Empowering Engineers: Enhancing Communication Skills through a Technical Communication Lab

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Abstract

Communication labs and writing centers at universities support ABET-accredited engineering programs' mandate to train students "to communicate effectively with a range of audiences" [1]. In this paper, we describe efforts to establish and analyze a new technical communication lab within the engineering school at Johns Hopkins University. In its first three semesters in operation, consultants at the Technical Communication Lab (TCL) completed over 1,000 sessions for 294 students. On a post-session survey, almost all students rated their session excellent, stated they would return to the TCL, and affirmed they would recommend the center to others.

However, the Technical Communication Lab still faces some challenges in terms of advertising, logistics, and breadth of services. To alleviate these concerns, the TCL will partner with faculty in different departments, investigate other scheduling software, publish student-facing resources on its website, gather support resources and additional training for its consultants, and offer several workshops each semester for the engineering school. We hope other institutions can apply our "lessons learned" when developing their own centers and resources to improve their engineering students' communication skills in multiple disciplines.

I. Introduction

Engineers have always communicated with various technical and non-technical audiences, such as users, managers, and other professionals. Therefore, in addition to engineering coursework, technical oral and written communication skills help prepare students for their future careers. The Society for Technical Communication defines technical communication as "a user-centered approach for providing the right information, in the right way, at the right time so that the user's life is more productive" [2]. Over the past two decades, many institutions have established technical communication labs to guide and train students in these technical communication skills, emphasizing oral and written communication for business, engineering, and the sciences over the humanities.

Compared to technical communication labs, writing centers have a much longer history, with a journal, the *Writing Center Journal*, established in 1980. Technical communication labs are rarer but have become more common in recent decades. A prominent example is MIT, which pioneered the use of a communication lab in 2012 and has worked with other universities to adopt and adapt its model [3], [4]. Our university has recently established its own Technical Communication Lab (TCL) as a resource for undergraduate and graduate students seeking to improve their technical writing, oral communication, and visual design capabilities. After three

semesters and more than 1,000 appointments with students, we believe it's time to pause and evaluate our services thus far.

Some technical communication labs, such as at MIT, have recently evaluated and assessed their services [5]. Such evaluation allows communication lab managers to understand what is working well for students and consultants and to identify areas for improvement. We used student registration information, surveys, interviews and a focus group to understand how the TCL has performed by the end of its third semester in operation. Our data indicate that students and consultants view the TCL as successful for three main reasons: the expertise of consultants, the variety of appointment types offered, and the satisfaction of cross-disciplinary interaction among students and faculty. Given that JHU hires lecturers and graduate students as consultants, our model provides an alternative to the more common peer-to-peer model used at other universities. While identifying the successes of the TCL, this paper also discusses some of its shortcomings: lack of publicity on campus, logistical issues with scheduling, and lack of workshops and online resources. We hope other universities can apply our "lessons learned" when developing their own centers and resources to improve their engineering students' communication skills in multiple disciplines.

II. Literature Review

For over a century, engineers in academia and industry have expected engineering students to develop communication skills by the time they enter the workplace. In 1916, for example, the Cleveland-based engineering educator Barker wrote: "To be successful in engineering, training in mathematics and science is absolutely necessary; a good knowledge of written and spoken English is a further requirement" [6, p. 188]. In following decades, engineering educators addressed this need by including courses on technical writing in their curricula. But some educators felt that approach was insufficient and they debated whether writing courses should be elective or required. For example, Davis, a professor of English at the Air Force Institute of Technology who surveyed 245 professional engineers in 1975 on the importance of technical writing in their careers, summarized the situation at the time: "Although technical writing is coming to be accepted as a respectable course offering in engineering programs, it is still regarded as an 'add-on' by many faculty members—something to be used to fill an open slot when other courses are not available" [7, p. 209]. His survey showed that most engineers, about 80 percent, agreed that technical writing should be required for engineering graduates. Conversations continued, spanning beyond technical writing to include oral and visual communication skills.

Engineering associations have repeatedly underscored the importance of written and oral communication in engineers' professional development. The ASEE regularly emphasizes communication skills in its annual conferences. For example, the Liberal Engineering/Engineering & Society (LEES) division states, as one of its goals, "helping

engineers to develop an ability to communicate effectively" [8]. In its report on "The Engineer of 2020," The National Academy of Engineering listed communication skills as one of the key attributes of future engineers. "As always," the report stated, "good engineering will require good communication" [9]. As of 2024, the Accreditation Board for Engineering Programs (ABET) lists "an ability to communicate effectively with a range of audiences" as its third student outcome. Such declarations extend beyond the United States. For example, Riemer, writing on behalf of the UNESCO International Centre for Engineering Education, listed English and foreign language skills, oral communication, technical writing, visual literacy, and interdisciplinary communication as key attributes of the twenty-first-century engineer [10]. Engineers are just one of several professional groups who are expected to enhance their communication skills [11], [12].

To address this need for students to acquire communication skills, undergraduate and graduate engineering programs can offer entire courses on technical communication, integrate exercises into their traditional curriculum, or offer support services such as one-on-one consultations in a technical communication lab or writing center. Since these approaches work best in tandem, various universities in the United States have established technical communication labs over the past decade. These technical communication labs offer different kinds of services and hire different kinds of consultants, such as students or lecturers or both. For example, in 2012, MIT established a Comm Lab with plans to appoint liaisons in each of the departments in the School of Engineering. The MIT model is a "discipline-specific peer-mediated model" [4]. Two other universities, Brandeis University and Rose-Hulman Institute of Technology, adapted key aspects of the MIT Comm Lab to their own contexts. Brandeis established a Science Communications Lab for its Division of Science that is peer-to-peer but discipline-nonspecific, whereas Rose-Hulman installed its Comm Lab within its Makerspace to emphasize the connection between engineering and communicating. MIT reports that representatives from "Boston University, Brandeis University, Caltech, Cornell University, and Northeastern University" have attended the Comm Lab's Summer Institute, which helps other institutions to adopt and adapt the MIT model [13], [14]. This cluster of MIT-inspired programs all emphasize written, oral, and visual communication skills, and not just technical writing or public speaking. As another example, Virginia Tech established a Comm Lab that is peer-to-peer, discipline-nonspecific, and focused on public speaking [15].

Following the example of these other institutions, the Whiting School of Engineering created its own Technical Communication Lab (TCL) in 2022 to develop students' technical communication skills and support the work they do both inside and outside the classroom. The TCL's four major services are English as a Second Language, Presentation and Interview Practice, Technical Writing, and Visual Design. Students may schedule appointments to practice conversing in English or improve their overall English skills; revise resumes, cover letters, and statements of purpose for job or graduate school applications; revise a class assignment or a journal article at any stage, from early draft to near completion; rehearse a presentation; reformat

a data visualization; and more. Consultants are either lecturers or graduate students in the Whiting School of Engineering.

Managers of technical communication labs need empirical data to assess how effective and satisfying their labs' services are for students and consultants. Some studies of writing centers have used surveys to analyze satisfaction [16]. The MIT Communication Lab completed a "formal quantitative study" of its writing services and Volpatti et al. shared results at ASEE 2020 [5]. We acknowledge the importance of such thorough tests and plan to conduct similar studies of our own in the future. As a younger communication lab with limited resources, we have developed a simpler set of analytical tools to assess our lab. We combined data from student registrations and appointment forms, responses from student surveys, one-on-one interviews with students, and a focus group of our employees. We believe this approach allows us to go beyond a simple survey to understand the experiences of both our student clients and our consultants.

III. Methods

To understand the TCL's strengths and weaknesses, we analyzed data on both the students who use the lab and the employees who run our consultations. As outlined below, we used student registration information, voluntary surveys, and one-on-one interviews to better understand the student experience. We used a focus group to better understand the employee's experience.

A. WCOnline Data Collection and Survey

The Technical Communication Lab uses WCOnline as its scheduling software for all appointments. WCOnline collects information from student registrations and tracks data for each student appointment. This data includes information like the student's year, major, and first language, as well as the type, time, and date of their appointment. After each appointment with the Technical Communication Lab, students receive a voluntary survey link by email. The brief survey asks about the student's appointment as well as things they enjoy or would like changed at the TCL. (See Appendix A for survey questions.)

B. Student Interviews

At the end of the Fall 2023 semester, we emailed 5 students who had used the Technical Communication Lab for our one-on-one consultations. We chose students who had made multiple appointments during the semester to get more in-depth student feedback. We conducted the interviews over Zoom and all students completed participant consent forms. (See Appendix B for interview questions.)

Of the 5 students, one was an undergraduate student in Materials Science and Engineering while the other four were graduate students in Computer Science, Robotics, Civil

Engineering, and Engineering Management. Two students had used the TCL since its inception in Fall 2022, while the other three students had registered and used the TCL starting Fall 2023. The students had made between 5 and 48 appointments with the lab. Therefore, the students interviewed represent a wide sample of the students who use our services.

C. Consultant Focus Group

At the end of the Fall 2023 semester, we conducted a focus group with the six consultants in the Technical Communication Lab. Each consultant completed a participant consent form and met together over Zoom for one hour to discuss their experience in the lab. (See Appendix C for focus group questions.) This gave us insight into the experience of the employees of the TCL.

IV. Results and Discussion

A. WCOnline Data and Voluntary Survey

Over three semesters from Fall 2022 to the end of Fall 2023, the Technical Communication Lab served 294 students during 1050 separate appointments. Most clients (44%) made one appointment during this time, with 34% of clients visiting the Technical Communication Lab 2-3 times.

Although the Technical Communication Lab is open to other schools, over three-fourths of all appointments were booked by students in the Whiting School of Engineering. Moreover, about 75% of appointments were booked by graduate students. More than half (56%) of all appointments were booked by native Chinese speakers, with the second most appointments (19%) being booked by native English speakers. However, a similar number of clients (134 native Chinese speakers vs. 109 native English speakers) booked appointments during this time, so native Chinese speakers booked more repeat appointments, especially for English as a Second Language appointments, than native English speakers.

The most common majors of student clients were Engineering Management, Applied Math and Statistics, Biomedical Engineering, Financial Mathematics, Chemical and Biomolecular Engineering, Material Science, and Mechanical Engineering. The most common type of appointment was English as a Second Language, followed closely by Technical Writing. The most common reason for booking an appointment was for help with job applications, followed by class assignments, journal articles, and English conversation practice. Students also booked appointments for help with presentations, slide design, interviews, and school applications.

222 students completed the voluntary survey by email. Almost all students rated their sessions as excellent (94.6%) or very good (5%). Most survey respondents (97%) said they would return to the Technical Communication Lab and would recommend the lab to others

(90.5%). When asked what was most helpful about their session, students highlighted the expertise of the consultants and their practical feedback. Students also mentioned that the appointments helped them build confidence and develop their communication skills. When asked what they would like to change about the appointment, many students mentioned that no change was needed. However, a few students pointed out some issues with the scheduling software and wished for more time slots/flexible times for appointments. Some students also felt that the appointments would be more useful if they had personally prepared more in advance.

B. Student Interviews

We interviewed 5 students to better understand their experience using the Technical Communication Lab. When asked what they enjoyed about the TCL, the students focused on the expertise of the consultants and the practical feedback they received in their appointments. The international students in particular mentioned how the English as a Second Language appointments improved their confidence, especially with spoken English.

When asked what we could improve in the Technical Communication Lab, the students mostly emphasized logistics rather than the appointments themselves. They said sometimes it was hard to find an available appointment that fit their schedule or that sometimes they would like to book more than two appointments (the current limit) during a busy week. One student mentioned not knowing which type of appointment to book and wanted more information on the individual consultants in the lab.

When asked about possible workshops, students suggested topics related to English as a Second Language, such as academic English or workshops geared towards international students, topics related to job applications, such as a workshop on interviewing, or topics related to writing, such as the academic writing process. When asked what resources they would like to see added to our website, students mentioned templates, sample documents, and resources for international students.

C. Consultant Focus Group

When asked what they enjoyed about working in the TCL, the consultants all mentioned the students, saying they were highly motivated and that they enjoyed meeting students from many different backgrounds and majors. They appreciated building rapport with repeat clients, seeing them improve over time, and interacting with students outside the classroom. However, they also mentioned that having additional materials and earlier training, particularly with university IT services, would have made their jobs easier.

When asked about how we could improve the TCL, all consultants mentioned advertising. The Writing Center at JHU is well-known, but many students are unaware of the recently established Technical Communication Lab and only book an appointment when

recommended or required by one of their professors. Consultants also mention that students occasionally book the wrong type of appointment, for example coming to an interview practice appointment to work on their resume or cover letter, which would be more appropriate in a technical writing appointment. Consultants suggested job-related topics for potential workshops due to high student demand. If we added more student-facing resources to our website, consultants suggested job seeking advice and sample documents as well as information on designing slides and poster presentations.

D. TCL Areas for Improvement

Advertising is a major challenge for the Technical Communication Lab. As a newly established resource on campus, it is much less well-known than the Writing Center in the Krieger School of Arts and Sciences. Despite campaigns to visit classes, email professors, and distribute flyers on campus, many students are unaware that we exist or are confused about the types of services we offer. We hope to partner with faculty in different departments who can recommend our services to their students. We also hope to attract more students by offering workshops each semester.

Both students and consultants at the TCL mentioned logistical issues. Our scheduling software, WCOnline, was created specifically for writing centers, while the TCL offers many different types of appointments. Students are confused about which type of appointment to book, which appointments are available in person, and how long each appointment will be. We have already switched from using the WCOnline platform to using consultants' personal Zoom rooms for online consultations, but we are looking into other options for the fall semester. We will also review our schedule to decide if we should keep offering all types of appointments or if we should offer more hours for certain appointments or certain days.

Finally, the TCL only offers one-on-one appointments. While these consultations have been well-received, we would like to increase the way we support the students at JHU. We plan to expand our website to include more student-facing resources and offer workshops on popular topics. We also want to build a repository with resources for our consultants and offer earlier, more efficient training to build their confidence.

E. TCL Strengths

From the data collected, we can see that the TCL is popular with both our student clients and our employees. While many universities employ peer-to-peer models with undergraduate staff in writing centers to cut costs, a recurring theme in the student surveys and interviews was the expertise of the consultants. Students value meeting one-on-one with faculty members or graduate student consultants who know a lot about teaching English as a Second Language, technical writing, visual design, or public speaking. Besides, with a large proportion of our

student clientele coming from graduate programs, undergraduate consultants would struggle to serve many of our clients.

Another strength of the TCL is the wide variety of appointments it offers. In the interviews, one student mentioned that the TCL appointments "include every topic I might need in research and studies." While our technical writing appointments are popular, students also appreciate the support we offer for improving their visual design, presentation, interview, and ESL skills. Other university writing centers may also benefit from expanding the types of appointments and support services they offer.

Finally, employees at the TCL are highly satisfied. Graduate consultants get experience working with engineers from many different backgrounds while faculty appreciate interacting with students one-on-one outside of the classroom. The TCL can be a great place for new faculty to get accustomed to our students and for graduate consultants from our master's program in engineering management to work with engineers from many different disciplines.

F. Future Research

Our analysis has given us insight into the experiences of our student clients and consultants, as well as highlighted both areas for improvement and strengths of our Technical Communication Lab. In the future, we would like to analyze student work as well to understand exactly how our consultations impact students' technical communication skills. Other technical communication labs have analyzed student writing samples [5], but we would also like to evaluate changes to student presentations, interview skills, visual design, and English language skills as a result of our services. This additional data may also help persuade professors in other departments to recommend and support the Technical Communication Lab.

VI. Conclusion

Having completed more than 1000 appointments and served hundreds of students in our first three semesters, the TCL is thriving. By focusing on employing well-qualified consultants who can offer strong feedback, we've been able to offer a unique service within the school of engineering. Moreover, by thinking beyond the confines of a traditional writing center, we've been able to help our engineering students improve their visual communication and public speaking skills in addition to their technical writing abilities. If we can improve our advertising and expand the kinds of resources and services we currently offer, we believe we can have an even greater impact in the future.

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Appendix A: Voluntary Student Survey

1) I would rate this session: Excellent, Very Good, Good, Fair, Poor, Unacceptable

2) I will return to the center: Yes, No, Maybe

3) I will recommend the center: Yes, No, Maybe

4) What kind of appointment did you have? Technical Writing, Presentation Practice, Interview Practice, Visual Design, ESL

5) What was most helpful about your session? (open-ended question)

6) What would you like to change about your session? (open-ended question)

7) Other comments/suggestions? (open-ended question)

8) Can we use your anonymous survey results and comments for an upcoming conference paper and presentation? (Yes/No)

Appendix B: Questions for Student Interviews

1) Tell us about your experience with the Technical Communication Lab. What consultants did you work with and what kind of appointments did you book?

2) What did you enjoy about your Technical Communication Lab appointments? Why?

3) In your opinion, how could we improve the Technical Communication Lab? What would you like to see changed about the Technical Communication Lab?

4) What was your experience using the Technical Communication Lab scheduling software?

5) In the future, if we offered workshops, what kind of topics would you like to see? What would make you want to attend one of our workshops?

6) In the future, if we added more materials to our website, what kinds of materials would be helpful for you?

7) Do you have any other comments or suggestions for the Technical Communication Lab?

Appendix C: Questions for Consultant Focus Group

1) Tell us about your experience working as a consultant in the Technical Communication Lab.

2) What have you enjoyed about working in the Technical Communication Lab? Why?

3) What additional support or training would help you as a consultant?

4) In your opinion, how could we improve the Technical Communication Lab? What would you like to see changed about the Technical Communication Lab?

5) In the future, if we offered workshops, what kind of topics would you like to help with?

6) In the future, if we added more materials to our website, what kinds of materials would you like to help make?

7) Do you have any other comments or suggestions for the Technical Communication Lab?