering technology (ET) graduates to better meet the needs of industry, as well as to meet the general education requirements at many institutions. One way to include writing experiences in the ET curriculum is to identify courses already writing intensive and create appropriate assignments to develop improved student writing skills. The “Writing Assignments for Technical Courses” workshop sponsored by the Liberal Education Division at the 2000 ASEE Conference discussed how student peer review can be used with well-designed writing assignments in technical courses. Based on this workshop, writing assignments in a junior level civil engineering technology course have been used to help students improve their writing skills. Writing assignments varied from transmittal memos, technical memos, laboratory reports and a five to seven page research paper on topics that time constraints prevent from being covered in class. To compare the effectiveness of peer reviewed writing assignments with non-peer reviewed assignments; the peer review process was used only for the paper. All other writing assignments were not peer reviewed. Peer review teams of three students were assigned by the instructor based on writing abilities observed during the first half of the semester. In order to expose students to a wider variety of technical information, students were matched so they reviewed papers on topics different from their own paper. Two students reviewed each paper. Assignment grades were based primarily on the final paper but a portion of the grade was related to the review process. A questionnaire obtained student feedback on the writing assignments and peer review process. Recommendations for improvement of peer review writing assignments are presented.

I. Introduction

Improving communication skills of students is a goal throughout engineering technology programs. ABET,¹ colleges and universities with ET programs,² as well as employers³ all agree that student communication skills need to be improved. Written communication skills are one of the areas especially needing improvement. Additional writing courses, however, are not the most effective way to improve student writing.⁴ Adding additional courses to the curriculum is difficult in the already crowded course sequence at most institutions. In addition, improved student writing tends to occur more through writing assignments that provide regular practice in major discipline courses, rather than through separate writing courses.⁵ As a result, ET faculty should look to their existing courses to see how writing assignments can be implemented or expanded to help students improve their writing skills.⁵

At the University of Pittsburgh at Johnstown (UPJ), the required introductory course in Soil Engineering included writing assignments and had potential for additional and improved writing exercises. Describing soil structure and behavior, documenting laboratory experiments, and discussing special concerns in soil engineering make written assignments easy to implement. Experience in this course the previous year, as well as with senior design project final reports, suggested that students did not need just to practice writing more, but also needed more feedback to improve their writing skills. As a result, course writing assignments gave students practice at writing in a variety of formats and provided feedback on their written documents. Through peer review, the students received feedback from their peers as well as from the instructor.

II. Writing Assignments Utilized

The writing assignments varied. Short transmittal memos to the instructor were submitted with every assignment and laboratory report. Other assignments consisted of technical memos submitted to explain a process or discuss topics encountered through reading. Some writing experiences came from short explanations or discussions associated with the results of numerical homework problems. Laboratory reports provided a more formal writing exercise. Students also wrote a research paper on a topic of their choice. This provided experience researching the literature in soils engineering. All assignments were submitted directly to the instructor except for the research paper. The research paper was peer reviewed by other students in the class. After incorporation of the peer review comments, revised papers were submitted to the instructor for grading.

III. Assignments without Peer Review

Student assignments completed without peer review indicated various levels of effort by students and in many cases illustrated poor quality writing. Students tended to expend more effort and submitted better quality writing for assignments discussing topics covered through reading. A wide range of effort and quality of writing was observed in laboratory reports. During their sophomore year, students are supposed to learn proper laboratory report preparation in strength of materials laboratory. Different instructors, however, may be less demanding resulting in groups of students who are less prepared for report writing in upper division laboratory courses. Additional effort is needed in the upper division to help students who struggle with laboratory report preparation. Low student effort and poor writing were especially apparent in short written explanations or discussions associated with numerical homework problems. Some students ignored these parts of problems completely while others presented incomplete sentences or single word answers. Through feedback, students were told to provide more detailed discussions and to use complete sentences. Marginal improvement was observed on these types of writing assignments during the semester. Additional considerations are needed to improve writing skills on these assignments.

IV. Peer Review Assignment

Peer review can help students to improve their writing skills.^{5,6,7} In peer review, students review their classmate's writing to identify weaknesses and propose improvements to the author. Peer review exposes students to procedures used in industry. Consulting engineering firms perform

internal and external peer reviews of written documents.⁸ Peer review is a form of quality assurance intended to reduce losses and limit liabilities.⁹ Through peer review, engineering firms are able to produce a quality product promoting professionalism and resulting in positive experiences for clients. Professional work encourages repeat clients and business survival.⁹

Student peer review teams can either be chosen by students or assigned by the instructor.^{6,7} Peer review team size could be as few as two or as many as five. Larger groups may have difficulty working together. All students in the class participated in the peer review process. Peer review teams of three students were used. The goal in assigning teams was to have students writing and reviewing papers on different topics. While the review of the technical content of papers may have been difficult for some students, the intent was to expose the students to new concepts they might not otherwise have learned about. The other consideration was to create teams in which members could help each other improve their writing. Creating peer review teams of students with poor writing skills does little to help improve those skills. Students were assigned to teams so students with better writing skills would assist their peers most in need of improvement. In addition, students with poorer writing skills would hopefully learn by reviewing well-written papers.

Peer review can be arranged anonymously so that the identity of the author is unknown.^{6,7} This creates an impartial review process. If the reviewer knows the author, they may not provide a truly impartial review of the paper.⁶ Anonymous peer review is common in technical journals and conference proceedings.¹⁰ In industry, internal peer review is almost always not anonymous and the reviewer knows the author's identity. External reviews in industry are often anonymous, where the author is not known but the identity of the engineering firm is known.

Anonymous peer review eliminates problems of students not reviewing their colleagues' papers impartially.⁶ Anonymous peer review requires more instructor involvement coordinating paper collection and distribution. Anonymous peer review was not used in this trial. Peer review team members knew the authors of the papers they were reviewing. They did not know the peer review team assignments until they turned in their papers for peer review.

Students had one month to complete their paper after selecting a topic. Two copies of the paper were submitted. In return, each student received papers from the other two members of their peer review team. Along with the papers for review, a numerical evaluation worksheet⁶ was provided to guide them in their review. A copy of the worksheet was provided to help students prepare their paper for the peer review process. The evaluation worksheet is included in Appendix I. Two students out of 22 submitted papers late for peer review.

The peer review was to be completed in one week. During this week there were no other assignments in the course. The authors then had two weeks to revise and submit their final paper. Along with the final paper, the two peer reviewed papers and evaluation forms were submitted. The final paper accounted for ninety percent of the student grade. The student's review of the other papers contributed the other ten percent.

Almost all of the students provided constructive reviews including editorial comments written on the papers. All students used the evaluation forms to numerically rate the various parts of the

paper. Two reviewers provided no written comments on the papers reviewed. One of these reviewers also submitted their paper late. It is questionable whether this student read the papers or just circled numbers on the evaluation forms. The poor effort on the review was accounted for in the grading.

Students were told they should consider the comments and suggestions of the reviewers but were not obligated to make changes that they did not agree with. Most students made the suggested changes. Some disregarded good suggestions and submitted final papers that were still poorly written. Some papers still had errors in spelling and grammar that had been corrected by the reviewers. Most of the final papers were well written. Some students who had submitted poor writing earlier in the semester showed noticeable improvement in their writing on the research paper. Reading and grading the final papers was easier than if the papers had not been peer reviewed.

V. Student Survey and Feedback

At the end of the semester, students completed a survey to determine their attitudes and comments on using the peer review process. The survey is included in Appendix II. The results of the survey showed students definitely believe they submitted a better research paper because of the peer review process. A slight majority of students learned something about a technical topic by reviewing someone else's paper. A slight majority of students also noted the peer review process might be useful in preparing laboratory reports but only if fewer laboratory reports are required. A slight majority felt they learned about technical writing by having their paper reviewed. They were mixed, however, on whether they learned about technical writing by reviewing papers themselves. Students were not concerned that the reviewers knew who the author was. They were mixed on their preference for performing peer review anonymously. Most students do not think peer review would be useful for other writing assignments. Most prefer to use peer review for one longer writing assignment rather than several smaller assignments. Students strongly felt adequate time was provided to write the paper, perform the peer review and make final corrections. They overwhelmingly felt that I should continue to use peer review in my courses at UPJ.

The majority of student comments indicated the peer review process helped them prepare a better paper and prepared them for reviewing the work of others in the future. Some suggested having more than just two reviewers. One student noted that it was useful to know the reviewers since they needed to have review comments clarified. Some students felt anonymous peer review is better because reviewers will be more honest. Some students prefer one longer assignment but found it difficult to review a paper on an unfamiliar subject. Some students believe there is not sufficient time to use peer review on numerous assignments during the semester. Another student suggested more benefit would result from a number of shorter peer review assignments. Multiple assignments allow learning about several different technical topics and provide more practice writing and reviewing.

VI. Conclusions and Recommendations

Writing assignments in technical courses provide students with writing experiences necessary to meet communication skill requirements of ABET,¹ institutions,² and employers.^{3,5} Without

feedback, however, writing assignments will do little to improve students' writing skills. Providing meaningful feedback is difficult for many instructors, especially at teaching institutions where instructors are responsible for grading. Student peer review provides a way to improve the writing quality of assignments so the instructor's effort in providing feedback is reduced.⁶

To encourage improved student writing skills, assignments in a civil engineering technology course have been reassessed. Opportunities to practice and improve writing include memos and laboratory reports submitted throughout the course. An additional research paper assignment was added to the course requirements to expose students to topics not covered in lecture. This paper incorporated a student peer review process to improve the quality of student writing in the final papers. The students responded well using the peer review process for the research paper assignment. They seem hesitant to expand the use of peer review for other writing assignments, such as memos and laboratory reports.

It is recommended that for a research paper assignment, an anonymous peer review process be used. Numerous peer review assignments throughout the semester make anonymous peer review difficult due to the time and coordination involved. For numerous smaller writing assignments and laboratory reports, peer review teams should be established to work together in the laboratory and in class throughout the semester. Individual and team writing assignments are possible. Working for the good of the team would hopefully encourage honest peer review and a conducive learning environment between the students.

Peer review writing assignments can be useful for incorporating writing assignments in ET courses. Peer review provides students additional feedback from which they can improve their writing skills. Giving students additional practice writing in ET courses can help students improve their communication skills to better serve the needs of industry. Writing assignments using student peer review can be less time consuming to grade and may encourage ET faculty to include more writing within the ET curriculum.

Appendix I

CET 1131 – Research Paper Peer Review Evaluation Worksheet

Paper Title/Topic: _____

Author: _____

Review the paper and give points for each of the following:

Introduction 5 10 15 20 25

The author formally defines the topic of the paper. The terms used to define the topic are clear, precise and avoid ambiguity.

Process paper: The author states the purpose, goal, or application of the process.

Engineering problem paper: The author provides an explanation of the problem and concerns associated with projects involving the topic.

Application or technology paper: The author provides a general overview of the use (purpose) in engineering projects and the considerations necessary for their use.

Explanation and Topic Development	5	10	15	20	25
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Process paper: The author explains the process clearly and adequately gives purposes or goals for each step in the process. The steps in the process are consistently related to the purpose, goal, or application of the entire process.

Engineering problem paper: The author clearly and adequately explains the problem and its causes. Examples of possible solutions or remediation methods are clearly presented.

Application or technology paper: The author clearly and adequately describes the use of the technology in civil engineering projects and gives suitable examples of their use. The author clearly and adequately describes the process used in selection or design using the technology.

Conclusion	5	10	15	20	25
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All papers: The author completes the paper within the 5 to 7 page limit specified in the assignment.

Process paper: The author concludes the explanation by increasing the reader’s understanding of the sequence, theory, or applications of the process in engineering projects.

Engineering problem paper: The author concludes the explanation by increasing the reader’s understanding of the causes and solutions of the engineering problem.

Application or technology paper: The author concludes the explanation by increasing the reader’s understanding of the application or use of the technology in engineering projects.

Visual	3	6	9	12	15
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The author uses visuals (figures, diagrams) to illustrate the process, engineering problem, or application or technology that clearly illustrates what is discussed in the paper. The components of the visual are properly labeled. The visual is not done by hand. The source for the visual is correctly documented/referenced. The visual has been given a caption or title and is referred to in the body of the paper. If the paper does not have any visuals, evaluate if the paper clearly develops the topic so that visuals are not necessary, and consider the overall visual layout of the paper (margins, font, spacing, etc.)

Grammar, punctuation, spelling	2	4	6	8	10
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The author uses proper grammar, punctuation, and spelling. Nouns and verbs agree in number (singular or plural). Author uses gender neutral language (no use of “He” or “She”). Sentences make sense. References are properly formatted and referred to in the paper.

Appendix II

Peer Review Survey

In this course you wrote a research paper using a peer review process to prepare your final paper. In order to improve this type of assignment, please provide some feedback.

1. Do you feel that using the peer review process with your research paper in this course resulted in your submitting a BETTER final paper than you would have submitted if the paper had not been reviewed by others?

1	2	3	4	5
Not at all				Definitely

2. Do you feel that you learned something about a technical topic by reviewing the papers of others?

1	2	3	4	5
Not at all				Definitely

3. Do you feel that you learned something about technical writing by reviewing the papers of others?

1 2 3 4 5
Not at all Definitely

4. Do you feel that you learned something about technical writing by having your paper reviewed by others?

1 2 3 4 5
Not at all Definitely

5. Did it bother you that your colleagues reviewing your paper knew that it was your paper?

1 2 3 4 5
Not at all Definitely

6. Would you prefer to review each other's papers anonymously?

1 2 3 4 5
No Yes

7. Would peer review be useful for other assignments in this course (memos, lab reports)?

1 2 3 4 5
Not at all Definitely

8. If the laboratory portion of this course only required each student to write two or three lab reports during the semester would peer review be useful on those reports?

1 2 3 4 5
Not at all Definitely

9. Would you prefer one large writing assignment with peer review, such as this research paper, or would you prefer several (3•) shorter writing assignments using peer review?

_____ More, shorter assignments _____ One longer Assignment

10. Was the schedule adequate for:
Completing the draft of the paper (about 1 month after selecting a topic)?

1 2 3 4 5
NO YES

Performing the review of two papers (1 week)?

1 2 3 4 5
NO YES

Revising and submitting the final paper (2 weeks)?

1 2 3 4 5
NO YES

11. Should I use PEER REVIEW again in my courses at UPJ?

_____ No _____ Yes

_____ Yes, but not in any other class I will take with you.

12. Please provide any other comments or suggestions for improving the peer review process and its influence on YOUR EDUCATION.

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ANDREW T. ROSE

Andrew T. Rose is an Assistant Professor of Civil Engineering Technology at the University of Pittsburgh at Johnstown (UPJ) in Johnstown, Pennsylvania. Before joining the faculty at UPJ, he was a Staff Engineer with GAI Consultants in Pittsburgh. His teaching interests include soil mechanics, foundation design, structural steel design, structural analysis, and incorporating practical design experience and professional practice issues into the undergraduate civil engineering technology curriculum. Dr. Rose received B.S. and M.S. degrees in Civil Engineering from the University of Connecticut in 1985 and 1986 and a Ph.D. from Virginia Polytechnic Institute and State University in 1995.