The Good, the Bad, and the Ugly: Using Exemplar Papers to Improve Students' Ability to Self-Evaluate with a Rubric

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Abstract

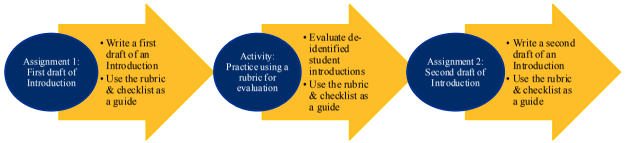
Research suggests that providing students with a rubric increases scientific writing skills; however, we have found that the quality of scientific writing in a course-based undergraduate research experience (CURE) is poor even with a detailed rubric. We tested whether requiring students to use a rubric to evaluate high-, intermediate-, and low-quality examples of de-identified student writing improved students' ability to self-evaluate scientific writing using a rubric. We found that providing students with exemplar papers along with a writing rubric improved the students' ability to self-evaluate, and ultimately improved the quality of scientific writing in undergraduate students enrolled in a CURE.

Introduction

Effective written communication is a basic skill required for all undergraduate students, and learning to write a scientific paper is a standard part of the biology curriculum at Marian University. As a department, the biology faculty has developed a "Writing Across the Curriculum" model to guide students in learning to analyze and write about scientific research. We have produced a rubric to scaffold the learning process throughout the curriculum. However, we have found that even with a rubric and a detailed list of requirements, students still produce poorly written scientific papers. Thus, we have incorporated an activity in the BIO203L Molecular Genetics lab requiring students to use the rubric to evaluate high-, intermediate-, and low-quality examples of de-identified student writing. We report that this activity improves students' ability to self-evaluate scientific writing with a rubric.

Methods

This study was conducted with the informed consent of the 49 students enrolled among 3 sections of BIO203L during the Spring 2019 semester. BIO203L is the lab portion of a core biology course and is conducted in a CURE format in which students work in small groups to perform actual research and write a scientific paper, focusing specifically on the introduction section. Of the students enrolled, 80% were freshmen and 20% were juniors.



Results

Instructor Evaluations of Students' Scientific Writing

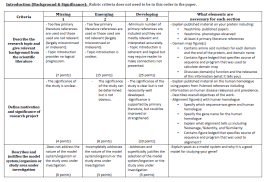


Fig. 1 – The rubric used in BIO203L is a version of the Research Across the Curriculum rubric modified so that the top score is in the "Developing" category and the required elements are listed specifically.

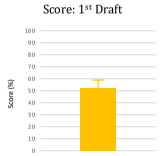


Fig. 2 – Despite the detailed rubric, students did not score well on their first draft of an introduction to a scientific paper.

Student Evaluations of Exemplar Papers

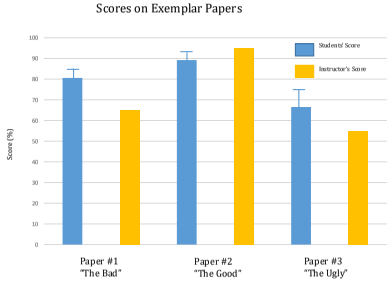


Fig. 3– Using the rubric, students scored moderate– and low-quality example introductions to scientific papers higher than did instructors, suggesting that the students were not using the rubric appropriately.

Self-Evaluations are More Accurate Following the Exemplar Activity

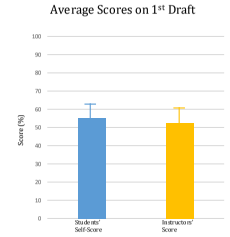


Fig. 4 – Following the exemplar activity, students were asked to re-evaluate their introductions. Students' self-evaluations closely matched the instructor's evaluations following the activity, suggesting that students better understood how to use the rubric appropriately for self-evaluation.

Students' Scientific Writing Improves Following the Exemplar Activity

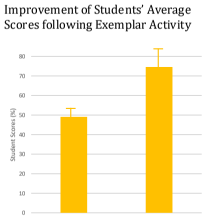


Fig. 5 – After the exemplar activity, students were asked to revise and submit a second draft of their introductions. The instructor evaluations displayed marked improvement of the students' ability to write an introduction to a scientific paper.

Students' Perceptions of the Exemplar Activity

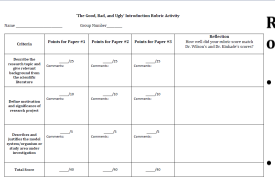


Fig. 6 – The handout that accompanied the exemplar activity asked students to reflect on the utility of the activity.

Representative Student Reflections of the Exemplar Activity

- "This allows me to see what our group needs to do to get our introduction to an A graded paper"
- "I think this really showed me how specific this section needs to be and what all needs to be included"
- "Now I understand what specifics you are looking for in this section"

Conclusion

This study suggests that a rubric alone is not a sufficient tool for increasing undergraduate biology students' scientific writing skills. However, we found that providing students with exemplar papers along with a writing rubric improved the students' ability to self-evaluate, and ultimately improved the quality of students' scientific writing skills.