Board 142: Work in Progress: Engaging STEM Students in Revising Technical Writing Assignments

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Abstract —The continued struggle to improve undergraduate student technical writing skills in STEM disciplines is well documented. Solutions have been proposed, implemented, and inconsistently sustained. One approach to improving disciplinary technical writing is through Writing Assignment Tutor Training in STEM (WATTS). WATTS is an interdisciplinary, collaborative approach in which STEM faculty work with writing centers and generalist peer tutors to provide just-in-time assignment-specific feedback to students. WATTS research was funded by an NSF IUSE collaborative grant (award #s 2013467, 2013496, & 2013541). In WATTS, the STEM instructor collaborates with the writing center supervisor and prepares materials for the tutor-training including assignment examples, a glossary of terms, areas of concern, and the assignment learning outcomes.

Among other benefits, WATTS has shown statistically significant outcomes towards improving student technical writing [1]. Tutors provide specific, appropriate feedback to the students during the tutoring sessions. However, one area that remains a challenge is engaging students in revising and implementing that feedback in their writing process. An important next step is to find new ways to engage students in the revision process so they can effectively use the feedback they receive from multiple interdisciplinary audiences and begin to internalize the benefits of the revision process.

Here, we begin the work of increasing student engagement with a multi-pronged approach to revision. Students begin by assessing their own work with the assignment grading rubric and instructor materials to identify areas for potential improvement. The instructor, using the materials prepared for the WATTS tutor-training, provides feedback on areas of concern. Students then visit the writing center to get individual peer feedback. Finally, students create a plan that combines the varied feedback sources for revising their writing. This allows students to engage at multiple stages and take ownership of their revision process.

This work-in-progress paper discusses an interdisciplinary approach to fostering student engagement in the iterative revision process. We used Kang et al.'s Design-Based Change Model (DBCM) [2] as a framework to envision, plan, implement, and sustain practices in institutional contexts for WATTS implementation. Next steps include piloting this approach in the classroom to provide a more engaging iterative revision process and comparing the number and types of revisions completed in the writing.

I. Introduction

Writing Assignment Tutor Training in STEM (WATTS) is an interdisciplinary collaborative approach to improving student technical writing. In this approach, STEM faculty work with writing centers and generalist peer tutors to provide just-in-time assignment-specific feedback to students. The STEM instructor and writing center supervisor work together to provide a one-hour tutor-training that highlights assignment examples, a glossary of terms, areas of concern, and the assignment learning outcomes.

WATTS research was funded by a National Science Foundation (NSF) Improving Undergraduate STEM Education (IUSE) collaborative grant (award #s 2013467, 2013496, & 2013541). The results of this research demonstrated statistically significant improvements in student technical writing [1]. These improvements can be attributed to the WATTS-trained tutors who provide appropriate feedback to the students during their tutoring sessions.

This team's research has explored changes between pre-tutoring and post-tutoring assignments and demonstrates that, while the writing improves, it is still a challenge to engage students in revising their work. During the WATTS research project, students took writing assignment drafts to a WATTS-trained tutor for feedback. While the tutors provided feedback that aligned with the assignment instructions, instructor feedback on areas of concern, and quality technical writing best practices, when we compared the pre- and post-tutoring drafts, a low percentage of students implemented the tutor recommendations.

In addition, survey responses indicated that students did not anticipate returning to the writing tutors for additional support. Finding ways to engage students in the revision process and effectively use the feedback they received while also internalizing the benefits of the revision process are important next steps to further expand the WATTS approach.

We used a modified version of the AAC&U Written Communication VALUE Rubric [9] to assess all drafts for two groups across multiple institutions: the experimental group visited tutors who were trained using WATTS, and the control group visited tutors who were not trained using WATTS. Even without implementing all the suggestions, our reviews of the experimental group drafts showed statistically significant improvements that exceeded those of the control group drafts [1]. The research did not demonstrate full engagement by the students in the iterative writing process; however, in order for WATTS to be successful, the students must be engaged in this process.

To address this issue and further enhance STEM writing outcomes, we propose a model that involves structured revision engagement activities. This paper will present the current work in progress including a review of the relevant literature on student revision in STEM writing, the proposed methodology for designing and testing a student-driven iterative revision process to improve student engagement, and the future research plans and implications of this work in WATTS.

II. Relevant Literature

Similar to the findings of WATTS, Andrews et al. [3] observed that a collaborative approach to revision is perceived to be beneficial to all stakeholders. The issue of student engagement in technical writing is broadly perceived as a concern [4]. STEM instructors generally believe strategies to incorporate an iterative writing process would benefit their students [4]. We propose applying Kang et al.'s DBMC [2] model as a framework to support the incorporation of a more iterative student revision process. Stakeholder engagement was high among all participants during prior iterations of the WATTS model, however, there is room for increased student engagement. Fig. 1 diagrams the stakeholders and engagement overlap.

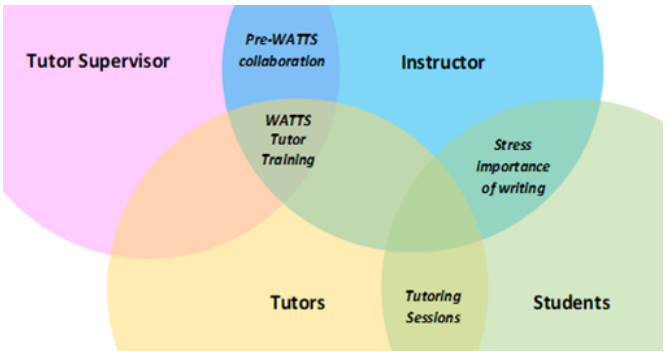

Figure 1 WATTS stakeholders and areas of engagement

A. Kang et al.'s Design-Based Change Model (DBCM)

We used Kang et al.'s Design-Based Change Model (DBCM) [2] as a framework to envision, plan, implement, and sustain practices in higher education contexts for WATTS implementation. Future work includes piloting this approach in the classroom to provide a more engaging iterative revision process.

Kang et al.'s model is based on Kotter's [5] eight stages to leading change for a broader implementation. Kotter's approach is designed to guide business and industry leaders through implementing change within their organizations [2]. Kang et al.'s DBCM provides a framework for broader implementation of WATTS. Additionally, it can serve as a guide for the creation, implementation, and revision of the student-driven iterative revision process.

There is minimal literature in the field that discusses student revision strategies on technical or STEM writing. The major themes regarding revision strategies primarily focus on the effectiveness of peer review strategies. Andrews et al. [3] found that students value contextual, real-time technical writing assistance. Though the focus of Haffa et al.'s [6] research was on developing critical thinking skills, written technical communication was a component as well, and their findings showed that an iterative approach, including self and peer reviews and instructor feedback, showed a higher uptake of skills and greater student success outcomes.

Research into the academic rank of students and the impact in the peer-review feedback demonstrated that academic rank had limited impact in the feedback [6]. Self-assessment by participants showed less self-awareness of issues than the peer-reviews, and both were less aware of issues than when assessed by the instructor [6]. When assessing the impact of writing-to-learn, peer-review, and revision, Finkenstaedt-Quinn et al. [7] observed a positive increase in rubric scores between original and revised drafts.

Any approach implemented to create a sustainable solution to address the issue of student engagement in the revision process needs to embed the approach and result into consistent use and engagement in improving student technical writing. Therefore, we propose an iterative student-driven revision process to expand on the themes found in the above literature that are similarly found in WATTS.

3. PROPOSED METHODS

The purpose of this work-in-progress paper is to address these issues by designing a prototype of a student-driven, iterative revision process. The proposed process will be piloted and used with the WATTS model. This work seeks to increase student engagement in the revision process and provide students with skills that can be transferred to future technical writing assignments.

Research Question: To what extent does the use of the student-driven, iterative revision process improve engagement in student revision as measured by changes from the pre-tutor visit draft to the post-tutor final report submitted in the course?

Students will begin with a draft of the full report for the assignment and will self-assess their work with the selected rubric, identifying changes that would improve the written communication. The instructor will give general feedback based on the training materials created for the WATTS tutor-training. Students will meet with a WATTS tutor to get additional targeted selective feedback and will use the triangulated feedback (self-assessment based on rubric, instructor feedback, tutor feedback) to create a revision plan. Once revisions have been made, students will attach a final feedback implementation report to the instructor submission to outline which changes they made and why (or why they did not change something suggested in the feedback). Kang et al.'s DBCM will guide our implementation.

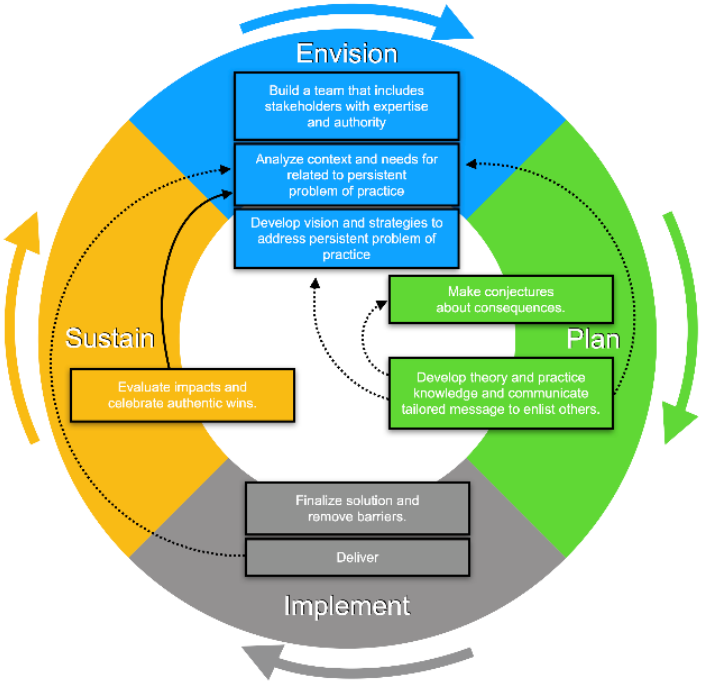

Figure 2 Adaptation of Kang et al.'s DBCM [2]

A. Envision

1) Build a team that includes stakeholders: (Completed in prior iterations of WATTS.) The researchers form the basis of the initial team. They include the creators of WATTS, a tutor supervisor, a STEM instructor, and a STEM education researcher.

2) Analyze context & needs: During prior iterations of WATTS implementation, an advisory board meeting brought up student engagement with the writing process as an area for improvement, especially investigating ways for the newly gained WATTS skills to be transferred to new technical writing assignments that students complete.

3) Develop vision & strategies to address the problem: This work-in-progress paper serves as a medium to develop the strategy to address the problem. The researchers discussed ways to increase student engagement in the writing process while trying to minimize increased workload for the instructor. The proposed solution is a student-driven iterative revision process.

B. Plan

1. Develop theory & practice knowledge AND make conjectures about consequences: The researchers will develop the pilot of the student-driven iterative revision process by creating a template. Considerations for the template include sections for the following:

- Self-assessment of initial draft and preliminary revision plan.

- Note-taking area for feedback provided from the instructor.
- Section analysis of the report format and description of intended audience.
- WATTS-trained-tutor visit feedback.
- Self-assessment using the modified AAC&U VALUE Written Communication Rubric to assess the draft.
- Full revision plan (what the student is considering revising)
- Revision implementation report (what the student actual revised, what feedback was implemented and why, what feedback was not implemented and why not).

The expected outcomes include increased student participation in the writing process, further improvements in student technical writing, and internalization of skills for better knowledge transfer to future technical writing.

C. Implement

1. Finalize solution and remove barriers: The researchers will finalize the student-driven iterative revision process. To lower the impact on STEM instructor time during the pilot, the technical communication instructor will introduce the process to the student participants.

2. Deliver: The technical communication instructor will implement the process in conjunction with the WATTS model, pending IRB approval, during the fall 2024 in a paired engineering technology lecture/lab and technical communication course. The technical communication instructor will guide the students during the pilot in the use of the process and gather student feedback of the template and process.

D. Sustain

1. Evaluate impacts & celebrate wins: The researchers will compare the pre- and post-tutoring WATTS student drafts to determine how many and what types of changes students made. This iteration will be considered a success if changes are made, and this creates a baseline for future iterations.

4. Implications and Future Research

This work-in-progress proposes a pilot for engaging STEM students in a student-driven revision process to improve STEM writing. Using the NSF-funded WATTS data, a comparison of this pilot with the prior work could be made to note the number and types of revisions made with and without the student-driven iterative revision process. Implications could include STEM student writing improvement and more and better student engagement with the revision process. Having students engage with the revision process can also improve the sustainability of WATTS and its goal to improve student technical writing. Future goals include expanding the pilot research to enhance student engagement and outcomes. Future potential research questions could include the following:

- To what extent does the use of this method improve student perceptions of the value the writing process (draft/revise/feedback/revise/submit)?
- To what extent do students recognize the connection of the writing process to post-graduate communication tasks in the workplace?

Future research opportunities could include grant funding applications to research and assess two sections of classes, one as the control group not using this revision process, and one as the experimental group using the revision contract.

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