WIP: Developing a Technical Writing Curriculum: From Cornerstone to Senior Design Courses

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Introduction

Who We Are

At NYU Tandon School of Engineering, the cornerstone Introduction to Engineering & Design course provides primarily first-year engineering students with not only hands-on experience designing, creating, and iterating upon a semester-long design project, but also opportunities to think critically about how to explain their work to a wide variety of scientific and layperson audiences. Our course is co-taught by an engineering professor, writing professor, and near-peer mentor (an undergraduate teaching assistant). The Introduction to Engineering & Design course's unique marriage of technical experience through laboratory exercises in addition to written exercises is meant to help students cultivate a holistic and thoughtful approach to engineering throughout their academic and professional careers. The collaboration between engineering and writing faculty has been a foundational aspect of our course for the past thirty-two years.

Defining Technical Writing

In the words of writing-in-disciplines (WID) scholar Robert Irish, "Clear communication builds trust. Technical competence is necessary, but is never sufficient" [1]. Irish's words inform our understanding of what technical writing can and should do, particularly given the rapidly evolving landscape surrounding technology and innovation. While technical writing can (and must) fulfill a wide variety of aims, we define the genre for our students as a factual and evidence-based explanation of scientific work (as well as empirical decision-making) which is successfully geared towards its target audience. In other words: we want our students to practice writing about scientific and engineering endeavors in a manner that is clear, factual, and professional, while maintaining clarity.

Given this definition of technical writing, our Introduction to Engineering & Design course places near-equal weight on students cultivating writing and communication skills (including presentation and public speaking skills) in addition to technical skills. Our objective has been, and continues to be, to give students a foundation for technical writing that will serve them throughout their academic and professional careers.

Revisiting the Technical Writing Curriculum

When reviewing our curriculum, we found that we had a number of questions regarding the efficacy of our longstanding writing assignments (namely lab reports where students wrote up the results of their weekly lab exercises). Our longstanding curriculum included 10 lab reports over the course of the semester. Through course evaluations and verbal feedback, students complained about how long these lab reports were (often 15-20 pages per week), and many often felt that this was merely "busy work" with no real purpose. Writing faculty also expressed frustration with the fast-paced nature of evaluating these reports, noting that many students were simply unable to process so much writing and feedback effectively within a one-semester course. Anecdotally, we'd heard faculty in other departments express disappointment with student technical writing during their senior year capstone projects, but it was unclear to us how, or if, students were being prepared for this form of technical writing in their second and third years of undergraduate coursework after completing Introduction to Engineering & Design.

Questions emerged from conversations around our technical writing curriculum, which we realized we'd need more concrete answers to in order to better serve our students. How often were engineering students writing lab reports for high-level classes within their majors? What other kinds of writing assignments (if any) were students assigned in other STEM courses beyond just a lab report? How was their writing evaluated within these STEM courses? What style guides or disciplinary genre conventions were they asked to follow? By answering these questions, we felt certain we could adjust our curriculum to better suit our students' needs and provide them with the best possible introduction to technical writing and communication skills.

Literature Review for Technical Writing Curricula

Despite recognizing the value of writing, STEM-focused colleges and universities often struggle to articulate which exact writing skills and tools they wish engineering students to master during their undergraduate education [2]. Regardless, technical writing at the undergraduate level has been proven to help students foster their individual critical thinking capabilities, and writing collaboratively with other students allows them to cultivate essential teamwork skills [3].

Writing education in engineering schools is often viewed as less vital, particularly in the context of rigorous four-year undergraduate learning outcomes required by ABET and similar accreditation organizations [2]. The result is that writing on the whole is often neglected in STEM classrooms, if not glossed over or ignored completely after undergraduates complete their first-year composition class(es) [2]. When writing is not assigned or prioritized in STEM education, writing assignments may then be viewed as unnecessary and unimportant by students, a perception which can also extend to faculty members [3].

Rather than viewing technical writing as nebulous or superfluous when assessing students' scientific and technical skill level, there is evidence to suggest that integrating different kinds of

lower-stakes writing into college-level STEM courses can greatly improve student outcomes. Technical writing assignments allow students to practice professional communication skills as well learn how to explain their scientific findings [4]. Journaling about technical, analytical, and professional work allows students to gain insight about their experiences as well as practice low-stakes writing [5]. Pre-writing exercises as well as exploratory writing can assist students' problem-solving skills, particularly when preparing for a higher-stakes technical writing assignment [6]. Allowing STEM students the chance to write both formally and informally about their technical and analytical work helps them cultivate their critical reasoning skills, despite these forms of exercises often being dismissed as frivolous or unserious forms of schoolwork in an otherwise jam-packed curriculum.

When reviewing our own technical writing course curriculum, we looked to ideas from evidence-based pedagogical practices rooted in composition and rhetorical studies, particularly those born from WID and writing-across-curriculum (WAC) programs, for guidance. WID/WAC programs create pedagogical strategies for developing, teaching, and assessing academic writing. In addition, WID/WAC provide pedagogical frameworks for teaching the genre conventions, audience expectations, and rhetorical approaches needed to write effectively in specific academic disciplines [7].

Project Approach

To understand the impact of our writing curriculum, we (1) surveyed undergraduate students for the writing skills they have retained from our course, and (2) hosted student and faculty focus groups representing the 6 academic departments that require our course as part of their curricula, to help identify strengths and gaps in our program. We used the findings from this study to inform curricular and instructional change in our course.

Students were surveyed to identify the writing skills they gained from Introduction to General Engineering & Design and provide insight on the transferability of those skills to writing for other STEM courses, particularly upper level courses. These questions are listed in Table 1.

Table 1. Writing Assessment Survey Questions

Survey Questions	Options
How confident are you in writing skills after taking Introduction to Engineering and Design?	Select one of the following: 1(Not confident),, 2, 3, 4, 5 (Extremely confident)
Approximately how many hours per week did you spend on writing assignments for Introduction to Engineering and Design?	Select one of the following: 0 - 2, 2 - 4, 4 - 6, 6 - 8, 8+

Approximately how many hours per week did you spend on writing assignments in your other STEM courses?	Select one of the following: 0 - 2, 2 - 4, 4 - 6, 6 - 8, 8+
What type of writing do you expect to do in your academic career?	Check all that apply: Technical reports, research papers, presentations and proposals, professional emails, lab notebooks and project documentation, other (please describe)
Are you asked to follow strict guidelines for your written assignments (templates, style guides, etc.)?	Select one of the following: Yes, no
What kind of resources/guidelines do you use in writing?	Check all that apply: Style guide, sample lab report, lab manual, university writing center, rubrics, public resources, generative AI, other (please describe)
Briefly describe why you selected the resources/guidelines for the question, “What kind of resources/guidelines do you use in writing?”	Open-ended
How similar is your writing experience in EG-UY 1004 compared to your other courses?	Select one of the following: 1 (not similar), 2, 3, 4, 5 (extremely similar)
What kind of writing are you doing, both in coursework and outside of class?	Check all that apply: Lab reports, academic essays, code documentation, maintaining a lab or project notebook, memos, requests for proposals, portfolios or personal websites, other (please describe)
Which writing skills from Introduction to Engineering and Design have been useful in your other courses?	Check all that apply: Structuring technical reports, citing and integrating sources, organizing and presenting data, identifying errors and limitations, synthesizing data, team writing, professional communication, Other (please describe)
How would you rate the usefulness of the writing professor's feedback?	Select one of the following: 1 (not useful), 2, 3, 4, 5 (extremely useful
How would you rate the usefulness of the TA grader's feedback?	Select one of the following: 1 (not useful), 2, 3, 4, 5 (extremely useful)
Please elaborate on the ratings you provided.	Open-ended
In what area of writing instruction did you need more support?	Open-ended
If you have used generative AI to assist you with writing assignments, which tool(s) have you used and what do you use the tool(s) for? (e.g., outlining, generating text)?	Open-ended

This survey was distributed to all Tandon undergraduate students who took the course between Fall 2022 through Fall 2024, with data collection taking place in Spring 2025.

Following analysis of the survey results, we developed focus group questionnaires for students and faculty (Table 2). Focus groups were facilitated as semi-structured interviews. Each focus group comprised 6 representatives from the academic departments that require Introduction to General Engineering & Design as part of their degree programs.

Table 2. Student and Faculty Focus Group Questionnaires

Student Focus Group Questions	Faculty Focus Group Questions
What writing resources were the most helpful for you? Why?	Which writing resources (sample lab reports, rubrics, manuals) do you find most effective in supporting student learning?
What challenges did you face when trying to structure your lab reports or presentations?	Where do you see students struggling the most in writing assignments?
Which writing skills do you feel you improved in most during the course?	Where do you students succeed in writing assignments?
How confident are you now in writing technical documents for other STEM courses?	How do you currently guide students in structuring lab reports or technical documents?
Do you feel like the technical writing instruction in this class prepared you for the writing you have done in your other courses?	How are you giving students feedback on their writing assignments?
How would you describe the value of the feedback you received from TAs?	How do you coordinate feedback between professors and TA graders?
How would you describe the value of the feedback you received from writing professors?	What are the writing skills students need to succeed in your discipline?
In what ways could feedback timing or clarity be improved to better support your learning?	Where do you think more explicit instruction is needed (e.g., passive voice, technical analysis, critical thinking)?
Which areas of writing instruction did you feel needed more support? Are there writing skills that you wished you learned in this class?	If you could make changes to the writing instruction process in EG-UY 1004, what would it be?
Thinking about your first technical writing assignment versus your last technical one, what changed the most in your writing process?	

Results and Discussion

We received 130 responses to the survey, with all academic departments that require Introduction to General Engineering & Design represented. The results of our survey in part confirmed what

we'd learned in our literature review. Students did take many of the technical writing skills from Introduction to General Engineering & Design with them, particularly in regards to writing for a lay audience. 70.8% of respondents reported that they felt confident or extremely confident in their writing skills after taking the course; resources such as the style guide, sample assignments, and rubrics supported students in their learning. Students particularly valued the regular feedback provided by our team, delivered in writing and during individual writing conferences.

But, outside of our course as well as first-year composition courses, most STEM students were not receiving much additional technical writing instruction or assignments in their upper-level course work. In their focus group, faculty similarly shared that most writing was assigned in the third or fourth year, in upper level lab and design courses. The writing assignments vary by program, including technical reports and memos, code documentation, lab notebooks, and professional documents. 46.9% of respondents felt that their writing experience in other courses was either extremely dissimilar or dissimilar to their experience in our course. When assigned written work in upper-level courses, students were not evaluated with the same level of written feedback they received in our course or first-year composition courses. We also learned that students found the first-year workload overwhelming, to the point where incorporating instructor feedback on longer written assignments was not always possible. The result was that students often struggled with longer, higher-stake technical writing assignments such as design capstone projects during their senior year.

We applied the results of this project into our curriculum by scaffolding out our assignments more, prioritizing teaching good technical writing habits while assigning fewer long lab reports (only two) in favor of shorter memo assignments (three related to lab exercises and three related to their semester-long design project, or six in total). Rather than emphasizing students producing a "perfect" lab report right away, we instead reworked our assignments to highlight good writing skills and "habits of mind" they would likely need when writing for future coursework and in the real world. These skills include revision, writing for a non-STEM audience, incorporating sources and outside research into their work, as well as learning to read and implement a new style guide. In order to better support students as they worked on these new assignments, we introduced new technical writing material into our course's recitation lesson plans, including peer review workshops, an AI writing workshop, and more.

Scaffolding shorter assignments also gives students a chance to "practice" technical writing before diving into a full lab report, allowing for earlier instructor intervention if necessary. Memo assignments are shorter than lab reports, which provides students more time and space to work on the assignment (in addition to making grading easier and faster for faculty) (see Appendix for sample assignment and writing professor rubric). Each memo corresponded to a part of a full lab report, allowing students a lower-stakes avenue to practice technical writing skills without writing a full 15-20 page report immediately. After students completed the three

memos based off of lab exercises, they then wrote their first of two lab reports. The three memos for their semester-long design project allow them an opportunity to research, pitch, and explain their final product and receive feedback on their work before writing a full final design report (which are typically 25-30 pages). By receiving feedback from their writing professor, students were able to improve quickly and more efficiently.

One of our goals was to make reading and incorporating feedback on student writing easier and more approachable by breaking down the writing process into smaller, more manageable chunks. Each memo highlights different sections of a lab report to help students gradually build an understanding of what was expected of them once they did write a full one themselves. After one semester, many writing faculty reported that student grades were improving steadily over the course of the semester, and students were better able to incorporate feedback from shorter assignments. By the end of the semester, their writing was more focused and thoughtful than in previous semesters.

Another conclusion drawn from this work was the need for additional faculty support and community surrounding technical writing instruction at our institution. We have continued this work through an ongoing community of practice, which has brought together a group of both STEM and writing faculty to discuss how best to support students learning technical writing beyond their first-year engineering experiences. So far, this meeting series has allowed for sharing of writing assessment resources as well as workshopping of various ways writing can be incorporated into a STEM curriculum.

Our technical writing curriculum work has the potential to both improve student writing and critical thinking within first-year engineering courses, as well as begin to map out a more concrete path forward for STEM faculty to incorporate meaningful technical writing assignments into upper level coursework. By placing a premium on technical writing as an ongoing practice and habit that fosters both innovative problem solving and critical thinking, it can become yet another (figurative) tool in our engineering students' belts.

In order to continue our work on improving our technical writing curriculum, we hope to continue our survey work speaking with students and faculty about their experiences with technical writing in upper-level coursework. There could also be room to observe how members of our new ongoing community of practice start to implement technical writing assignments in their classrooms, allowing further study of best practices regarding teaching technical writing in specific engineering disciplines.

Acknowledgement

This work was sponsored by the NYU Office of Academic Program Review & Assessment.

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Appendix

A sample memo assignment rubric can be seen below, as well as a writing professor rubric for that specific assignment.

(For context: in our course, writing professors' grading focuses primarily on report formatting, style, and sentence-level grammar/mechanics. A teaching assistant or engineering professor will assign a separate grade based on technical content).

Lab 3 Technical Memo

This assignment is due at 11:59 PM the night before Lab 4.

Prepare a memo of 600 to 750 words, written from the perspective of an employee addressing a supervisor at a mechanical component manufacturing company. The employee would like to suggest the use of AutoDesk Fusion to study the safety of components manufactured by the company. The supervisor has not used AutoDesk Fusion before and has asked the employee to perform a pilot investigation that demonstrates the usefulness of AutoDesk Fusion for this task.

This memo will introduce the pilot investigation. It should provide sufficient detail for the reader to understand the motivation behind the pilot investigation.

Use the subject line and outline below to complete this assignment.

Subject: Using Autodesk Fusion to study component safety

To: [Section Instructors' Names]

From: [Author's full name]

Date: [Date]

In the body, include:

- A list of who completed the work and the date it was completed. (Memo date can be different from lab date.)
- A statement of the purpose of this experiment, addressing the importance of component safety
- A description of the metrics that were used to evaluate component safety
- A discussion that introduces CAD software and Autodesk Fusion, explaining:
    - What CAD software is, and how it will be used for this study
    - Why Autodesk Fusion is an appropriate software for this study
- A brief summary of the initial investigation, referring to the methods used and highlighting key findings.

Lab 3 Intro to CAD Workshop Memo Rubric
{10 points per criterion}

This memo includes real-world context, laws, principles, equations, and/or specifications needed for an intelligent but uninformed reader to understand the experiment done during lab.	
All key terms are defined in the author's own words (or using short, judiciously selected quotes) with appropriate citations for paraphrased and/or quoted material.	
A Works Cited section must be included (note: Works Cited does not count towards the word count).	
The memo answers the assignment prompt.	
The document is organized in such a way that each paragraph flows from one to the next in a manner that is easy to follow. It is well-organized, comprehensive, and easy for a reader with minimal technical knowledge to follow.	
The author only uses passive voice. Active voice is not used anywhere in the document.	
The author has written this memo using a mix of past and present tense where appropriate. The report is written in complete sentences, without fragments or run-on sentences (no numbered or bulleted lists).	
Sentences are punctuated/stylized correctly (includes, but not limited to: periods, commas, semicolons, apostrophes, capitalization, and spaces). All words are spelled correctly in American English.	
The memo is written in a clear and concise manner (no more than 750 words maximum, 600 words at minimum).	
The memo follows all EG1004 Writing Style Guide rules.	