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Towards a Transformative Collaboration: Technical Writing, Engineering, Industry

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Work In Progress: Towards a Transformative Collaboration – Technical Writing, Engineering, Industry

Abstract

This paper reports on a work in progress collaboration between Engineering and English faculty at an American university in the Middle East region and examines the initial impact of the team's reorganization of a required Technical Professional Writing course on engineering students' educational experience as they learn effective and relevant professional communication skills in the field of engineering; as they network with mentors from various industries; and as they train to be effective writers and competitive candidates in their engineering fields.

We hypothesize that the significant collaboration between English and Engineering faculty in developing assignments, providing feedback to students throughout their projects, and assessing students' final products, as well as the partnership with various partner industries, considerably improves our students' writing journey at TAMUQ as they learn effective and relevant professional communication skills in the field of engineering. We also discuss the steps forward to make this collaboration a model for other courses in our curriculum at our institution.

Introduction

Strong writing skills are crucial for competitiveness in STEM fields. Clear and cogent writing and communication skills are critical competencies as identified by ABET (Accreditation Board for Engineering and Technology) [1], and the National Academy of Engineering [2]. Today's successful engineer must master more than one competency (see figure 1), including communication and writing skills, which comprise between 20%-40% of an engineer's workday: writing project proposals, memoranda, business letters, and e-mails. As they move up the corporate ladder, those in senior management can spend over 70% of their day writing [3].

Global Competence
Understanding global markets and business practices: languages; work in multicultural global environments; global ethics, safety and security; cultural, social and political awareness

Technical Competence
Engineering science fundamentals; technical discipline; design and manufacturing and innovation; system engineering

Professional Competence
Entrepreneurship; effective communication; leadership and diverse teams; flexibility; curiosity and creativity critical thinking
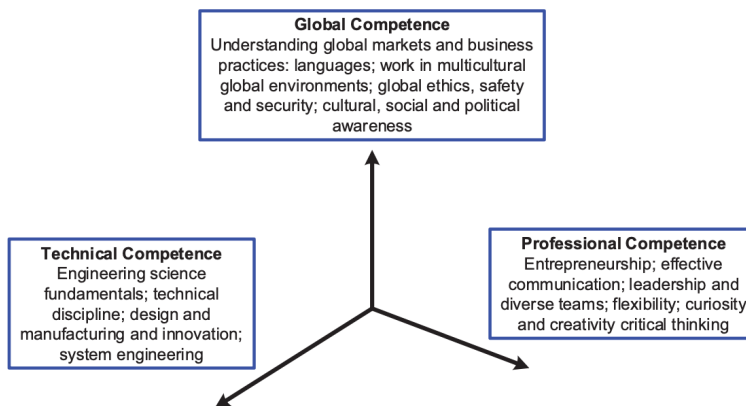
Figure 1: Requirements of a twenty-first-century engineer [4].

Despite the significance of writing and communication in the engineering field, research indicates a gap between communication instruction in engineering programs and expectations

from the professionals in the field, who indicate that they need novice engineers with better communication skills [3]. This suggests that what students learn in their academic programs does not necessarily meet the demand of the industry.

This paper describes the response of two English faculty members to these concerns as we reorganize the only required technical writing course in the students' degree plan, in collaboration with two faculty members in engineering and members of local industry in Doha, Qatar. The aim of reorganizing the course, ENGL 210 "Technical and Professional Communication," is to develop an interdisciplinary approach to teaching technical writing in which English and Engineering faculty, as well as industry partners, play equally important roles in preparing students to meet the academic and professional expectations for effective writing and communication in engineering fields, both local and international.

Background
Our undergraduate engineering students at Texas A&M Qatar take only ONE course in Technical Professional Communication (ENGL 210). The objective of the course is to provide students with practice in technical and professional writing and communication. This course is also offered at the main campus location in College Station, and, given the diversity of majors offered there, it is necessarily general in its content to fulfill the needs of all student backgrounds and disciplines. Moreover, because of the rigorous and highly structured engineering degree plans, students are not able to take any other writing course in English and must rely on courses that are writing-intensive in their engineering programs. The result of these constraints is that engineering faculty express concern that students in their upper-division and capstone courses struggle with expressing their knowledge in oral and written genres. As one engineering faculty (mechanical engineering) notes, "the following bullet points are very general and are probably all objects of life-long learning, but they are the things that I come across with technical writing/presentation in general: accuracy of our own expression, either written or verbal, credibility of the sources we cite and validity of their claims, dimensions to a problem, awareness of our own limitations." We must ask the question, then, where do we begin to teach these important writing/thinking skills to our students, and how do we ensure their continuity throughout their writing journey?

In a survey conducted with engineering faculty teaching writing-intensive courses [Figure 2 and Figure 3], data shows that some engineering faculty believe that writing instruction should not be considered part of an engineering class. They indicate that they have no time to focus on writing in their course and that they "view themselves as content specialists and not writing instructors" [6]. Writing is 'specialized' knowledge best taught in an English class. In response to a survey question, "Which skills do students struggle with in your class?" faculty indicate that "correct language, clarity, coherence" and "plagiarism" are their two major concerns [see Figure 2]. Faculty were also asked, "Which skills are challenging for you to teach in your class?" As seen in Figure 3, "audience expectations," "correct language, clarity, and coherence" as well as "plagiarism" are the most challenging for the survey participants. We also asked faculty about writing instruction in their class [see Figure 4]. While some indicate that they do include some writing instruction and practice in class, a significant percentage (approx. 31%) rely on the services of the Division of Arts & Sciences Writing Center to conduct workshops on important topics such as "Literature Review," "Critical Writing and Thinking Skill," as well as "Technical

Lab Reports." Moreover, these faculty do not necessarily address the skills with which students struggle, such as audience awareness and expectation, and language clarity or correctness, commenting that these skills should be taught in their English classes.
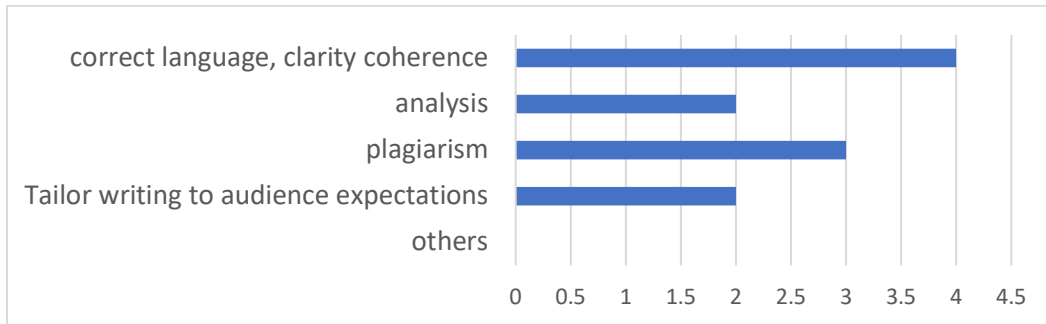
#	Field	Choice Count	
1	correct language, clarity coherence	36.36%	4
2	analysis	18.18%	2
3	plagiarism	27.27%	3
4	Tailor writing to audience expectations	18.18%	2
5	others	0.00%	0
			11

Figure 2 – Which skills do students struggle with in your class? (check all that apply)
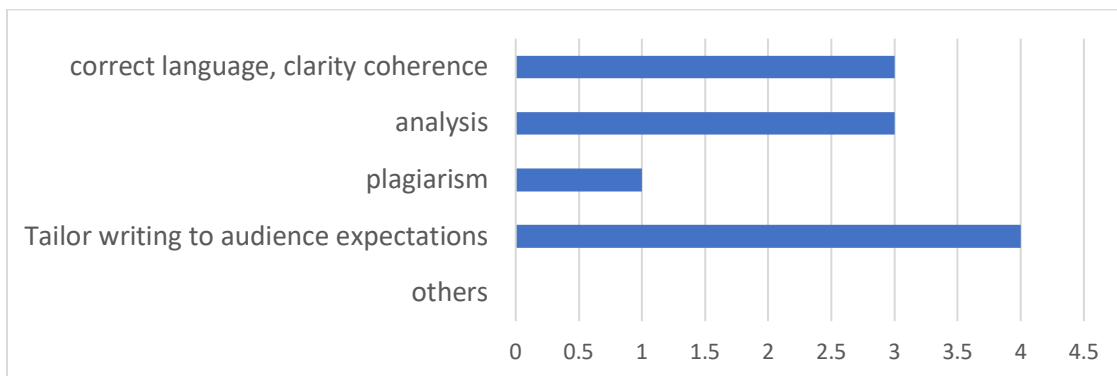
#	Field	Choice Count	
1	correct language, clarity coherence	27.27%	3
2	analysis	27.27%	3
3	plagiarism	9.09%	1
4	Tailor writing to audience expectations	36.36%	4
5	others	0.00%	0
			11

Figure 3 – Which skills are challenging for you to teach in your class? (Check all that apply)

#	Field	Choice Count	
1	instruct student on writing regularly	23.08%	3
2	provide opportunities for writing practice	23.08%	3
3	discuss writing models (such as paragraphing, literature reviews, rhetorical devices, etc)	15.38%	2
4	conduct workshops regularly	7.69%	1
5	invite the CTL to conduct in-class workshops	30.77%	4
			13
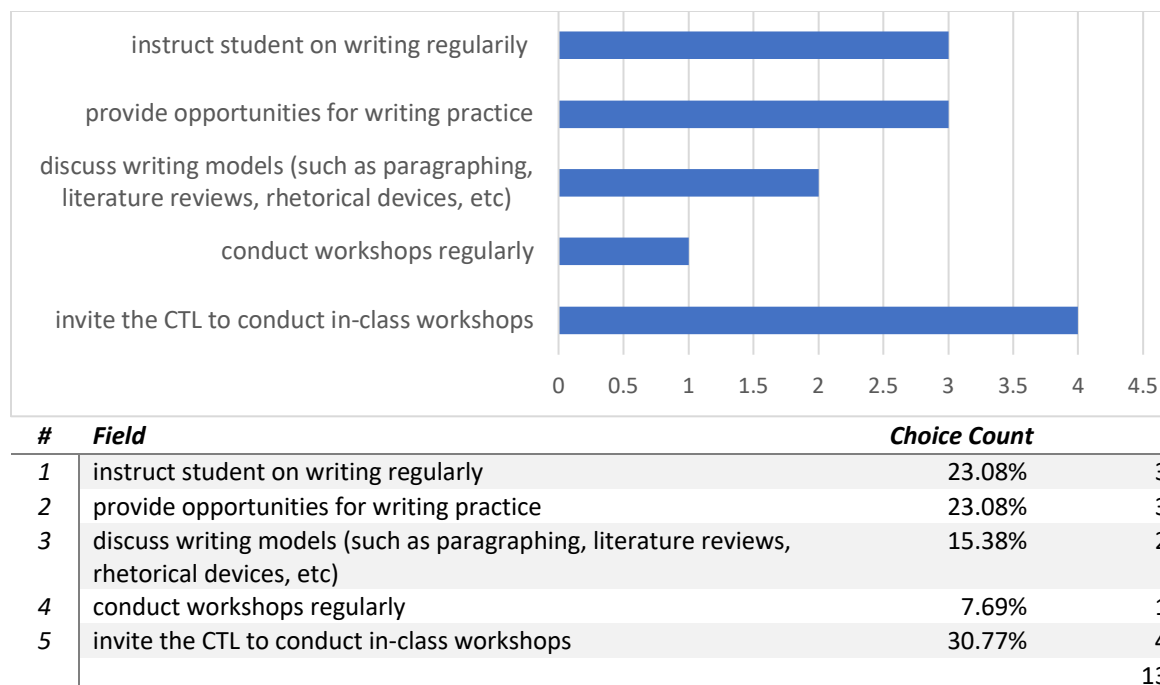
Figure 4 – Throughout the term, I _____during class time (Check all that apply)

Our institution, naturally, has had its own "turf wars;" however, the goal of our collaboration is not only to educate one another on the expectations and limitations of our course content and expertise but to also build a bridge between these two radically different disciplines. With the aid of a Transformative Educational Experience (TEE) Grant, our team has been able to successfully narrow the gap between our disciplines as we work together towards student success.

A Radical Collaboration
Because ENGL 210 is a general technical writing and communication course that can be taught across all disciplines, there are numerous approaches English instructors may use. Some focus on content and assessments better suited to business settings – newsletters, memos, incident reports, and business proposals – while others have introduced ideation presentations and prototyping [7].

We, on the other hand, redesigned the course to focus on what engineering faculty identified as relevant aspects of writing in the field of engineering: problem statements, research and literature reviews, project proposals, progress reports, and scientific poster design, with additional focus on integrating UX design and data visualization in the students' projects. The cross-disciplinarity in our team is key to our methodology as it has enriched the impact of student learning in the ENGL 210 course. Indeed, for our reorganization to be successful, we needed three components: knowledge of best writing practices, knowledge of the engineering discipline, and effective course/curricular planning.

Our first meeting in summer 2021 was a challenge, as we each brought our own disciplinary biases and (mis)understanding/(mis)perception of writing and thinking. These disciplinary and conceptual differences were also reflected in our assessment expectations and rubric design.

However, despite the challenges encountered, our meetings did serve as a space in which we entered critical dialogue with one another about what writing means, what thinking entails, the multi-dimensions of engineering problems, ethical decisions in problem solving, and an awareness of student limitations as well as our own limitations. We asked each other questions such as: is it ethical to expect our students to find solutions in a "writing," non-technical, non-specialized class? Why are students researching engineering problems and engineering solutions in a technical writing course? Why *can't* students learn about engineering problems and solutions and express their knowledge in clear, succinct, and effective writing with an awareness of audience and purpose? Why set limitations on the content of a writing course? Furthermore, because one faculty member in our team serves as the Writing in the Disciplines (WID) coordinator at the Center for Teaching and Learning, she was able to share her observations about perceptions of writing from both English and engineering perspectives. Through the WID Coordinator's efforts to bridge the gaps between the disciplinary approaches, we were able to discuss concepts such as "writing to learn," "learn to write," and "meaningful writing," and developed and implemented effective evaluation strategies for a variety of different thinking and communication activities.

Through these often-challenging discussions, the English faculty emphasized the importance of designing **authentic meaningful assignments** centered around Qatar Vision 2030 – a government-issued document outlining the vision for the country's comprehensive development in four sectors (also referred to as pillars): human development, social development, economic development, and environmental development [8]. Eodice, Geller, and Lerner define meaningful writing as agentive, allowing students to develop a sense of agency as writers, learners, and thinkers; as engaging where students can easily engage with course material and with their classmates and faculty; as learned for transfer, where course material and acquired skills and knowledge can be used beyond the class [9]. Therefore, the QNV is integral to our course material because by talking about local issues and challenges faced in this region, students can see the relevance and impact of their work. Using the "writing to learn" or "learn to write" approach, or essentially, what writing studies scholars include under "writing across the curriculum," we created assessments that more closely align with engineering faculty and industry professionals' expectations for effective oral and written communication. We selected the following team assignments for the redesign:

- o Problem Statements
- o Oral Presentations
- o Poster Design
- o Technical Reports (including literature review, solutions, and data visualization)

Over the course of one year, we aim to test the theory that close collaboration between Engineering and English faculty on developing clear engineering-oriented assignments, providing oral and written feedback on students' work, and allowing numerous revision opportunities not only enriches students' learning experience but also significantly improves their technical writing and communication skills beyond the course. We aim to iterate this experiment four times (or in four cycles). Each cycle includes 20-40 student participants and the same four faculty members (two from English, two from engineering)
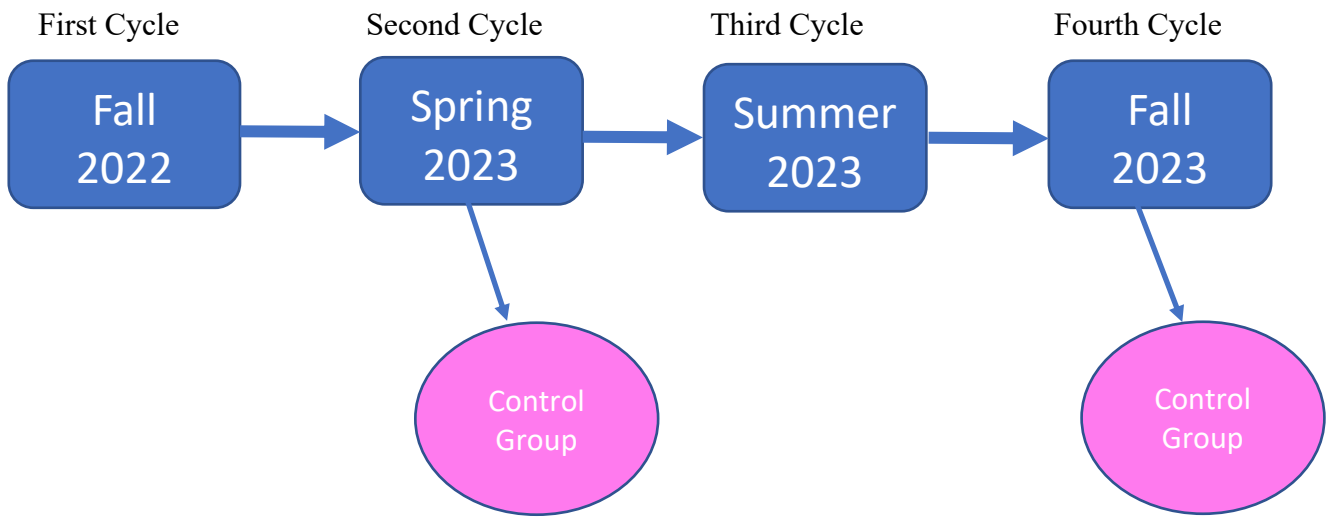
Figure 5 – English 210 Iteration

In the first cycle, the engineering faculty gave oral feedback on drafts of assignments and presentations while the English faculty gave written feedback using their own rubrics for all the assignments. Engineering faculty presented to the class on choosing engineering problems before teams began working on their first project: identifying and researching an engineering problem in Qatar.
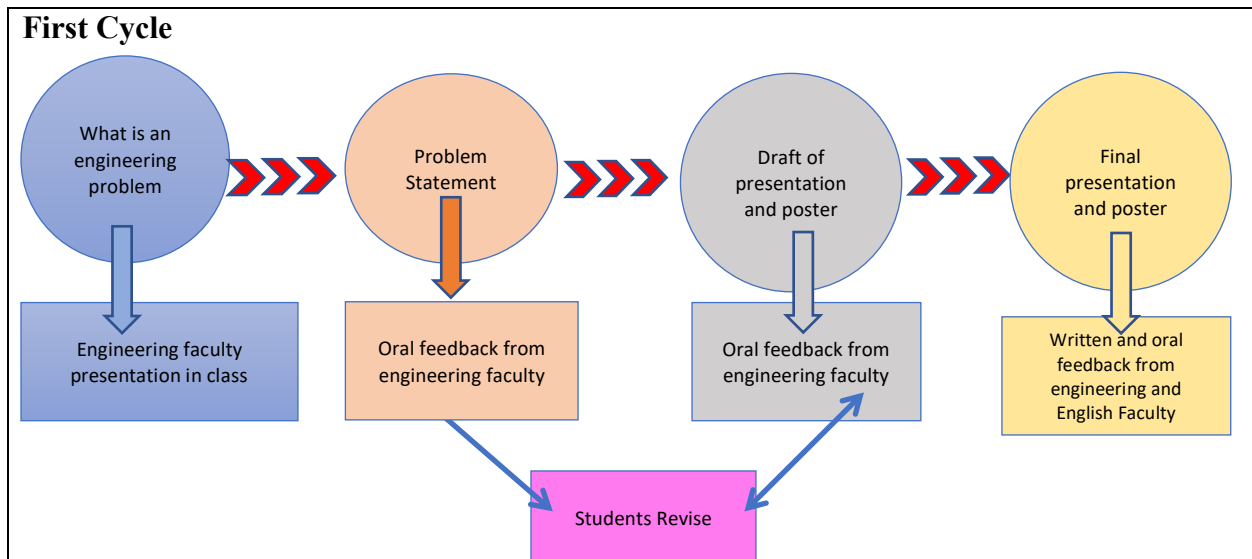

Figure 6 –Fall 2022, First Iteration

In the second cycle, engineering faculty involvement increased as both Engineering instructors gave feedback on all the group assignments as well as oral feedback on the final written assignment – the Technical Report. This addition, we hope, will significantly contribute to students' understanding of writing expectations in writing-intensive and senior design courses in engineering.
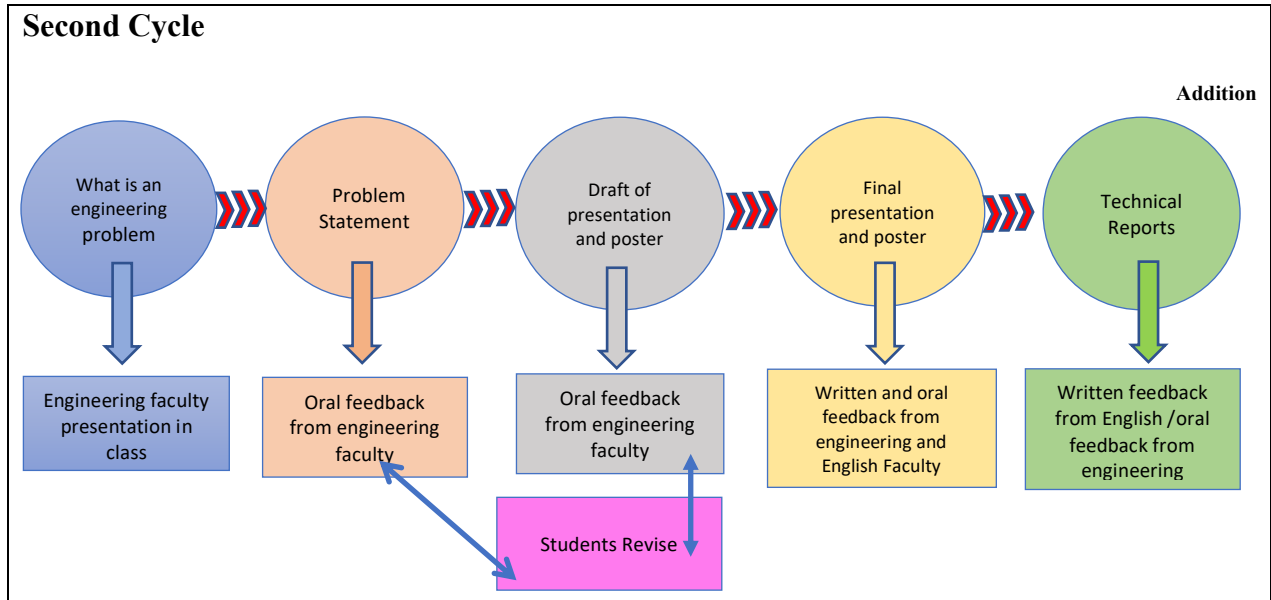

Figure 7 – Spring 2023, Second Iteration

Collaboration with Industry

Our collaboration with the industry brought a unique experience to our students. Because our institution has established very strong ties with local and international industry (Ashghal, Qatar Airways, Shell, ConocoPhillips, Schlumberger), we were able to invite representatives to speak to our students about a variety of topics including the importance of written and oral communication, teamwork collaborations, and the challenges women face in engineering. Some of these representatives are alumni, which gives our students the opportunity to see how growth and success can happen after graduation. Collaboration with the industry also allows us to implement some of the industry's needs in our lesson plans and assessments.

Moving Forward

As we continue to collaborate in our 3rd and 4th cycles, we aim to measure the impact of our multidisciplinary collaboration through multiple methods of assessing students' learning. Although many of the ENGL 210 students commented on the usefulness of the industry visits and indicated appreciation for the feedback received from engineering faculty, we have not yet had sufficient time or data to measure whether the course redesign actually improves the learning experiences and preparation of our students for their higher-level writing intensive engineering courses. Moving forward, we will use pre-course (summer & fall 23) and post-course surveys (spring, summer, fall 23) to measure whether students' perceptions about their experiences in the classes change. We will also meet to assess students' various communication skills (oral, visual,

and written) at the beginning (summer & fall 23) and again at the end of the semester (spring, summer, and fall 23). To determine the efficacy and impact of our collaborative approach, we will include a third section that will act as a control group against which we can measure and evaluate the other sections [see Figure 5]. The control group section will not have engineering faculty or industry professionals involved in the course. Besides student course surveys, we will hold face-to-face interviews with individual students and focus groups and collect writing samples and other course artifacts to conduct a complete analysis of qualitative data. Indeed, as some of our other colleagues in other institutions note, "When faculty members across disciplines work together, everyone benefits—students, faculty, the university, and the community" [10]. Moving beyond this experiment, we hope to reverse this model as English faculty collaborate with engineering faculty on Capstone courses, and offer their input and expertise on clear communication, persuasive argumentation and cogent and clear writing in senior design engineering courses.

Appendix

As we collect date for this work in progress project, we are constantly gathering evidence through surveys, focus group interviews and anecdotal evidence. Below, please find solicited reflections from engineering and English faculty.

Faculty 2 (Division of Arts and Sciences, Writing Faculty)

Although the Engineering and English faculty on this project is still working on developing various activities, I'm impressed with the impact of our efforts on students' writing, communication, and professional development. Based on informal feedback from students' journal reflections and my own observations of students writing and classroom talk, students feel more engaged with and invested in the Technical Writing course because they clearly see the connection to requirements and expectations for student writing and communication in upper-level engineering courses. They also enjoy the classroom presentations and workshops in the TW course provided by our engineering faculty collaborators. For example, the presentation by both faculty on "Identifying Engineering Problems" helps students see the Problem Statement team project through an engineering "lens," which, in turn, makes the assignment more relevant to them. I'm eager to explore the impact of our collaborative efforts on students' learning from a more data-driven research focus."

Faculty 3 (Mechanical Engineering, Program Chair)

It is an excellent idea to ask students in ENGL 210 to work in teams on projects with societal importance early in their curriculum. This will help them better appreciate the core engineering courses. Having engineering faculty mentor the groups and provide feedback is essential in ensuring the complexity of the real problems our society faces given in the right context. On one hand [students] can better highlight the importance of the topics discussed and on the other hand, explain that such problems need continuous collective efforts from everyone.

Faculty 4 (Mechanical Engineering, Faculty)
We had four sessions with students, but how they posed their problems became more to the point and scientific after each session.
- The feedback I received from our colleagues who attended the student's oral presentations and examined their poster presentations was very positive. They found it very beneficial to the courses that they will take with them later.
- Students whom I have seen after taking ENGL 210 have been much better at defining their project and stating the problem clearly, compared to other students.

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