Technical Writing Skills in Engineering

The Role of Collaborative Learning

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Abstract

While Engineering is an inherently interdisciplinary field, the discipline of technical writing is often overlooked and undermined. This research paper aims to address the gap between technical writing skills and Engineering academia through an interdisciplinary lens. Approaching this research through the Engineering, Technical Writing, and Communication disciplines reveals that collaborative learning through writing projects significantly improves the technical writing skills of Engineering students, as well as their motivation to write and learn. These collaborative writing activities include team-based learning, collaborative critiquing, and writing-to-learn. This research finds that learning technical writing within the realm of the Engineering curriculum is more beneficial than the standard university writing course, as undergraduate students will learn why these skills are important to their careers, and are given a specific set of requirements that will set them up for success in the workplace.

Key Terms

WTL, TBL, and collaborative critiquing are the key terms that are incorporated in this paper. The Writing-Across-the-Curriculum Clearinghouse (WAC Clearinghouse) defines WTL (writing to learn) as activities that are short, impromptu, or otherwise informal and low-stakes writing tasks that help students think through key concepts or ideas presented in a course. TBL (team-based learning) is defined by psychologist Dr Larry K Michaelson as a small group instructional strategy that gives students the opportunity to “apply instructional knowledge through a sequence of activities that includes individual work, teamwork, and immediate feedback” (Parmelee, 2012, p.276).

Introduction

University undergraduate STEM programs undoubtedly undermine the level of writing skills that their students need to succeed in the workplace. Engineering students in particular, are stripped of the written and verbal communication skills that allow them to thrive in their field. The interdisciplinarity of STEM, specifically engineering, is being ignored, and this sets Engineering students up for failure. It is clear that Engineering is not simply Engineering; it is an encapsulation of three disciplines: Engineering, Technical Writing, and Communication. This research explores this interdisciplinarity through the question, “How are Technical Writing skills improved in Engineering through collaborative writing projects?”. The inclusion of the technical writing is necessary to explain what “technical writing skills” are, and why they are important in Engineering. Communication, a recurring topic in this research, emphasizes the lack thereof, and importance of written and verbal communication skills in establishing oneself in a career; technical writing, being a form of written communication, goes hand in hand with this discipline. Approaching this research from an interdisciplinary lens emphasizes the complexity of the issue at hand, while highlighting the overarching ideas of the research question: academia and individual learning.

Engineering

For this research, engineering is the core discipline that questions whether or not STEM students are receiving the writing skills that they need to succeed in their field. Students in the field of engineering are often “rather people of action rather than of words”, decreasing their motivation and interest in technical writing (Rus, 2015). However, it is clear that written and verbal communication are skills that engineering employers look for. In fact, when called upon to write technical documents, engineers are “required to obey a set of norms which are characteristics of this type of texts” (Rus, 2015). Within the engineering discipline, the type of writing that engineers will be doing requires adequacy in technical writing due to the complicated nature of the discipline itself.

Technical Writing

In order to find how the technical writing skills of engineering students are improved, it is crucial to have an adequate understanding of the discipline on its own. The term “technical”, referring to “knowledge that is not widespread, that is more the territory of experts and specialists” explains why STEM students, especially engineering students, should acquire technical writing skills (Beilfuss et al., 2019). The skills that students are taught in a technical writing class however, are beneficial to any discipline. The focuses of the courses are on formatting, purpose, and appropriate language, as well as putting a clear distinction between academic writing and technical writing. One of the most important aspects of learning technical writing is being able to define a clear purpose and articulating it clearly for the reader. For an engineering student writing a lab report or instructional model, articulating a purpose in an efficient matter is crucial.

Communication

Looking into previous research in the realm of Engineering academia, communication is a recurring discipline that presents itself, going hand in hand with engineering. Many careers in STEM involve team-based work, communication amongst other employees and customers, and those in higher positions. Professor Deborah Faye Carter at Claremont Graduate University noted that “written, oral, and graphic communication skills are considered to be part of students’ preparation” for undergraduate practice (Carter et. al, 2015, p. 366). Though there is less of an emphasis on technical writing courses in many undergraduate STEM programs, communication courses and skills are highly valued. In any workplace or educational setting, it is clear that communication is a vital skill to have in order to succeed and move higher in a profession, and other disciplinary fields as well.

Common Ground

This interdisciplinary research concludes several common findings, the first regarding the motivation of engineering students. A study conducted by engineering professor Dana Rus

found that using authentic materials in the teaching of technical writing to engineering students increased motivation. According to Rus, authentic materials are “something that students can relate to and they can see the practical objective of the writing task” (Rus, 2014, p.1112). In this study, students were asked to write about the process of producing energy from coal, and in guided, collaborative writing, correct any mistakes. The study exemplified that students were more motivated to complete writing tasks and improve their writing skills when it was a topic specialized to their field, as well as in a group setting. The discipline of communication has a similar take on motivation. A study implemented at the University of Alabama by Shenghua Wu et. Al found that implementing TBL instructional models in engineering lab courses helped students perceive their writing skills in a “more positive manner…leading to them being more confident in technical writing” (Wu et. al, 2022, p. 8). Additionally, the study proves that TBL is effective in supplementing students’ attitudes towards writing and therefore, supplementing their performance. Similarly, the study by Wu incorporates another common finding: writing to learn.

WTL activities give students “more active responsibility for their learning”, and the act of completing writing tasks with fellow engineering peers proves itself “a successful technique for learning” (Wu et. al, 2022, p.2). This concept stems from the idea of transitioning from passive learning to active learning, and allowing students to approach course content in a way that honors them. Similarly, from the viewpoint of technical writing, traditional writing courses and methods are often intimidating to engineering students due to their complexity and uniformity. Dietmar Tatzl, lecturer of English language courses at the University of Applied Sciences in Graz, teaches said courses to aeronautical engineering and aviation management students. His investigation of students’ perspectives on semester-long collaborative writing assignments finds that this collaboration in projects “delivered important insights into… student progress in both language and content matters” (Tatzl, 2012, p.296). When given assignments that focus on both the technicality and clarity of writing, students are learning how to write on the basic level, as

well as within engineering and other technical fields. Tatzl's study also leads into the third common finding; necessary workplace skills are gained from collaborative technical writing.

In regard to the study, Tatzl describes the rationale behind collaborative technical writing assignments as "exposure… to critical reflection, discussion, and revision… and thus an increase in higher order thinking skills as well as professional writing proficiency" (Tatzl, 2012, p. 283). Communication skills were also among the skills that resulted from continued collaborative technical writing. Correspondingly, a survey conducted regarding how intercultural communication is taught in technical writing reveals that the inclusion of intercultural communication in technical writing is a result of an increase in diversification of the workforce. The study concludes that the average technical writing course "serves students with different majors and interests and aims to prepare them for workplace communication" (Matveeva, 2008, p.388). Both Tatzl's technical writing perspective and Matveeva's communication perspective include the argument that necessary workplace skills such as critical thinking, writing proficiency, and communication skills stem from incorporating technical writing work into the engineering classroom.

Disciplinary Conflicts

Despite the frequent coherence and common arguments of these disciplines, there are several conflicts and contradictions that exist in this research. One conflict that presents itself is that not all engineering students appreciate the cross-disciplinary nature of collaborative writing. While Tatzl's study concludes that "learners appreciated the cross-disciplinary collaboration in projects", another study says otherwise (Tatzl, 2012, p. 279). Kamau Wright of the Stevens Institute of Technology finds that an alternative method, "the use of a portfolio approach in which writing in individual papers is never graded", encourages students to create multiple drafts and improve on each one (Wright, 2020, linking section, para. 7). This conflict sheds light on the importance of acknowledging differences in learning styles, something that should be confronted when introducing collaborative writing in the classroom. An additional conflict highlights the

arguments for reading to learn versus writing to learn. When collaborative critiquing exercises are incorporated, students improve their skills by evaluating “the quality of the writing by identifying the strengths and weaknesses of each passage” (Carr, 2013, p.751). While this technical writing perspective argues for reading or peer reviewing to learn, the study conducted by Wu argues that students benefit more from writing to learn. Wu et al. argue that WTL activities such as summaries, word problems, and explanations/explorations “were combined to promote students’ understanding and learning of course content” and generated greater motivation in learning as well (Wu et al, 2022, p.2). While these two sets of disciplinary conflicts are different, they both tie in the issue of learning styles and help spark the conversation of what helps students succeed the most; in this case, incorporating technical writing skills into a collaborative effort in one way or another.

Conclusion

The research presented proves that the disciplinary perspectives of Engineering, Technical Writing, and Communication help bridge the gap between technical writers and engineers, and help create a more cohesive learning experience. The interdisciplinary approach to Engineering education reveals the relevance of cooperative learning, as well as active learning; furthermore, students thrive when learning in a collaborative environment. Writing to learn in a group setting benefits students in numerous ways, but most importantly, by increasing their motivation and understanding of the role that technical writing plays in their field. While each student will have their own learning style, the TBL approach allows students to play different roles in their assignments or projects, while still learning the vital skills such as communication and conciseness, that will set them apart in the workplace. By emphasizing the importance of technical writing in a way that caters to the learner, engineering students will no longer feel that writing is a foreign, complicated task, and realize its role not only as an undergraduate student, but as an employee as well.

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