Board 8: Work-in-Progress: BME Students' Perspectives on a Laboratory Technical Writing Cycle

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Work in Progress:
Biomedical Engineering Students' Perspectives on a Laboratory Technical Writing Process

Introduction

Graduates from ABET accredited engineering programs are expected to demonstrate an ability to communicate effectively [1-2]. Developing students' technical writing skills are particularly difficult to teach and more time consuming to assess [3], often limiting the number of opportunities students have to practice and improve throughout their undergraduate education. While recent studies have shown positive impacts of using rubrics to measure student scientific writing skills [2-5], little has been reported regarding the cumulative impacts of a structured student writing proces. Here we expand on previous work, which introduced a student technical writing process and presented preliminary data supporting improvements in students' technical writing skills after completing the process in multiple junior-level biomedical engineering lab courses [6]. This current work in progress aims to explore how students perceive the impacts of this writing process on their own technical writing development; this will add valuable insight into how this structured student writing process impacts biomedical engineering students' learning.

Methods

Technical Writing and Assessment Process

In the junior and senior years of our Biomedical Engineering (BME) undergraduate program at The Ohio State University, students select and complete three of six laboratory courses (Biomaterials, Biomechanics, Biotransport, Bioimaging, Cell/Tissue Engineering, and Micro/nanotechnologies). The learning objectives and assessments are identical in each course, with a particular emphasis on students' ability to write technical lab reports. The culminating assignment for each course is an individually written laboratory report in the style of a journal article publication.

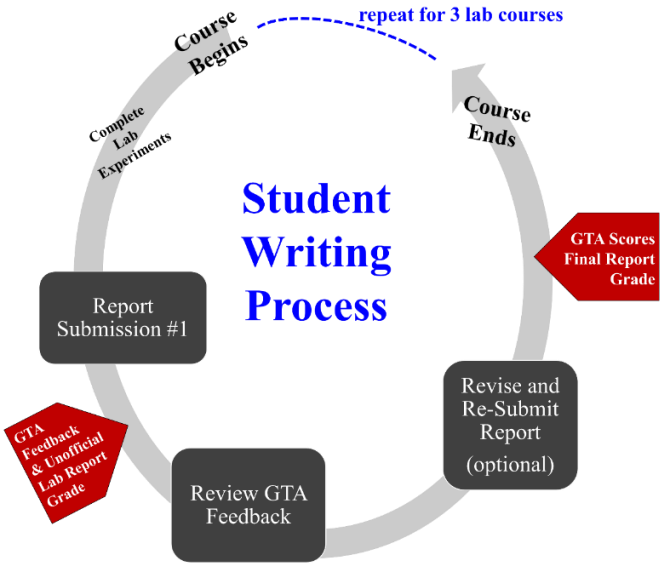

Figure 1: The student technical writing process implemented in upper-level Biomedical Engineering laboratory courses.

Previous work presented a novel student writing process (**Figure 1**) [6]. Briefly, students were provided a detailed rubric and two weeks to submit their laboratory report; during that time, technical writing-focused graduate teaching assistants (GTAs) were available for office hours. After students submitted their reports, the GTAs assessed the writing against the rubric and provided detailed formative feedback. Students were then permitted one revision and re-submission opportunity to address deficiencies in their writing, potentially recovering up to half the points lost from their first submission. Students were required to follow this identical technical writing and assessment process throughout each of their three upper-level laboratory courses.

Measuring Students' Perceptions on the Technical Writing Process

Previous results [6] observed a significant improvement in students' second lab report performance relative to their first submission, suggesting that a one-semester rubric-driven writing and revision student writing process had a measurable impact on student performance. Additionally, there were significant improvements between the second submission report in the first course and the first submission of the second course.

To corroborate with previous study results, we are developing a survey to measure Biomedical Engineering students' perceptions of the student writing process. Survey questions will ask students about: their growth in technical writing reports (or skills); the accuracy of scores to technical writing ability; and the utility of the writing cycle, rubric, and GTA feedback. Sample survey questions measuring students' perceptions are showin in **Table 1**. The majority of survey questions use a 4-point Likert scale (Strongly Disagree, Disagree, Agree, Strongly Agree). The remaining questions provide open-ended descriptive or informative input. Students indicate which parts in **Figure 1**, above, are beneficial or limiting in developing technical writing skills. The survey is currently being administered to BME students who have completed at least one of the six laboratory courses offered.

Table 1: Survey questions measuring features in the writing cycle

Category	**Survey Question(s)** **Response options are 4-point Likert scales unless indicated otherwise by [ ]**
Student Writing Process	• What part(s) was most/least helpful [Fig 2 selection] • What part(s) were confusing or misleading [Fig 2 selection] • Writing, revising, and resubmitting reports did/did not improve my technical writing • My writing improved with each report submission
GTA Feedback	• GTA identified ways to improve my report • GTA feedback helped me understand how to write a better technical report
Rubric Feedback	• Rubric criteria provided clear guidelines for the content to be included • Rubric criteria helped me write a technical lab report • My rubric score informed me on how to improve my technical writing • My technical writing improved because of the feedback I received from the rubric

Technical Writing Ability	• I rate my writing skills before and after each lab [1-5] • My writing skills are reflected by my report grade • The report grading across each lab course was consistent • My grades and writing skills improved with each submission
Self-Efficacy	• I feel more confident to write a technical lab report • I believe I can write a technical lab report without a rubric • How many iterations of the writing cycle are required for you to feel confident in writing a technical lab report? [1-4] • I feel confident writing future reports without a rubric

Preliminary Results

Preliminary survey results have been collected (n=27). Thus far, 96% of the respondents agreed or strongly agreed the writing process improved their technical writing skills and increased their confidence in writing a technical report. Additionally, 100% of the respondents agreed or strongly agreed the rubric criteria helped them in writing a technical lab report, with 88% feeling confident they could write future technical lab reports without a rubric. When asked how many iterations of the writing process were required to feel confident in writing a technical lab report, 51% of BME students stated 2 iterations, while the remaining resondents were primarily split between three (22%) and 4+ (19%) iterations.

In regards to instructor feedback obtained as part of the writing process, 78% of the responding BME students indicated that their writing skills improved because of the feedback they received from the rubric. Additionally, 92% of the respondents agreed the formative GTA feedback was helpful in understanding what was needed to write an improved technical lab report.

Students were asked to identify multiple least and most helpful components of the writing process. Many students (44%) felt there was nothing in the writing process that was least helpful to them; the other most common response was attending GTA office hours (22%). Most helpful components of the writing process included using the rubric (70%), receiving formative GTA feedback (67%), and having the ability to revise and resubmit the technical report (63%).

The preliminary findings represent only a portion of BME students' perceptions, as there are over 100 BME students completing one or more lab courses each semester. Future work includes robust analyses of all survey questions in Figure 1, including summation of open-ended student comments, as well as collecting additional student survey data throughout the next academic year.

Conclusions

We have developed a rubric-driven technical writing process that provides a means for teaching and assessing students' abilities to communicate effectively. This current work-in-progress begins to add the students' perspectives for how the writing process is impacting their technical writing skills. We anticipate that student survey results will uncover additional insight for students' current and future technical communication self-efficacy.

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