THE EFFECT OF STUDENT REFLECTION QUALITY ON A TECHNICAL WRITING ASSIGNMENT RESUBMISSION

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Abstract – *The role of reflection and self-regulation in academic performance was tested using the “Exam Wrapper” strategy with a writing assignment for a technical elective course. The technical writing assignment involved the creation of a detailed outline for a technical report. This outline was submitted for grading and feedback before a subsequent extended technical report assignment. The outline was graded by the course teaching assistant, following a detailed grading rubric.*

After receiving the grade and feedback, students could resubmit a revised outline for re-grading, and include a reflection on the circumstances of their performance. Using the grading rubric, the resubmission was graded by the course instructor. A second graduate student evaluated the student reflection quality, and the resubmission quality.

The effect of the self-reflection quality on re-submitted assignment improvement was assessed. The average grade improvement for students who resubmitted a reflection was +15.1 % (n=16), and for students who resubmitted without a reflection was +6.3 % (n=3). The difference between the average resubmitted and first submission grades positively correlated with reflection quality. These results suggest that a reflection exercise associated with a resubmission has potential to improve student technical writing quality.

Keywords: Exam Wrapper, Technical Writing, Student Reflection, Rubric.

1. INTRODUCTION

Reflection is important to analyze experiences, gain understanding and awareness of one’s own thought processes [1]. Student’s abilities to reflect on their own thinking is being introduced into post-secondary institutions [2]. This concept of self-reflection and re-submission of student work was applied to a technical writing assignment in a technical elective course. As technical writing is an important engineering skill, a few writing assignments were a component of this technical course material, and its evaluation.

The writing assignments included a report outline (15 % of the final grade), and final report (25 % of the final grade) on a subject of the student’s choice, related to the course material on sustainable materials processing. The value of an outline for organizing report content, and creating a

shorter document for a manager to review [3] were both goals of the outline assignment. These writing assignments were also meant to engage the student in a deeper and more creative learning exercise [4]. Credit was given for an editing history of the final report (5 %) that was meant to encourage the students to revise their work before submission.

The grading rubric for the report outline was detailed; in summary, technical quality (60 %), technical literary quality (clear, concise, well-supported text, 20 %), and technical report quality (report structure, following formal instructions, 20 %) were evaluated separately. This reflects a written assignment evaluation scheme presented by Swarts and Oldell [5]. Through a perspective that engineering work is rhetorical, Swarts and Odell’s goal was to assess the importance of engineering writing as it sustains engineering work, and the importance of technical writing quality combined with the quality of the engineering design described in the design report.

In previous course iterations, the graded technical report outline, that included comments for improvement, was returned to the students before the final report due date. The goal was for the student to incorporate the feedback into the final report, and improve their final report quality. The motivation for the work presented in this paper is to determine if the “Exam Wrapper” strategy could be applied to a technical report outline assignment, and if a self-reflection would further motivate the student to improve their technical report outline quality before the student embarked on writing their final report.

The “Exam Wrapper” concept described by Lovett [6] is a tool used to develop student metacognitive skills and self-regulation tools. The Exam Wrapper is classically a short, one-page written assignment given to students upon receipt of a graded assignment or test. Three general types of questions are asked of the student: how did you prepare for this effort, what mistakes did you make, and what could you do differently in the next exam or assignment? This extra reflection effort that focused on a recent academic performance, with the opportunity to improve the performance through a resubmission, might provide behavioural feedback for how students could better prepare for and improve their future academic performances.

This study aims at understanding the effect of the Exam Wrapper method in an upper level, technical elective writing assignment in a technical elective course. Positive

effects on student learning by using the Exam Wrapper technique could support the extension of this method in lower-level courses and other upper-level courses. A future study of the effectiveness the Exam Wrapper tool across a larger student cohort would ensure a more significant sample size, the opportunity to draw stronger conclusions, and to further understand the effect of self-reflections in helping these students in the job market.

As a preliminary assessment of the Exam Wrapper technique, a technical report outline assignment was used to test the effectiveness of an optional self-reflection submitted with an assignment resubmission. It was determined that the Exam Wrapper exercise improved the quality of the student resubmission. The quality of the student reflection correlated with the improvement in resubmitted technical outline quality.

2. EXAM WRAPPER EXERCISE

Undergraduate (20) and graduate (3) students enrolled in a technical elective course on the topic of “Sustainable Materials and Materials Processing”. One of their assignments was the writing a technical report outline on the topic of an analysis of the sustainability of a material or a material production process. This assignment was used to test the effect of an Exam Wrapper exercise.

2.1. First Evaluation

The outline was graded by the course teaching assistant, using a detailed rubric. The technical report quality was assessed by evaluating the quality of the table of contents, introduction, conclusion, reference quality, and if the assignment was written in point form. The technical quality was assessed by the quality of their definition of sustainability, if the definition was related to the subject of their report, the description of their report subject, use of technical data, explanation of material properties and/or process chemicals, toxicity of the process or materials, energy analysis, and description of process waste streams. The technical literary quality was assessed for its clarity, concision, and use of references. The teaching assistant used a one-page rubric to provide comments and grades beside each aspect of the grading rubric.

2.2. Optional Resubmission, with or without an Exam Wrapper

After the graded assignments were returned to the students, they were given the option to resubmit their technical report outline for re-grading. They were also given the option of submitting a reflection that was framed by the assignment grading rubric. The students who submitted a reflection with their resubmission were offered a bonus of 10 % for their resubmission. These bonus points were not included in the following analysis. The reasoning behind a student reflection, and the format of the reflection for the assignment were explained to the students.

The self-reflection instructions explained the theory that self-reflection could improve student learning and performance. The Exam Wrapper assignment instructions outlined how writing a description of how a student did not answer a question correctly, and what misconceptions and/or misunderstandings prevented them from a correct answer, reduces future similar mistakes. The students were given self-reflection examples that included but were not limited to: working too quickly, fatigue, only a superficial understanding of the subject, inexperience with a similar problem, could not find adequate references, not reading or understanding the question correctly, and/or no time to revise the work before submission.

Students were asked to complete each grading rubric section with their personal comments about their performance in each section. It was stated in the assignment that the goal of this self-reflection was not to populate the form with the examples provided, but to think about why their work fell short of expectations. It was noted that the self-reflection comments would not be evaluated by the teaching assistant who graded their first submission, or by their course instructor who would grade the resubmission, but by a research associate.

2.3. Student Response

Of the 23 students who submitted a first technical outline, 3 (14 %) resubmitted a revised outline without a reflection, and 16 (73 %) students submitted a revised outline with a student reflection. Two students changed the subject of their technical report, and one student discussed their technical report outline during office hours instead of submitting a reflection. These three students were not included in the study. One student did not resubmit.

3. RESUBMITTED ASSIGNMENT QUALITY IMPROVEMENT AND REFLECTION QUALITY

Figure 1 compares the first submission assignment grades, binned in grade decades, with the resubmitted assignment grades. It is evident that the resubmitted grade results were higher than the initial submission grades.

Figure 1: Grades for the first technical report outline submission (blue) and the resubmitted outline (orange).

The course instructor and teaching assistant calibrated the grading scales before the assignment was given to the

students. A research assistant was hired to assess the student reflection quality on a scale of 0-10. The research assistant also reviewed the initial and resubmitted assignments. The change in grade between the first and resubmitted assignments was calculated by subtracting the grades assigned by the course teaching assistant for the first assignment from the grades for the resubmitted assignment that was evaluated by the course instructor.

3.1. Average Grade Differences

The average grade improvement of the resubmitted assignment for students who did not submit a student reflection was 6.3 % (n=3). Due to the low sample number, no statistical meaning will be associated with this result. The average grade improvement for students who resubmitted their assignment with a reflection was 15.1 % (n=16).

3.2. Assessing Student Reflection Quality

A research assistant was hired to assess the quality of the student reflection on a scale of 1-10. A grade of 10/10 was given for a very substantive reflection; student identified their mistakes, acknowledged where and how they went wrong; some students indicated that they did not work hard enough on the report or did not put enough time in writing it. They fully understood what the problem was and managed to think of a way to correct it. This correction on the second revision showed improvement in many ways, from structure to scientific content. For grades from 6-9/10, the grade represented the substantive quality of their reflection; they understood the problem but the degree of the solutions to address those problems varied. Students in this category, had a good quality of reflection, understood the problems and had solutions for improvement. Students who earned a reflection grade of 5/10 and below submitted a superficial, if any, detailed reflection. Students who earned this grade did not seem to have fully grasped where their performance lacked quality. In cases where the students described reasons for their low grade, it was mostly for lack of time, being overwhelmed by too much information, or lack of resources.

3.3. Effect of Student Reflection Quality on Assignment Grade Improvement.

The results of the student reflection quality were plotted with the quartiles of improvement in student assignment grade after the resubmission. For purposes of data presentation, a student reflection quality of 0 represents the students who did not submit a reflection with their resubmission.

Figure 2: Grade improvement (%) versus the quality of the student reflection. A reflection quality of 0 indicates no reflection was included with the assignment resubmission.

There is a positive relationship between the improvement of the student grade between the initial and resubmitted assignment, and the quality of their reflection. The students who did not submit a reflection scored as low as students who submitted the most superficial reflections, and as high as the improvements by students with reflection scores of 5-7/10.

The largest improvements in assignment grade were associated with the highest reflection quality (9-10/10). The widest range of grade improvement was noted for a reflection grade of 8/10.

4. DISCUSSION

Although correlation is not causation, the data suggest that students who submitted a reflection with their assignment resubmission improved the quality of their assignment over the improvement of their cohorts who did not submit a reflection.

The number of student reflections that were assessed for quality was low (n=16). Among this group, there was a difference between the grade improvements for three groups of reflection quality. There are marked grade improvement for the middle quartiles between the lowest ranked reflection quality (3/10), a group between 5-7/10, and 8-10/10. An improved quality of the student reflection, binned in these groups, correlates with an improvement in resubmitted assignment quality.

It is possible that a thoughtful self-assessment, in combination with a detailed rubric with detailed feedback, provides the opportunity for the student to correct their performance with the subsequent submission of a revised assignment. It is possible that students who did not see the value in the reflection exercise also did not see value in the assignment, and therefore did not allocate significant attention to either effort. There are many contexts and options for using the Exam Wrapper concept. In the case presented, a positive correlation with student reflection quality was observed for a technical writing assignment.

5. CONCLUSION

In the case of a technical writing assignment with a detailed rubric, the optional submission of an Exam Wrapper self-reflection resulted in a correlation between the self-reflection quality and the resubmitted assignment grade improvement. It is possible that a student who produced an effective reflection could identify and quantifiably improve their technical writing assignment more than a student who did not reflect, or provided a superficial reflection. Student engagement in the reflection activity, and the opportunity to improve their work for resubmission in a short time-line, resulted in an improved technical writing assignment quality. These results will contribute to future uses of the Exam Wrapper in other courses.

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