
AC 2012-5274: DEVELOPMENT OF A WRITING WORKSHOP FOR A MECHANICAL ENGINEERING LABORATORY COURSE

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Abstract

Engineering students typically encounter formal engineering report writing in their laboratory courses. These courses normally occur in the curriculum well after the required English composition courses. Besides the increased demands of being able to write an engineering report, many students at this point are rusty in the grammar department. To help overcome these difficulties a two week technical writing component (writing workshop) was added to the junior level mechanical engineering experimentation course in spring 2010. In this paper the writing workshop is presented in detail. Quizzes and the final paper submitted by the students were used for assessment of the students' writing.

Motivation

Engineers must not only be technically competent, they must also be able to communicate effectively. Many publications have highlighted the need for engineering students to have the necessary skills for both oral and written communication. The demonstration of these skills at the time of graduation is a criterion in EC 2000.¹

Within the normal engineering curriculum, students first encounter formal engineering report writing in their laboratory courses. At the University of Kentucky-Paducah students are first exposed to formal report writing in an introduction to mechanical engineering course the first semester of their freshman year. In this course grammar lessons are given by a retired faculty member who had previously taught business writing. Similar approaches have been used at other universities. This has been accomplished through writing centers that use faculty and/or teaching assistants from English departments, and having technical writers from the local community review student work, see for example References 2 and 3.

In addition to the grammar refresher, the students in the introductory course are presented with a Report and Homework Standards⁴ writing guide. The writing guide presents a format for homework and a complete description of the format for short (memo) and long reports. Writing samples are included, as well as details on equation formatting, effective figure and table construction, how to cite and list references, and a discussion on significant figures.

Unfortunately, the most intensive report writing experience does not occur until the spring semester of their junior year, when the first of two engineering experimentation courses is taken; the first course covers basic experimental methods, and the second the design of experiments

during the fall semester of their senior year. In addition to the increased demands of being able to write an engineering report, many students at this point are rusty in the grammar department.

To overcome these difficulties a one or two lecture refresher in grammar was used along with a re-introduction to the report writing format at the beginning of each of the two courses. The students were also provided with a WORD document that is a formal report template similar to the paper formats currently provided by many professional societies to further supplement the writing guide. Nevertheless, many students still had difficulty with the first few writing assignments. Thus, a two week technical writing component (writing workshop) was added to the junior level experimentation course in spring 2010; the refresher lectures are still used for the second experimentation course.

Writing Workshop Agenda

During the writing workshop there was approximately eight contact hours with the junior level mechanical engineering students. Table 1 presents an outline of the workshop. As displayed in Table 1, the workshop consists of lectures on grammar and technical report writing (figures, tables, nomenclature, referencing, etc.), quizzes, plus a writing assignment on an experiment. The grammar lectures were offered by the retired faculty member who had taught business writing. The writing assignment was progressive in that it involved a write and revise with feedback philosophy, while adding additional sections with each revision cycle.

The sections started with writing a description of the experimental facility (Assignment #1) and progressed up to the students writing the conclusion section (Assignment #3). Each writing assignment was reviewed by both faculty members and returned to the students with comments indicating areas needing improvement. During the longer class times the students met individually with each faculty member to discuss their writing assignments.

Writing Workshop Experiment and Assignments

The experiment used for the spring 2011 writing workshop was to determine the performance characteristics of a three-arm wind anemometer. The experiment was conducted in an instructional wind tunnel. Due to time constraints, the experiment was not conducted by the students. However, the students did observe the experimental set-up, operation of the wind tunnel, wind tunnel installed instrumentation, and data acquisition (measurement of wind tunnel velocity, temperature, pressure, and anemometer rotational speed) of one data point. Following the demonstration of the experiment, the students were supplied with a complete set of data points and the anemometer geometry.

The first assignment was to write a description of the wind tunnel and the experimental procedure used to acquire the data. This assignment was read by each faculty member and returned to the students at the beginning of the next class period. To encourage reflection, grammar, style, word choice, etc. issues were simply underlined so that the students could think

about their individual writing challenges. During a one-on-one meeting with each student, any questions concerning corrections were addressed. The most common problem encountered was the challenge of being able to proofread their writing.

Table 1. Workshop agenda.

First Class Meeting 50 minutes	Writing Workshop Introduction In-Class Quiz #1: Grammar, Usage, and Punctuation Assessment Assignment #1 submitted to students
Second Class Meeting 50 minutes	Assignment #1 due Quiz #1 returned and discussed Lecture #1: Grammar and Punctuation
Third Class Meeting 170 minutes	In-Class Quiz #2 on Lecture #1 Assignment #1 returned and discussed Lecture #2: Usage (Word choice, verb agreement, tense, possessiveness, numbers) Report format review, plus discussion on equations, figures and tables Assignment #2 submitted to students
Fourth Class Meeting 50 minutes	In-Class Quiz #3 on Lecture #2 Assignment #2 due Discussion on proper referencing and nomenclature
Fifth Class Meeting 170 minutes	Assignment #2 returned and discussed Assignment#3 submitted to students In-Class Quiz #4: Grammar, Usage, and Punctuation Reassessment In-Class Survey Writing time
Seventh Class Meeting 50 minutes	Last assignment to be submitted

The second assignment involved correcting any problems that arose in the first assignment and adding a section on data analysis. Since a prerequisite for the first experimentation course is fluid mechanics, the students were required to conduct a dimensional analysis and determine the appropriate non-dimensional groups to document the wind anemometer performance. The assignment involved summarizing the derivation of the appropriate non-dimensional groups. As was done for the first assignment, each faculty member read the student papers and the papers were returned to the students the next class meeting. Individual meetings were again held with each student to discuss any questions involving corrections necessary on their papers.

For the final assignment the students were required to process the ‘raw’ data into the non-dimensional groups, plot the data and add an appropriate trendline, and write the results and conclusion section for the paper. Any problems that were highlighted from the second assignment were also to be corrected.

The final assignment was read by each faculty member and returned to the students to give them one more opportunity for corrections. The version submitted after this last iteration was graded and returned. At this point, the students are covering regular course content, and starting to conduct required course experiments and submit laboratory reports on these experiments.

Lessons Learned

The first time the writing workshop was used in spring 2010 the experimental data was given to the students without them being able to observe the operation of the experimental facility, installed instrumentation, or experimental procedure. Student feedback indicated this made the writing of these sections in their reports more difficult. Hence, this was corrected in the second offering of the writing workshop in spring 2011.

The students need to be encouraged to find their own writing style. It is easy for the instructor to impose their way of writing on the students and this should be avoided.

Proofreading and word choice in the majority of cases were the main problems students needed to overcome. An emphasis was placed on having the students identify the mistakes they commonly make with their individual writing style.

Outcomes

A number of quizzes were given during the writing workshop. The quizzes involved typical grammar type of questions, as well as proofreading and correcting a paragraph with mistakes deliberately included in the writing sample. Due to the formulation of the writing workshop individual assignments were not graded. Hence, writing improvement was measured using the initial and final quizzes.

Using the spring 2011 writing workshop data, each student’s grade on the final assessment quiz improved when compared to the initial assessment quiz. The average grade improved by over 30 points. The greatest improvement was found in correcting the sample paragraph.

Survey

A survey was used at the end of the writing workshop to help improve its effectiveness. The survey from spring 2011 is given below.

Class Size

There were 14 students each in the spring 2010 and spring 2011 classes. The major issues with the writing workshop approach as described in this paper are the return of the writing assignments the next class period, and the one-on-one meetings with the students. A number of approaches could be used to overcome this difficulty. For example, the first and second assignments could be combined (facility description, experimental procedure, and data analysis) or the time between assignments could be increased.

Summary and Conclusions

The writing workshop was developed to help the students improve their written communication skills. It is based on a progressive writing assignment on a typical engineering laboratory exercise, and provides the students with continuous feedback. The key was to work with the students individually to help address the specific issues they were having with their written work. The ability to rewrite their papers based on direct feedback helped improve the effectiveness of their writing.

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References

¹“Criteria for Accrediting Engineering Programs” Accreditation Board for Engineering and Technology, Inc, October 29, 2011 (www.abet.org).

²Walker, K., “Integrating Writing Instruction into Engineering Courses: A Writing Center Model,” *Journal of Engineering Education*, 2000, pp. 369-375.

²Gnanapragasam, N., “Evolution of Technical Writing in Senior Design-A Case History,” *Advances in Engineering Education*, 2010, Vol. 2, No. 1.

⁴“Report and Homework Standards”, Murphy, W.E. and Reynolds, D., Revised Version January 7, 2011.