

Getting the Right Stuff with the Write Stuff: Instructional Methods to Improve Writing in a First Year Engineering Course

Peggy Kulesz and David Ewing

The University of Texas at Arlington
416 Yates Street, Arlington, TX, 76019, USA
E-mail: kulesz@uta.edu and david.ewing@uta.edu

Abstract

Engineering Problem Solving (ENGR 1300) is a first year engineering course at the University of Texas at Arlington (UTA) designed to prepare students for the rigors of the engineering majors by introducing them to engineering skills such as problem solving, programming, and professional writing. This embedded writing element, taught by members of the UTA English Department, differentiates this first-year course from many others. Heeding the concern of faculty members regarding the students' ability to write professionally, the curriculum committee for ENGR 1300 collaborated with the English Department to create an initial curriculum that tasked students with basic writing tasks such as professional emails, resumes, reports, and simple process papers. While these assignments seemed to answer some of the overall concerns of faculty, the wide range of reading and writing abilities we see among our students caused many to be frustrated because they could not complete these tasks, while others expressed resentment at having to replicate tasks they had mastered in high school. Writing instructors, too, noted their limited effectiveness when attempting to give meaningful feedback to large enrollment sections of students. To address these issues, the writing curriculum was revised to include the rhetorical précis assignments that build upon each other. These rhetorical précis assignments require students to assimilate large amounts of technical information and summarize it into a few, complex sentences. Using these assignments for our writing instruction not only allows writing faculty to give specific feedback even in large enrollment sections, but also challenges advanced writers, offers sentence level writing practice to less-prepared writers, requires critical thinking, and encourages complex synthesis of ideas.

This paper will explore the effectiveness of this method for all writing levels and will attempt to identify and compare correlations between the students' writing and overall grades in the course using these two methods.

1. Introduction

For the last two and a half years, UTA has been teaching a new class for first year engineers named Engineering Problem Solving (ENGR 1300) in order to reinforce our student's problem solving, programming, and professional writing skills. The reinforcement of problem solving and programming this class offers has been studied in other works [1-4]. However, in this work, we will explore the last goal of this class to improve engineering student writing to fully prepare them for their future in the engineering profession. As the authors of [5] have noted, integrating writing into engineering courses is far more effective than having separate language courses without engineering collaboration. Therefore, ENGR 1300 has an imbedded writing element in collaboration with UTA's English department. In Spring 2017, a new writing technique was piloted in one section of ENGR 1300 that showed promising results. This technique, fully implemented in Fall 2017, involves teaching the student to write rhetorical précis on many different engineering topics that include current engineer bios, the Grand Challenges, and current events. The aim is to assist the students in their ability to synthesize a large amount of information into short, precise summaries.

2. Background

The précis assignment is based on Margaret Woodworth's work [6] in which she asserts that précis writing can, "further the specific goals of interdisciplinary writing instruction; helping students learn to read and listen to what others have to say with greater comprehension, to question and evaluate what they read and hear, and to write and speak with control and conviction." Simply put, the précis (from the French for "precise") is a four sentence summary of a text that follows very specific and detailed guidelines. The first sentence requires students to accurately convey the context of the reading by naming the title, author, genre, publication information, and the major argument or topic addressed in the reading. The second sentence necessitates that students articulate the ways in which the author supports the argument or explains the topic, while the third sentence asks students to identify the

purpose of the reading. Finally, the fourth sentence challenges students to identify the audience of the reading and explain how they know this from the language used in the reading. In order to successfully write the précis, students must do more than give reading assignments a cursory glance or superficial once-over. The hallmark of an excellent précis is that it conveys the essence of the reading in a precise, succinct, and correct manner. Students who struggle with reading comprehension will be forced to read for recall and understanding, and this brings up another reason for using the précis in our program as we noted students' reading issues that translated into poor writing, poor comprehension of assignments, and failure in what we used to call "word problems" in math. Thus, an assignment focused on reading comprehension overall, while directing students to be attentive to detail, carries over into precise writing and to precision in engineering problem-solving. Research additionally indicates that summary writing improves the reading comprehension and language acquisition for students who are English Language Learners [7] who make up about 10 percent of our student population.

Besides the immediate benefits for reading comprehension and sentence level writing practice, the value of précis writing has long-term application. It prepares students to annotate and organize material for research (such as a literature review for a graduate level project) and equips them for the various types of executive summaries and reports they will write as working engineers. With the précis assignment's focus on audience and purpose, students begin to note the importance of communicating for different readers such as team leaders, supervisors, clients, investors, and other professional stakeholders.

3. Results and Discussion

3.1 Spring 2017 pilot

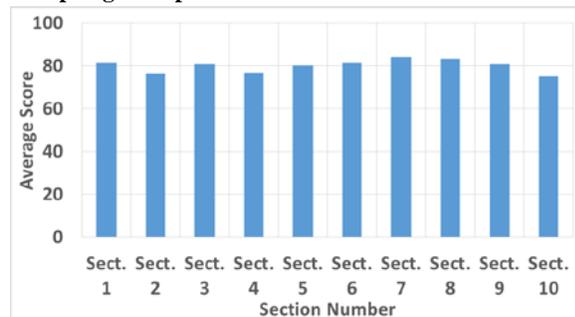


Figure 1. Average signature assignment grades for each section of ENGR 1300 in Spring 2017. Section 7 was the pilot section

The Signature Assignment asks students to research a scholarship or internship opportunity and write a one-page letter to apply for the scholarship. In the letter, students

must identify three requirements set forth by the institution or organization offering the scholarship/internship, and articulate how their own qualifications and experiences meet these requirements.

Section 7 was the pilot section. As can be seen in Figure 1, Section 7 had the highest average for the signature assignment. It should be noted that a t-test was performed and Section 7 was statistically indistinct to Section 1, Section 6, and Section 8, due to Section 7's abnormally high variance. However, these results were encouraging to suggest that the précis method may indeed aid students in compiling precise, well-supported, and accurate recommendations. Therefore, it was determined to apply this method to all sections starting in the following fall semester.

3.2 Signature assignment comparison

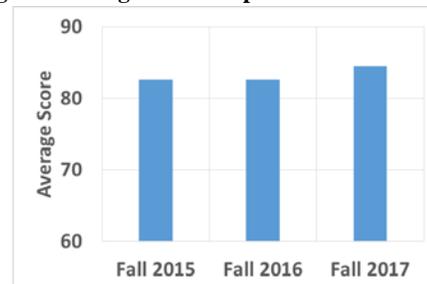


Figure 2. Comparison of the average signature assignment score across all Fall sections of ENGR 1300. Fall 2017 was the first semester of full précis implementation

After completion of Fall 2017, scores were averaged and are shown in Figure 2. Fall 2017 students showed a significant improvement in the average scores for the signature assignment, described in the previous section. Further, after a t-test was applied, it was determined that these scores were statistically different from the previous two fall semesters, while Fall 2015 and Fall 2016 were not statistically distinct. These results suggest that the emphasis on précis writing has helped students to understand the roles that audience and supportive argument have in writing engineering-focused works.

3.3 Audience writing comparison

For the Grand Challenges précis, teams develop a four sentence précis and create a PowerPoint slide that informs their readers about the primary focus of one of the NAE Grand Challenges for Engineering. In the Project Report, teams prepare a one page professional report that presents their recommendations for implementation of new production methods for their company and the audience for the report is investors who are not engineers.

In order to assess the effectiveness of the précis method on increasing audience awareness, average grades were used to determine if students improved within team

assignments. The Grand Challenge précis was early in the semester and team-based, but the Project Report, though team-based, was late in the semester. The grades studied were from the same student for each assignment and only included if the student turned in both. With all of these considerations, the Grand Challenge précis average score was 78.7 while the Project Report average score was 87.1. After a t-test was performed on this data, it was determined that these averages were statistically distinct. These improvements suggest that student awareness of audience and supportive argument has improved with the implementation of the précis instruction.

3.4 Précis improvement

Finally, to assess whether student ability to write an effective précis improved over the semester, we compared the scores from the first précis written and the last one written in class for assessment purposes. Again, as in the previous section, the grades studied were from the same student for each assignment and only included if the student turned in both assignments. Further, only a sample set of student's in-class précis were graded. With all of these considerations, the average score for the first précis was 76.4 and the final in-class précis was 76.0. After a t-test was performed, these averages were determined to not be statistically different. This was a surprising result, considering the results already obtained. More information and larger sample sizes will be needed in the future to ascertain why we see this fact.

4. Conclusion and Future work

In summary, after a pilot semester and one full semester, we have seen students improve in their audience awareness and supportive argumentation through cover letters and recommendation reports.

Although we were confident that the précis assignment would benefit students, streamline the grading process for writing instructors, and facilitate more focused feedback on writing, we still have questions about the immediate

effectiveness of the précis assignment to influence writing habits in other class writing assignments, specifically the actual rhetorical précis. More targeted scoring and research will be needed to explore this particular issue.

Acknowledgement

This work is partially funded by the National Science Foundation, NSF STEP grant DUE #0856796.

References

- [1] Ewing, D., "Using the SCALE-UP Method to Create an Engineering First Year Engineering Course", presented at the 2017 annual conference of the ASEE Gulf-Southwest Section, Dallas, TX (2017).
- [2] Ewing, D., "A Comparative Analysis of Underrepresented Minority Groups Taking a New First Year Engineering Course", presented at the 2017 annual conference of the ASEE Gulf-Southwest Section, Dallas, TX (2017).
- [3] Ewing, D., "Creating a First Year Engineering Course Utilizing the SCALE-Up Method", presented at the 2017 FYEE annual conference, Daytona, FL (2017).
- [4] Ewing, D., "The Effects of a First Year Engineering Class Using the SCALE-Up Method on Student Retention and Subsequent Student Pass Rates", submitted to the 2017 annual conference of the ASEE Gulf-Southwest Section, Austin, TX (2018).
- [5] Clayton, T., "Argument against Separate Writing Courses for Engineers", *Journal of Professional Issues in Engineering Education and Practice*, vol. 122, no. 3, p. 111-113 (1996)
- [6] Woodworth, M., "The Rhetorical Précis", *Rhetoric Review*, vol. 7, no. 1, p. 156-164 (1998)
- [7] Marzec-Stawiarska, M., "The Influence of Summary Writing on the Development of Reading Skills in a Foreign Language", *System*, vol. 59, p. 90-99 (2016)