
Engineering Majors and Writing: Is It the Instructor or the Student?

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Introduction

During an internship I held over the past summer, my supervisor would joke about the quality of writing of the engineers working on projects. She said that the biggest issue an engineer can have is their ability to communicate what they are doing to those not in engineering, both verbally and in writing. Her suggestion to me was to work on my writing skills, as I am comfortable talking to people ¹. This made me wonder: if these engineers had writing courses intended to prepare them for professional applications, why was their writing seemingly so poor? Were these individuals just bad writers, did they elect not to take certain courses, or did their instructors fail to provide proper instruction²?

The first place to look into is the scientific thought process. Students often view scientific knowledge as a collection of facts, formulas, and problem-solving methods that require memorization, which are separate from their everyday lives (Huang and Kalman; Pytash; Reynolds, et al.). However, researchers from a range of disciplines have documented the considerable intellectual accomplishments of children, adolescents, and adults in out-of-school settings with mathematics and literacy that often contrast with their poor school-based performances (Hull and Schultz). This information shows that creating a connection between academics and everyday life increases the likelihood of success.

A similar tool for success is engaged writing, which in the sciences not only promotes students' production of new knowledge, but also allows students to develop a competency in the specific practices of the field (Pytash; Warnock and Kahn). Writing also allows students to become participants in the science community. Despite the substantial evidence that writing can be an effective tool to promote student learning and engagement, the practices of using writing as a teaching tool are still not widely implemented in science, technology, engineering, and mathematics (STEM) disciplines, particularly at research universities (Hull and Schultz).

Bernard Madison tackles the issue of the separation of writing and quantitative reasoning in his article "If Only Math Majors could Write... ." He notes that science, math, and engineering majors have been neglected the kinds of classes that would provide the contextual uses for their knowledge in the lack of humanities courses required. He gives examples of how quantitative reasoning can strengthen written arguments as well as the general literacy of people who pursued humanities majors.

¹ Throughout my high school career, I was an accomplished member in the International Thespian Society with over 300 hours of performance time.

² I had intended to also research the professional side of this issue, but I had a limited amount of time for this project.

Madison's purpose of writing this article was to showcase the benefits for people being more quantitatively literate. His writing gives the inference that if science, engineering, or, per the title, math majors can write, they have a greater ability to pass along the data that they have pursued to those on the outside. This makes me wonder how students of the quantitative sciences have been affected by not having as many writing courses available or required.

The issue of writing not being used in STEM—specifically engineering—disciplines extends beyond the classroom. Strong writing skills are incredibly important for successful engineering careers (Al-Othmany and Ali), and these forms of multiple literacies are needed in the workplace, where working engineers have to communicate constantly through many modes. These modes can range from collaborating on cross-functional teams to presenting business cases to superiors and even explaining their work to the general public (Davis; Flory, et al.). Students' need for multiple literacies has been recognized by instructors and scholars, while most textbooks only focus on the more basic literacy skills (Carpenter; Gonzaga, Elsie, and Francis).

While many engineers spend more than 40% of their work time writing (Al-Othmany and Ali), a discrepancy comes between the education and the actual practice of writing. Engineering programs have been responding to the feedback of their graduates' employers by requiring more technical writing courses or more writing within the curriculum (Jensen and Fischer). Christopher Wolfe's "Argumentation Across the Curriculum" emphasized the importance of writing in engineering through a textual analyses of undergraduate assignments. He found the engineering and sciences to nearly always require argumentation in the writing assignments. Wolfe shows writing skills to be much more important to engineering majors than they are perceived.

However, the gap between what is being taught and what is expected still exists. In the study, "Perceptions of Memo Quality: A Case Study of Engineering Practitioners, Professors, and Students," Nicole Amare and Charlotte Brammer wanted to understand why there is such a massive gap between what employers expect in a memo and what new members of the workforce create when they both have received similar—if not the same—education on what a memo should and should not be. Amare and Brammer surveyed professors, students, and practicing engineers with a set of sample memos to collect their comments on the memos (180).

Their results showed that the professors' comments were 77% negative, 84.5% of which were focused on the content and style, while the engineers had 71% of their comments negative, with 87% focused on the content and style. The professors' comments were more focused on the style (46% versus 35%), while the engineers' were more focused on the content (42% versus the professors' 38%). The engineers clearly showed a preference to having enough information, stated directly, and in the appropriate words (184). Their study shows that having an understanding of the proper writing techniques is appreciated, while giving the information as quickly and simply as possible is a greater concern.

Amare and Brammer's study leaves me a question: why is there such a huge gap between what professors are instructing students and what is expected in the professional application? The first thing to consider is what professors view as the experience students have with writing assignments. In "Students' Conceptions of Tutor and Automated Feedback in Professional Writing," Rafael Calvo and Robert Ellis investigated what kind of impact different feedback methods have on students with written assignments. Their article provides the experience students have with professional writing assignments, which should reflect what professors know of the students' writing experiences.

What they found was that students were in two distinct groups: cohesive perception and fragmented perception. The students displaying a cohesive perception use the feedback as a separate perspective, tying it back to their development. The students that display a fragmented perception just used the feedback to show their work was recognized and to help complete only the assignment that the feedback is for (43). Calvo and Elis's study shows that there are students that

use the professor's comments to aid their writing development. This means there are professors that understand that their comments directly affect how students perform written tasks.

To provide a more practical manner of practicing scientific writing, Jon Leydens and Barbara Olds wrote to explain why publishing in scientific and engineering context courses are needed for graduate programs. For their article, "Publishing in Scientific and Engineering Contexts: A Course for Graduate Students," Leydens and Olds performed interviews with practicing engineers and all of the interviewees emphasized the importance of communication and writing skills because an increased ability in writing and communication had a direct link to an increased rate of career advancement. There were even reports of students inquiring about a course for these very skills, a clear sign that this was in dire need.

Leydens and Olds produced a great outline for a potential course for graduate students. However, why not offer such a course to undergraduates as well? Or, better yet, why not require such a course of undergraduates? Doing so would save the students time and energy by gaining this knowledge before they go into a graduate program or enter the workforce. It would also allow the professors in the graduate programs to better spend their time because the reports they would receive from students would be significantly more easily read and require less feedback.

Methods

For this project, I first conducted a survey of engineering students at UCF's Main Orlando Campus through the survey site, SurveyMonkey.com³. A copy of the survey is included in Appendix A and the results in Appendix B, and in it I asked the students what writing courses they had previously taken, how long ago that course was taken, and how they felt about the instructors for that course. This survey was intended to find out what engineering students felt about writing courses and their instructors.

My final research method was an interview with Thomas Wright. He is a professor in the Department of Writing and Rhetoric, instructing a class on writing and communication in the scientific community. The transcription of our interview is included in Appendix C. In this interview, I asked Professor Wright about his class and his thoughts on the writing skills of engineering majors, specifically the stereotype that engineering majors are not good at writing or communicating.

Results

The survey conducted showed that, of the 27 respondents, 21 students had only completed the Gordon Rule requirements of ENC 1101 and 1102, or the College Board's AP course equivalent. As Figure 1 shows, of the remaining six students, three students had completed a technical writing course, two had completed American Literature courses, and one had responded with a technical presentation course. As displayed in Figure 2, over 80% of the respondents had completed these courses over a year before this project was conducted, with nearly a third of this group not having completed a writing course in three semesters. One of my concerns was if the student or the instructor was the cause of the trend, so I asked the students about their score in this course. Figure 3 shows that over 95% of the respondents had scored a B or greater in their course, and none had failed their course.

³ I was advised to adjust the survey to make the previous course question multiple choice instead of open ended, but I did not feel a second survey would receive as many responses as the first only had 27 replies.



Figure 1: Courses Completed

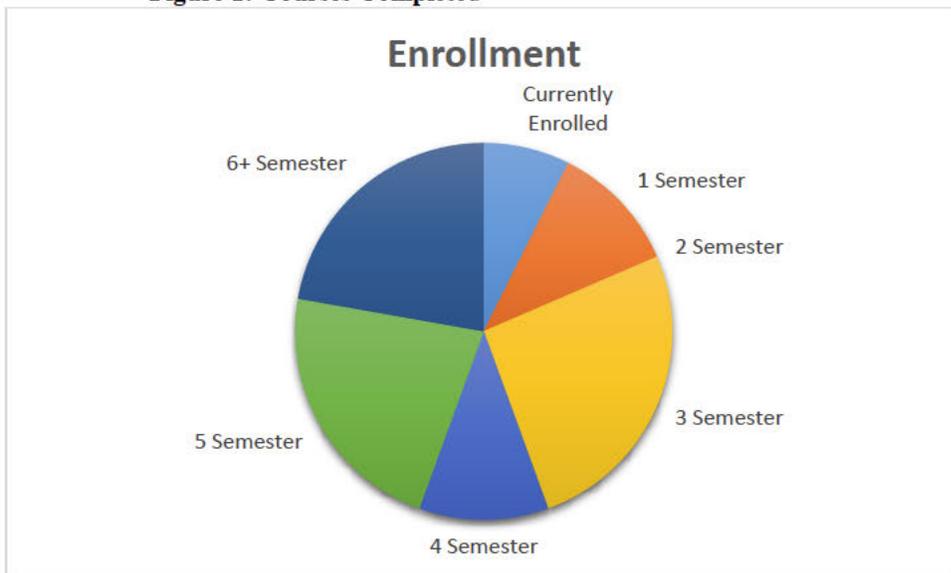


Figure 2: Enrollment

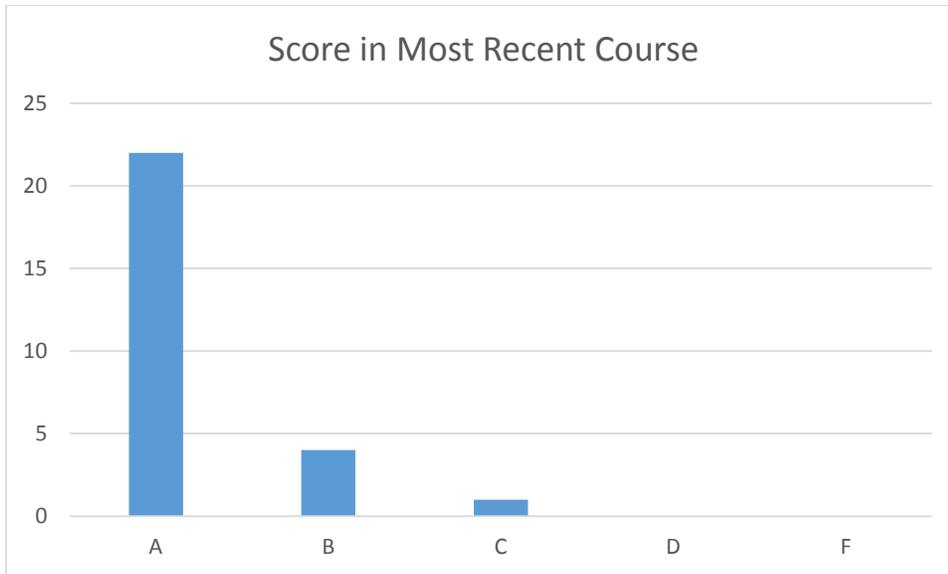


Figure 3: Course Score

During our interview, Professor Wright’s comments on the subject followed a singular idea: engineers can write; they just need to have a reason. Before interviewing Professor Wright, I had thought that engineers were unable to write comprehensible papers, and that engineers had an inherent disinterest in writing. Professor Wright made his opinion clear by saying, “Most engineers, most engineering students, can already explain things well within their own discourse communities,” and that “[engineers] have the drive to use writing, use speaking, use whatever they can to be able to get those ideas across.” He went on further to say, “I think I met maybe one engineer on the job who wasn’t really able to write well,” and even this individual was able to compensate through verbal communication.

Discussion

The purpose of this study was to discover if engineering students have difficulty with writing courses, and if the courses they are taking are contributing to their needs. Both the survey and my interview show that engineering students have no trouble with writing courses, and Professor Wright suggested that engineering students will actively be engaged in writing assignments. Both, though, also show that there is a clear lack of interest in writing among engineering students due to the primary focus being on the math and science needs of engineering and not on the communication needs.

My survey shows that these students are primarily focused on their math and science requirements because only 22% of respondents completed a writing course beyond the Gordon Rule requirements of ENC 1101 and 1102 or the College Board’s AP course equivalent. And over 80% of these respondents had completed these courses over a year prior to the survey. A year, even a semester, without completing a math or science course would be unheard of for an engineering student. So why is the medium that is used to share data completely ignored for any time?

Professor Wright went deeper into the relationship engineers and writing have, which followed the data gathered from the survey. He stressed that engineers can and will write, but they need a reason beyond the sake of writing. “The engineering classes that students have to take when going through that major take up so much of their time and effort that they don’t put as much of their own time into learning to write well,” as Wright said, and the vast majority of respondents to the survey—over 80%—had only done the minimum requirement of writing courses. So these students were missing out on some material, as Professor Wright has experienced, with most

students lacking “the ability to explain their materials without using their own lexis and genres.” In his professional experience, he was frustrated that freshly graduated students take about a year or two to fully understand how to properly write professional documents.

What I have been able to gather shows that, given a stimulus, engineers can and will write spectacularly. A complaint that Professor Wright had, as well as Amare and Brammar’s study, was that newly graduated engineers would struggle with writing in the workplace for the about the first year. Could this difficulty be avoided by requiring more writing courses to be taken by engineering majors or integrating more writing in engineering courses? As Amare and Brammar showed, there is some miscommunication between what the students are being taught and what professional engineers are expecting.

Conclusion

Engineers need to write in the professional world, and most engineering students are not nearly getting properly prepared for this need. It is important for engineers to be able to perform the hundreds of different calculations and experiments consistently and completely in their work. However, the completion of these tasks are worthless if they cannot share and express the findings or requirements. As stated by Professor Wright, fresh graduates tend to take time to understand how to professionally communicate, which is an understandable frustration because the purpose of going to education these new professionals is to prepare them for the professional world. This leads me to say further research into the writing engineers are expected to complete in the professional world is needed. This follow up could examine what new graduates have difficulties with in the professional world, investigate how long it takes them to successfully remove these difficulties, or investigate what is being done—if there is anything being done—by education institutions to remedy these issues with students.

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Cullen Fitzgerald

Cullen Fitzgerald is a junior at the University of Central Florida, majoring in mechanical engineering. His paper being featured in the Knights Write Showcase is a major reinforcement for what his parents taught him throughout high school: being able to properly write is the first step to being taken seriously.

Appendix A

Engineering Majors and Writing

***1. What specific major(s) are you in?**

- Mechanical
- Civil
- Aerospace
- Electrical
- Computer Science

Other (please specify)

***2. What kind of writing courses have you taken?**

High School

University/College

***3. How long ago was your most recent writing/composition course (including Summer semesters as one semester)?**

- Currently Enrolled
- 1 Semester
- 2 Semesters
- 3 Semesters
- 4 Semesters
- 5 Semesters
- 6+ Semesters

***4. How would you describe your writing/composition capabilities in relation to completing this most recent course?**

	Superior	Excellent	Good	Fair	Poor
Before the course	<input type="radio"/>				
Following the course	<input type="radio"/>				

***5. How well did you feel you were completing the most recent course's assignments?**

Superior	Excellent	Good	Fair	Poor
<input type="radio"/>				

***6. How did you score (in general) in this latest course?**

A	B	C	D	F
<input type="radio"/>				

***7. Approximately how much time would these assignments take you?**

- 30 minutes
- 1 hour
- 2 hours
- 5 hours
- 10+ hours

***8. How competent did you feel the instructor was in your latest course?**

Superior	Excellent	Good	Fair	Poor	N/A
<input type="radio"/>					

9. Please describe the instructor's feed back. Was it constructive and useful or not?

10. If you would like to participate further in this project, please provide an email that I can contact you at and state your preference of a group interview or a one-on-one.

- Group Interview
- One-on-one

Contact email

Appendix B

Q1

What specific major(s) are you in?

- Answered: 27
- Skipped: 0

Answer Choices	Responses
- Mechanical	96.30% 26
- Civil	3.70% 1
- Aerospace	0.00% 0
- Electrical	0.00% 0
- Computer Science	0.00% 0
Total Respondents: 27	
Comments(0)	

Q2

What kind of writing courses have you taken?

- Answered: 27
- Skipped: 0

Answer Choices	Responses
- Responses High School	85.19% 23
- Responses University/College	100.00% 27

Q3

How long ago was your most recent writing/composition course (including Summer semesters as one semester)?

- Answered: 27
- Skipped: 0

Answer Choices	Responses
- Currently Enrolled	7.41% 2

Answer Choices	Responses
1 Semester	11.11% 3
2 Semesters	0.00% 0
3 Semesters	25.93% 7
4 Semesters	11.11% 3
5 Semesters	22.22% 6
6+ Semesters	22.22% 6
Total	27

Q4

How would you describe your writing/composition capabilities in relation to completing this most recent course?

- Answered: 27
- Skipped: 0

	Superior	Excellent	Good	Fair	Poor	Total	Average Rating
Before the course	14.81% 4	29.63% 8	29.63% 8	25.93% 7	0.00% 0	27	2.67
Following the course	22.22% 6	40.74% 11	25.93% 7	11.11% 3	0.00% 0	27	2.26

Q5

How well did you feel you were completing the most recent course's assignments?

- Answered: 27
- Skipped: 0

	Superior	Excellent	Good	Fair	Poor	Total	Average Rating
(no label)	25.93% 7	37.04% 10	25.93% 7	11.11% 3	0.00% 0	27	2.22

Q6

How did you score (in general) in this latest course?

- Answered: 27
- Skipped: 0

	A	B	C	D	F	Total	Average Rating
(no label)	81.48% 22	14.81% 4	3.70% 1	0.00% 0	0.00% 0	27	1.22

Q7

Approximately how much time would these assignments take you?

- Answered: 27
- Skipped: 0

Answer Choices	Responses
30 minutes	7.41% 2
1 hour	37.04% 10
2 hours	44.44% 12
5 hours	3.70% 1
10+ hours	7.41% 2
Total	27

Q8

How competent did you feel the instructor was in your latest course?

- Answered: 27
- Skipped: 0

	Superior	Excellent	Good	Fair	Poor	N/A	Total	Average Rating
(no label)	14.81% 4	37.04% 10	25.93% 7	14.81% 4	7.41% 2	0.00% 0	27	2.63

Appendix C

First is what does your ENC 3455, scientific writing course, teach?

Wright: Well, the answer to that, I hope will be in the syllabus. You can look through the course objectives yourself. What I am really interested in having the students do is understand the different ways that scientific and technological and engineering writing can be conveyed. So there are a lot of different genres that are used, lot of different people who are interested in this kind of information, you know, there might be managers who might make a decision based on this information. There might be people who would use this engineering information to actually build things with it, carry on the project forward. There might be people competing for different bids for different projects and all these different audiences would need different genres they would need different kinds of information in it and I think it is important for my students to understand what kind of information that would go into these different genres in a way that their audience can understand it and use that information effectively.

Ok, awesome. So it is basically teaching the students how to write in different formats so that people can get the information.

Wright: Yes

So going off of that, what do you think is the most important writing skills an engineering student can carry into the professional world?

Wright: Most engineers, most engineering students, can already explain things well within their own discourse community, what they have to explain to different engineers with the same background they do just fine with that. What they tend to lack is the ability to explain their materials without using their own lexes and genres that they are familiar with, so I say the most important skill is to be able to explain to people who are not familiar with their own lexes, with their own genre, to find other kinds of language they can use to explain technical terms, that kind of thing.

Ok, so basically being able to explain things to other people and break it down into more simplified forms.

Wright: It is, indeed, important to be able to simplify it, but it is also important to be able to give very accurate, complex statements when those are necessary. If you're writing for another engineer, you really do need be able to make sure that you're not over simplifying the information that is needed to move forward with the project. So you need to be able to deal with varying levels of complexity.

Ok, so what do you think of the stereotype that engineering students are poor writers or communicators?

Wright: I think, at the student level, it's very much an issue of priority. The engineering classes that students have to take when going through that major take up so much of their time and effort that they don't put as much of their own time into learning to write well. But when they are able to take that time, when they are taking a course specifically devoted to it, they tend to do very well. And then when students get into the working world and they realize that no one is going to pay any attention to their ideas if they can't explain those ideas well, that's when it really clicks for them and they start focusing on making sure that people can understand them. At that point I've found that they can do very well indeed, the engineers that I work with in the corporate world. The ones straight out of college had a little bit of trouble sometimes, but once they had been there for a few years, they were usually able to explain things very clearly and write well, speak well, present well. These are the same kinds of things that we teach in this department.

That is an interesting perspective on it.

Wright: Now it would have been nice if they could have learned that when they were in college, you know, and not on the job. But I don't, I think I met maybe one engineer on the job who wasn't really

able to write well, and she was very good at explaining things face to face so she kind of used that as a way around it. She could explain things if you talked with her for a little bit. But in general I found that most of them could write pretty well once they had been there.

And final question, what do you think of the stereotype that engineering students have a disinterest in writing.

Wright: I think that ties back in with what I was saying before with them not being able to apply much of their time to it. And I think most of them are not interested in writing for its own sake, but they are interested, in my experience, in being able to take the ideas they have about engineering and get those ideas across to other people. And it hasn't hit them as much until they enter the work world when they realize, you know, this proposal for a two million dollar project isn't going to go through unless I can explain it extremely effectively. But even the students realize that the best idea in the world doesn't do any good unless somebody can understand it. They have that drive to use writing, use speaking, use whatever they can to be able to get those ideas across. So they are interested in it, not for its own sake, but for communicating about engineering.