

Developing Appreciation for Written Communication in Freshman Mechanical Engineering Students

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Abstract

The Greer Technical Communication Scholar program was launched to broaden mechanical engineering (ME) students' exposure to written communication and improve their written communication skills. The overall program goal involves addressing engineering communication skills throughout every level of the ME curriculum, with implementation staged over several years. This paper focuses on the immediate effects of the pilot stage on freshman students. During this pilot stage, ME freshmen received a series of written assignments. Senior ME students served as Greer Technical Communication Scholars who graded and provided detailed feedback for submitted work and spoke with students regarding the importance of written communication. Preliminary results show that while most students consider written communication skills important for the workforce, they underestimate these skills' degree of importance and frequency expectations. Based on the survey metrics used in this study, the pilot program appears to be effective, leading to the Greer Scholar program's continuation and expansion.

Keywords

Engineering instruction, communication in engineering, developing writing skills.

Introduction

Developing written communication skills has numerous benefits, but its importance can be overlooked in an engineering curriculum. Benefits to developing strong written communication skills include enhancing thinking and reasoning skills¹, enhancing retention and cognitive processing^{2,3}, and enhancing overall academic performance⁴. Additionally, there is substantial evidence to indicate that incorporating writing into a scientific field can enhance mathematical reasoning and aid in scientific learning⁵, particularly when engaging in scientific explanation^{6,7}.

Recently, the Greer Technical Communication Scholar program, made possible through alumni donation, has been implemented at Mississippi State University to enhance student perception of the importance of writing in mechanical engineering, to develop written (and verbal) communication skills of mechanical engineering students, to increase exposure of mechanical engineering students to written communication, and to reward excellent scholarship in technical communication. Through enhancing exposure to written communication, students should have greater opportunity to develop written expertise⁸, as well as to reap the benefits of cognitive and academic performance described earlier. The program is being implemented in stages, expanding each year to encompass a course within each level of the curriculum. Currently, the program is implemented in the freshman-level, one-credit hour, Introduction to Mechanical Engineering (ME 1111) course and has been expanded during the current academic year (2018-

2019) to include a sophomore-level course. However, this paper focuses on the pilot year of the Greer Scholar program (2017-2018), during which the program was implemented in only the freshman-level ME 1111 courses. In addition to the enhanced writing component now covered in the course, traditional topics discussed in ME 1111 include use of Excel, unit systems, engineering ethics, and ME career field opportunities.

Organization of Greer Technical Communications Scholar Program

The Greer Scholar program is funded through the generous donation of alumni and is implemented through the mechanical-engineering department and technical-communication program at Mississippi State. Each year, senior students who excel in technical communication are selected from a pool of applicants and provided with scholarship funds to assist in the classroom. For the pilot implementation, new in-class and homework assignments were developed to build freshman students' comfort and confidence in writing, as well as to stress the importance of written communication. During that year, Greer Scholar students provided feedback to the freshman students on these assignments, spoke to the students about the importance of written communication in both their coursework and in their employment experiences, and helped to develop grading rubrics for written assignments. The major writing assignments given (as homework) throughout the course of the semester in the Intro to Mechanical Engineering course are as follows:

- Why did you select mechanical engineering as your major, and what do you plan to do professionally after earning a degree in mechanical engineering?
- Find and discuss an example of an ethics violation in engineering that resulted in severe consequences in terms of finances and/or casualties. (Choose an example that was not discussed in class.) What are some ways that the situation could have been handled ethically, and how would those ways have mitigated the consequences?
- Earlier this semester, you were asked to identify why you selected mechanical engineering as a major and what you plan to do professionally after attaining the degree. Now that you have learned more about the expectations and opportunities associated with this curriculum and profession, comment on whether your academic and/or professional plans have changed after going through this course, and, if they have, specify how and why the plans have changed, explicitly identifying information presented (or experiences gained) in the ME 1111 course that led to the change in plans. If your plans have NOT changed, identify at least three insights/experiences/lessons that you have attained through the ME 1111 course that you think will help you achieve your academic and professional goals as you pursue your mechanical engineering degree.

Additionally, several smaller, in-class, group assignments were administered that required short descriptions of product operations or summaries of in-class research assignments. Thus, students gained experience in writing assignments that allowed time for organization of thoughts as well as in writing assignments that required extemporaneous responses.

Results and Discussion: *Student Perceptions and Reception*

Initial data gathered in the fall 2017 and spring 2018 semesters indicates that the Greer Scholar program is impacting student perceptions concerning the importance of written communication skills. In both semesters, pre- and post-surveys were given to freshman students, at the start of

the semester and later in the semester after hearing from the technical-communication department and from the Greer Scholars, to gauge student perceptions on writing. Data thus far suggest that while most students understand the importance of written communication when they begin the curriculum, the Greer Scholar program served to strengthen their perceptions and encouraged the students to focus on enhancing their writing skills. A total of 137 students participated in the fall 2017 surveys, while 34 participated in the spring 2018 surveys. Survey data from the fall 2017 semester presented in Figures 1-2 highlight changes in student perceptions of the importance of written communication, while Figures 3-4 highlight changes to student actions regarding written assignments in the course.

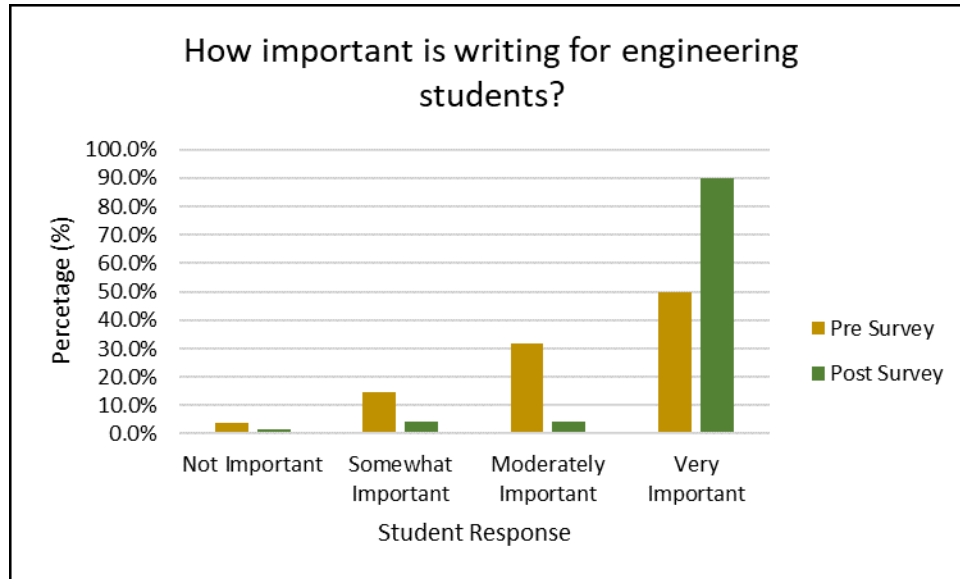


Figure 1. Fall 2017 survey data regarding importance of writing for engineering students.

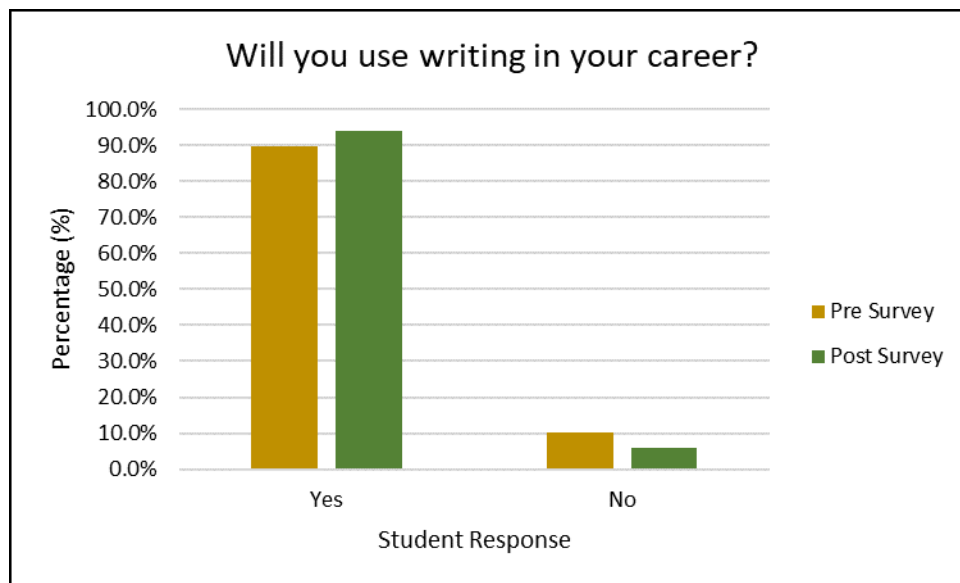


Figure 2. Fall 2017 survey data regarding student perception on written communication in careers.

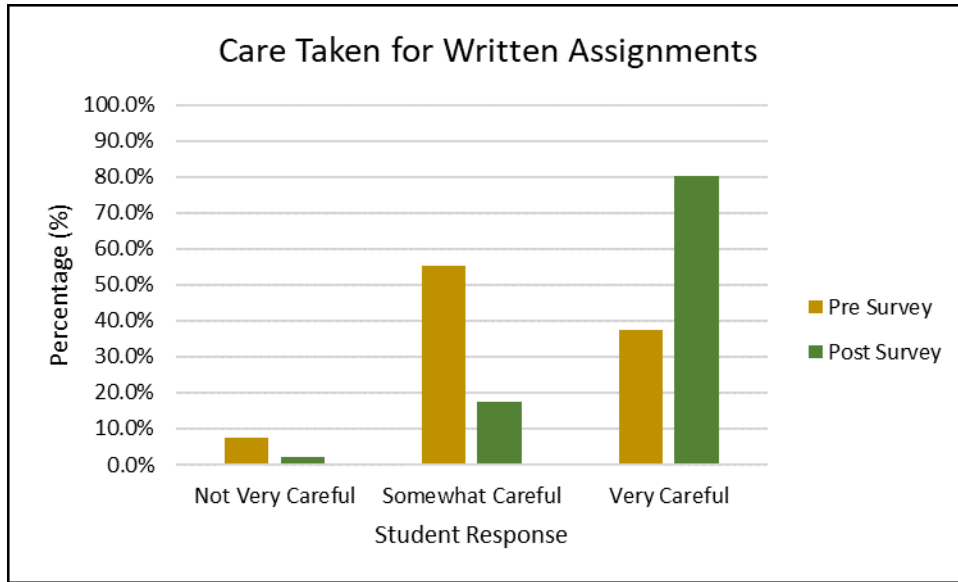


Figure 3. Fall 2017 survey results signifying commitment to enhancing writing skills through greater effort toward written assignments.

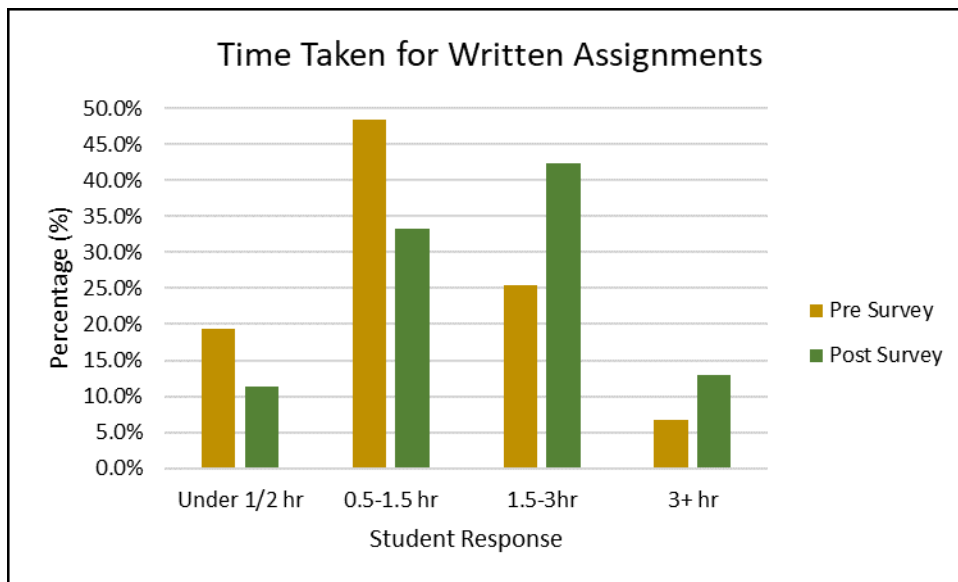


Figure 4. Fall 2017 survey data showing changes in time spent toward written assignments over semester.

Spring 2018 student survey data show similar results, though the survey questions were revised to include more targeted questions for the effect of Greer Scholars (along with other course presenters) on student perceptions and communication improvement. The spring intro section typically includes more mature students (greater concentration of transfers as opposed to freshmen), so it is not surprising that their overall attitude toward the importance of written communication was already positive upon entering the course, more so than that seen for fall 2017. However, even though the students came in with a very positive attitude, the overall class attitude toward writing was still enhanced, though to a milder degree than that shown in the fall 2017 results. For brevity, only the new results from the spring 2018 surveys are shown. Figures

5-7 show results from the additional survey questions added to the spring 2018 post-survey (administered after having completed a majority of the course).

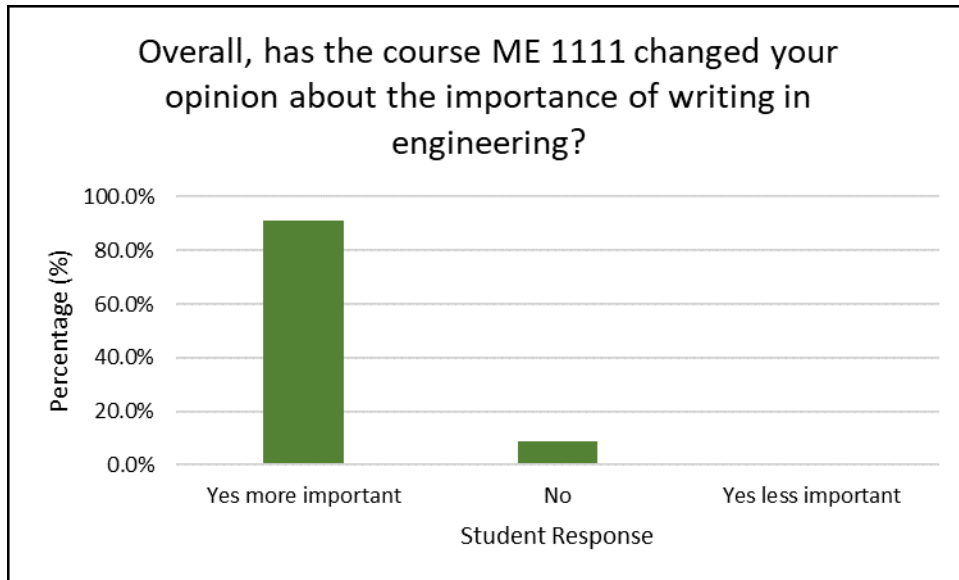


Figure 5. Spring 2018 survey data gauging changes in student perception toward written communication after taking the intro course.

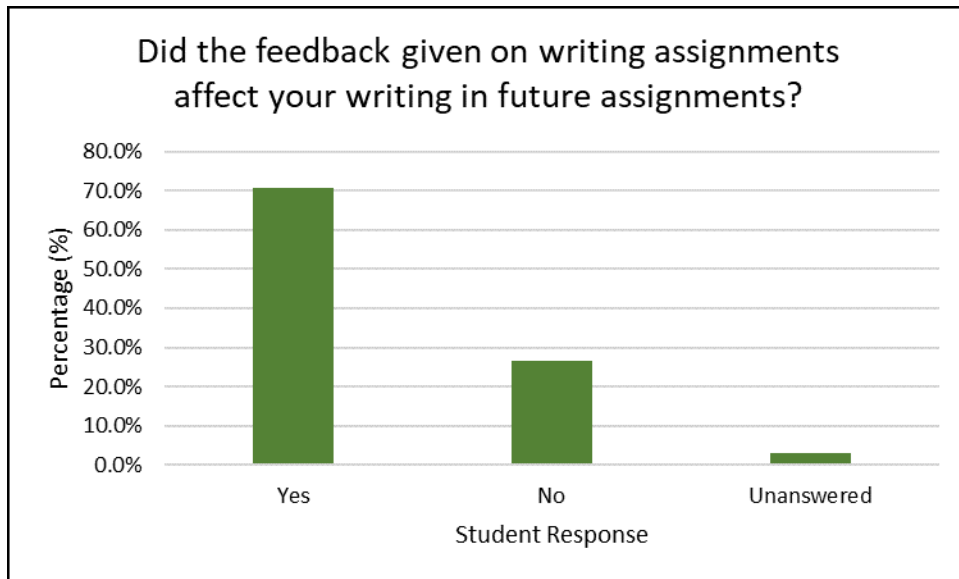


Figure 6. Spring 2018 survey data referencing impact of Greer Scholar feedback on writing performance.

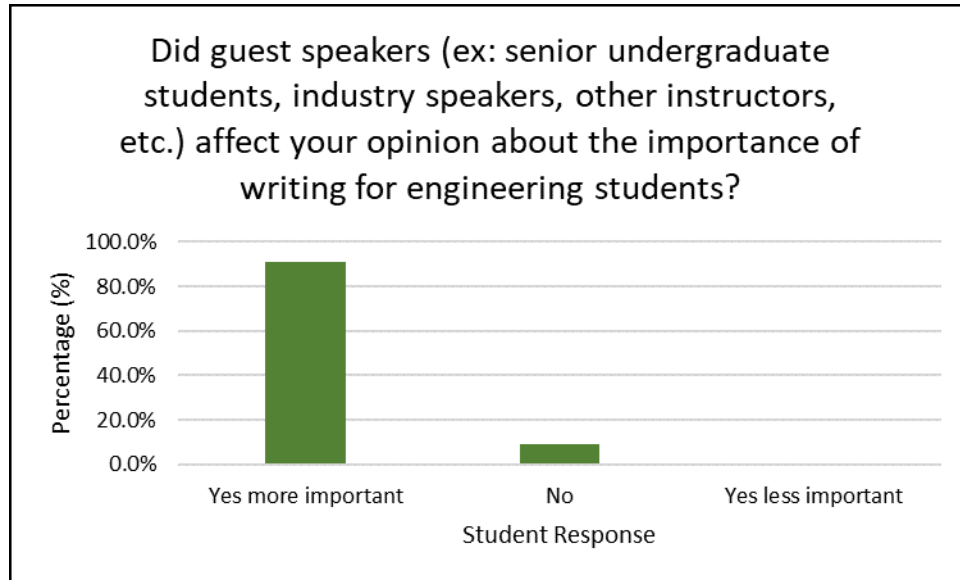


Figure 7. Spring 2018 survey data gauging effectiveness of speakers, including Greer Scholars, on student writing perceptions.

While the Greer Technical Communication Scholar program is still in its infancy, it is clear from qualitative data that the program is impacting student perceptions toward writing in a positive manner. Further work will be done to assess the impact on skill development over time.

Conclusion

Over the 2017-2018 academic year, a concentrated focus on the importance of writing for mechanical engineers was added into the Intro to Mechanical Engineering course at Mississippi State University. A major component of this focus included the development of the Greer Technical Communication Scholar program, where outstanding senior students were selected to assist with developing written communication skills for students in the course. During two semesters, student perceptions on written communication in mechanical engineering were assessed at the beginning and end of each semester, and data suggest that student attitudes toward writing were enhanced over the course of the semester. It is clear that students leave the intro class with a strong understanding of the impact of written communication skills on their future, and the students gained more experience in articulating their ideas through the coursework. The long-term effectiveness of this initiative will continue to be assessed as the students move forward through the curriculum, and the mechanical-engineering courses serving this writing initiative continue to grow in number each year.

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Alta Knizley has been part of mechanical engineering faculty at MSU since 2012. Her research areas of interest include energy sustainability and engineering education. Special interests include k-12 STEM outreach and minority and female leadership and recruitment in mechanical engineering. Currently, she works as an Assistant Clinical Professor and teaches courses within the thermal/fluids and analysis areas of the mechanical engineering curriculum at Mississippi State.

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