Letter of Transmittal

To whom it may concern,

The following report analyzes the discrepancies between undergraduate students, teaching assistants (TA) and professors within the College of Engineering (COE) at the University of Illinois at Chicago (UIC). Many undergraduate engineering students have expressed that writing is not a necessary skill for their major or career goals, but engineers already in the workforce tend to look back and admit that they didn't feel as prepared as they should have been.

To identify the main problem with undergraduate engineering students' lacking the writing skills necessary for their field, the principal investigator created surveys for each of the groups. The surveys were mirrored with each other to identify how much each group values the writing discipline and how they think writing instruction could best be taught. Survey participants are randomly selected and asked to participate in focus groups. Focus groups are meant to elaborate in survey answers with the goal of determining the best solution.

Based on survey results and focus groups, the principal investigator will make a recommendation to either allocate more writing instruction time during classes, collaborate with the UIC Writing Center, or develop external workshops that help undergraduate engineering students with anything that is writing-related.

I appreciate your time and consideration. If you have any questions or concerns, please reach out to the principal investigator. We forward to hearing back from you soon.

Sincerely,

Jennifer Hernandez

The Writing Discipline in the Engineering Classroom
at The University of Illinois at Chicago

Prepared by: Principal Investigator Jennifer Hernandez

November 30, 2019

Abstract

"The Writing Discipline in the Engineering Classroom"
At the University of Illinois at Chicago
A Recommendation Report

Prepared by: Principal Investigator (PI) Jennifer Hernandez

The writing discipline play a rigorous role in most undergraduate classrooms with the exception of those focused on STEM initiatives. Primarily in engineering classrooms, students have a difficult time seeing the value in writing, since the usefulness of the skill is not evident within their curriculum. Because of this, the principal investigator surveyed undergraduate engineering students, teaching assistants, and professors in order to identify discrepancies in each groups' attitudes towards writing. Randomly selected participants who responded to the survey also participated in focus groups to elaborate on final results from the survey. The principal investigator found that between external workshops, allocating more classroom time to writing instruction, and collaborating with the UIC Writing Center, the third option was best, since it does not take away from the current curriculum, and allows undergraduate engineers to seek help on their own time.

Keywords: STEM, writing, engineering, writing ideologies, writing centers

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Executive Summary

To determine why undergraduate engineering students aren't mastering their writing abilities as much as their counterparts in other fields, the principal investigator decided to survey undergraduate students, teaching assistants (TA) and professors within the College of Engineering (COE) at the University of Illinois at Chicago (UIC). The COE at UIC was chosen due to its proximity, but the problem of engineers not being ready to tackle writing projects upon entering the work field is present throughout the country. Many engineers themselves have admitted to not being prepared for writing related tasks as well as employers who have expressed that entry level engineers have more to learn.

However, if writing is necessary in the world of engineering, why aren't undergraduate engineering students seeing the connection between their classroom writing instruction and their long-term goals? Or is that they aren't being taught how to value of what they're learning? This report seeks to identify where there is a discrepancy in ideologies. The following assumptions have been made: professors and teaching assistants value writing, whereas students understand do not.

Based on evidence in recent years, survey results and focus groups, it was determined that collaborating with the UIC Writing Center is the best solution. While having professors allocate class time to writing instruction would better display how much professors value writing, the engineering curriculum is already rigorous, and spending more time on STEM material may cause stress to students. Developing external workshops would help, but this option would be less likely to work, as most engineering students would rather study or work during their free time. Students collaborating with the UIC Writing Center would be best because it could be complementary to current engineering classes. This option would also be useful to engineers because they could gain help from tutors who have been specialized to help them.

Illustration

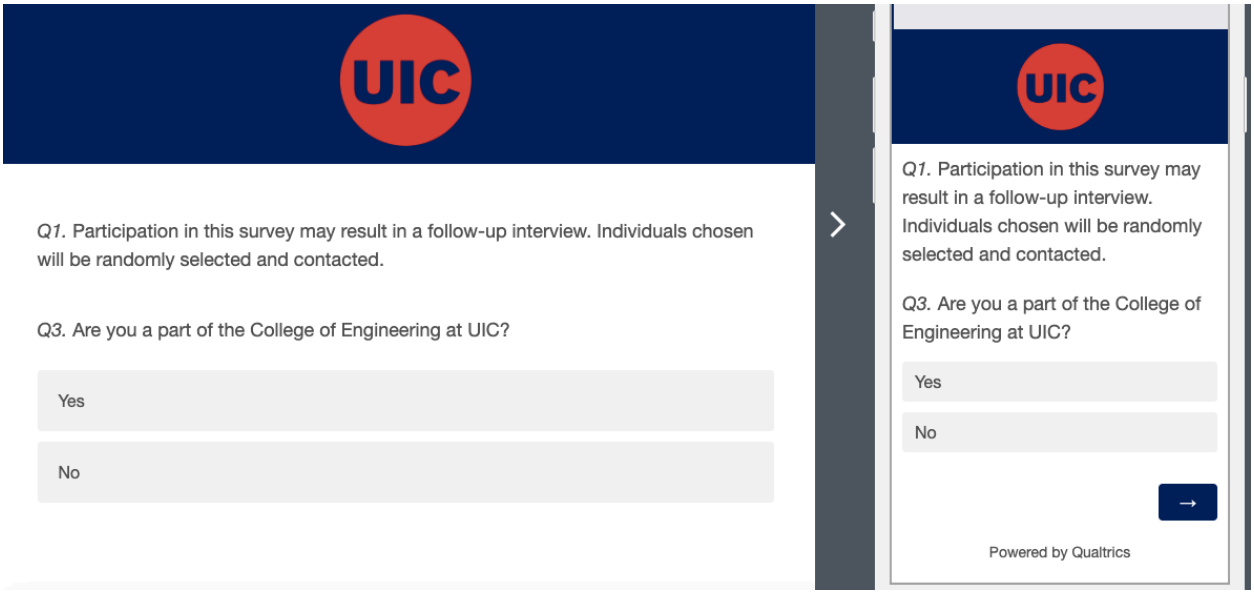

Figure 1. These are the first questions that participants will see upon opening the survey link.

Introduction

Research has shown that there is a great difference between professors' and students' attitudes towards the writing discipline in undergraduate engineering classrooms. This study seeks to identify the differences and examine each group' perspective in order to create a study plan that complements the current engineering curriculum taught at the University of Illinois at Chicago.

The research questions the researcher investigates are the following:

- Are there discrepancies between UIC engineering students, teaching assistants, and professors' attitudes towards the writing discipline?
- If so, what study plan can be created to accommodate for the disparity and prepare students to be qualified engineers?

The writing discipline has played a crucial role in undergraduate education, and for most, is a difficult skill to master. Engineers can't write, or at the very least are stereotyped as not being able to, and when assigned writing projects, they regurgitate the structure and diction as opposed to creating original work. That's the general preconception that UIC students have and that some engineering students themselves have admitted. But can this be resolved and why is this even a problem? The easiest explanation is that engineers simply don't have time, and when it comes to material that needs to be learned, calculations matter more than writing. Another go-to explanation also relies on professors' expectations that students should already know how to write for their field. The root of this problem is still unknown, however, there seems to be an overall understanding that the engineers just aren't prepared for writing when they enter the field. This report aims to acknowledge possible solutions for better preparing future engineers' writing abilities.

To aid in the understanding of how attitudes from students, teaching assistants, and professors play a role in the mastering of writing, it is important to understand what role the writing discipline has had thus far within the engineering classroom. In *Engineering Writing/ Writing Engineering* (1990), Dorothy Winsor discusses that engineering students devalue writing because they need to focus on the innovation of products. However, as opposed to researching why this is the case, she pays close attention to how writing is already incorporated within engineering classrooms. Moon, Gere & Schultz (2018) interviewed professors and found a variety of reasons that writing has not been included in the curriculum such as lack of space in current curriculums, lack of knowledge on writing instruction, and the belief that teaching writing is the responsibility of another discipline.

Although there is limited research on this topic, several scholars have made efforts to understand why engineers are not creating original work. Adding on to this, professional engineers have reflected on their experiences in writing and have shared that they did not feel prepared upon entering the field. Soltheengineer, from *The Engineering Mentor* (2019), attributes this lack of preparation to engineers' view that writing is a peripheral skill: one that

doesn't deserve the attention that is given to math and science. Koelsch (2011) agrees that engineers do not possess the skill to write as efficiently as they should but brings up the idea that not acquiring it is a self-limiting decision amongst engineers. This means that if an engineer chooses not to have proficient writing skills and decides to focus on numbers, that's acceptable, but they must come to terms with stagnation within the field as well as missed opportunities due to a lack of communication skills.

There are some solutions to engineers' struggle with the writing discipline presented by various articles. Some solutions include but are not limited to the following: taking classes focused on writing outside of their discipline; switching to a modular form of writing, a final product with contributions made from several engineers; and seeking help from the writing center tutors. In order to prevent further stagnation in engineers' writing abilities, professors should stress the value of writing in workplaces. Professor's should either teach the technicalities of writing or lessen their grading outcomes when reviewing students' written assignments. As opposed to rearranging a curriculum, professors can offer a writing workshop that details their expectations for style and format.

If this problem goes unresolved, we'll have engineers who are capable of innovating, but incapable of communicating these ideas to the public, investors, and colleagues. Writing goes beyond instruction sets and PowerPoints, the ability to articulate one's ideas helps for public speaking, speeches, or presentations of any sort. The key connection to acknowledge is that writing is a pathway to transferring knowledge, a skill vital to engineers who innovate for society at large. Based on survey results and focus groups, the principal investigator will make a recommendation to either allocate more writing instruction time during classes, collaborate with the UIC Writing Center, or develop external workshops that help undergraduate engineering students with anything that is writing-related.

The following sections discuss additional details about research methods, the results obtained, the conclusions drawn from the results, and an official recommendation.

Methods

Data Collection

In order to accurately display ideologies between the three sample groups within the COE at UIC, survey links were distributed to each subgroup. At the beginning and upon completion of the survey, participants were informed that survey participation could result in being randomly selected to participate in focus groups. Focus groups are semi-structured questionnaires meant to encourage participants to elaborate on their survey responses and react to the results.

Surveys

Three surveys were designed for each of the three sample groups belonging to the COE: undergraduate students, teaching assistants, and professors. Surveys will be distributed by email and through Facebook. Although surveys mirrored each other in terms of structure, certain questions differed to accommodate to the particular audience. For example, teaching assistants are unique because they are still students and they get to experience grading/ reviewing students' work. Their surveys were a bit longer because the PI wanted to see how they approached the writing discipline based off of both their experiences.

Professors' surveys were also a bit different since some questions asked them to reflect on their undergraduate experience to see if they too, came to value writing later in their careers.

As for students, questions asked focused on their writing experiences during their undergraduate studies. There is a question asking what year they are in (freshman, etc.) meant to identify seniors who are currently completing their senior design projects; projects that are mandatory for engineering students to complete in order to graduate. Senior design projects involve a written report that put engineers' writing to the test, so this unique question for seniors asks about how prepared they feel to write it. This what meant to measure a difference between upperclassmen and lowerclassmen— perhaps seniors felt more prepared by the time they complete this project and the writing instruction occurs somewhere closer to this point.

Three surveys were designed to differentiate the questions between all three sample groups. Although skip logic is available through Qualtrics, using one survey (one link) for all groups was too complicated and appeared repetitive from a test subjects' perspective. By differentiating all of the links, participants can feel qualified to answer all questions. If a participant were to access the wrong link, they would know immediately, as the survey asks for undergraduate class level, graduate level, or what type of instructor a professor is (lecturer, etc.)

Focus Groups

Participants who completed the surveys were informed that they had the potential to be randomly selected for focus groups. The purpose of the focus groups is to get a clearer

understanding on why participants responded the way they did as well as their opinions on the survey results in general. Focus groups consist of three to four students or teaching assistants. Individual in-person interviews will be available for professors since they have more involved schedules.

Focus are meant to create a definitive recommendation for writing instruction in the engineering classrooms at UIC. Although literature will be a significant factor in identifying a solution, the target audience needs to provide their input for their preferred solution. By facilitating focus groups, the PI can take under consideration each groups' preference on allocating more classroom time for writing instruction, collaborating with the UIC Writing Center or participating in external workshops.

A portion of the surveys asks for name and students' UIC emails. This way, Qualtrics can randomize those who respond, and the PI can reach them upon closing of the survey.

Analysis

Questions on the survey are designed with a Likert scale consisting of the following options:

- Not at all
- Slightly
- Moderately
- Much
- Very much

The purpose of this design is to divide respondents into the two extremes. Although some will answer with *Moderately,* it is expected that some questions will be towards either extreme. After survey results are found, the PI will perform a one-way ANOVA to see the interactions occurring in the answers. With this, the PI will identify whether there is a discrepancy between ideologies.

If there is a discrepancy, the focus groups will help in determining *why.* The starting questions for these interviews can be found in the Appendix.

The Likert scale phrasing was chosen at recommendation by a professor in the psychology department who completed research on which phrasing was preferred by survey particpants.

Findings

It is expected that students will not value the writing discipline in any grade. Because of the lack of writing instruction currently present in the COE, students will believe that it isn't a required skill for post-graduate work. However, survey results are vulnerable to dishonesty since students can answer in ways that they believe the PI wants to see. In order to receive more valid results, focus groups include the pressure of having to be dishonest to an actual person, reducing the likelihood of dishonesty. This way, the PI can get the focus groups' opinions for why they answered questions a particular why as well as their reactions to how all survey participants' responses. Students will also express preference towards collaborating with the writing center, since they prefer peer assistance.

Professors are expected to see the value, but do not know how to convey their ideologies in a classroom setting due to a strict curriculum. Professors are expected to answer honestly because there are no confounding variables present. They will also prefer writing center assistance, since it will not interrupt their course instruction and will offer students an opportunity to collaborate with others who focus on writing.

Teaching assistants may vary in their responses but are expected to also value the writing discipline due to their longer and more rigorous experiences in college level education. Some will have already experienced working with writing center tutors and will also recommend this tool for their peers and students. Based off of their experiences, they may advise against incorporating writing in the curriculum because of how heavy engineering material already is.

Collaborating with the UIC Writing Center will be the best option.

Recommendations

Because allocating more classroom time would be a difficulty for an already rigorous program, this would not be the best option. Although external workshops would provide students with more comprehensive help, they would not be valuable if students don't participate; it's anticipated that most students would rather not, since they would study or work in their free time.

Due to this, the best conclusion is the following:

In order to assist undergraduate students striving to become engineers, the UIC Writing Center should have tutors who are familiar with their writing assignments, in order to help them with tips and tricks to better their writing abilities.

Writing center tutors should use their professional development time, time spent to advance their tutoring abilities, to read engineering papers and identify their citation styles and structures as well as become familiar with the jargon used in their assignments. This way, tutors can understand what engineers generally need help for as well as be able to prompt them with questions, which in turn challenge engineers to articulate their responses.

It will also be recommended that when working on group projects, all writing contributors be present in order to not only collaborate with writers, but also amongst one another. This way, engineers can feel more comfortable asking questions and may also receive answers to questions they didn't know they had.

Another recommendation will be to set-up writing partners for engineers so that tutors can follow along with writer's progress. Gallery walks will also be encouraged for classes who wish to brainstorm project ideas.

**Gallery walks are a writing center activity that welcomes students to write down their ideas, and then present them to their classmates and tutors. This is meant to help them articulate their ideas as well as develop their projects based off of audience questions. These activities are done in groups of two: half the class presents for about 10-15 minutes and then the groups switch, and the presenters become the audience.*

References

Koelsch, J.R. (2011). Is Writing an Essential Skill for Engineers? Automation World. Retrieved from https://www.automationworld.com/article/automation-strategies/industry-business/workforce/writing-essential-skill-engineers

Moon, A., Gere, A.R., & Shultz, G.V. (2018). Writing in the STEM classroom: Faculty conceptions of writing and its role in the undergraduate classroom. Science Studies and Science Education. doi: 10.1002/sce.21454

SOLTHEENGINEER. (2019). Why (many) engineers suck at writing and what we can do about it. The Engineering Mentor. Retrieved from http://www.theengineeringmentor.com/blog/author/SolTheEngineer/

Windsor, D. (1990). Engineering Writing/ Writing Engineering. College Composition and Communication. 41(1), 58-70. http://links.jstor.org/sici?sici=0010-096X%28199002%2941%3A1%3C58%3AEWE%3E2.0.CO%3B2-N

Appendix

Writing in the Engineering Classroom- **Student Interview Guide**

The first group of questions will address students' undergraduate writing experiences across all curriculums and may reference survey results.

1. What has been your experience with writing in classes so far?
    a. What has contributed to these experiences?
2. What types of writing assignments have you encountered in your engineering classes?
    a. How prepared did you feel to write them?
    b. Did you find yourself asking for help?
        i. Who did you reach out to?
3. Do you think that enough time is dedicated to writing instruction engineering classes or that writing instruction should be taught in a different class?

The next group of questions will address ideologies towards writing.

4. Based on survey result answers to questions 21-22, why do you think professors and TA's value writing _____?
    a. Do you think that their view reflects with the way they incorporate writing instruction?
5. (Based on question 23) Can you elaborate on what you've heard or know about how writing plays a role in the engineering field, whether that's in the labor force or academia?

The final group of questions will focus on what types of instruction students prefer moving forward.

6. Per question 24 on the survey, you checked _____. How do you envision writing instruction being incorporated to benefit you?
7. Per question 26, why did you check _____?
    a. Can you share anything that you had in mind to include in _____?
    [insert workshops, writing center tutors, or class instruction]
8. What do you think should be a goal(s) for your professors or TA's in regard to writing instruction?

Writing in the Engineering Classroom- **Teaching Assistant (TA) Interview Guide**

The first group of questions will address TA's undergraduate writing experiences across all curriculums and may reference survey results.

1. What have your experiences with writing in classes been like?
    a. What has contributed to these experiences?
2. What types of writing assignments do you encounter in your engineering classes?
    a. How prepared did/do you feel to write them?
    b. Did/do you find yourself asking for help?
        i. When you do, who do you reach out to?
3. Do you think that enough time is dedicated to writing instruction in your engineering classes?

The next group of questions will address TA's role in the classroom.

4. What types of writing assignments do you see assigned in classes?
5. If you assist the professor in grading, what is included in the grading criteria for writing assignments?
    a. What do you generally expect from students' writing submissions?
6. According to question 16, what would you say is the main factor limiting the allocation of writing instruction time during class?
7. How often do students ask for help with writing assignments?
    a. What types of questions do you generally see?

The next group of questions will address ideologies towards writing.

8. How does writing play a role in your career?
9. Do you believe that writing instruction should be taught in a different class? If so, why?
10. Based on survey result answers to questions 21-22, why do you think students and professors value writing _____?
11. Can you elaborate on how writing plays a role in the engineering field, whether that's in the labor force or academia?

The final group of questions will focus on what types of improvements/ expectations TA's prefer moving forward.

12. Per question 26 on the survey, you checked _____. How do you envision writing instruction being incorporated to benefit you?
    a. Can you share anything that you had in mind to include in _____?
    [insert workshops, writing center tutors, or class instruction]
13. What do you think should be a goal(s) for professors and for and undergraduate students in regard to writing?

Writing in the Engineering Classroom- **Professor Interview Guide**

The first group of questions will address professors' undergraduate writing experiences across all curriculums and may reference survey results.

1. What have your experiences with writing in classes been like?
    a. What has contributed to these experiences?
2. What types of writing assignments did you encounter in your engineering classes?
    a. How prepared did you feel to write them?
    b. Did you find yourself asking for help?
        i. Who did you reach out to?
3. Do you think that enough time was dedicated to writing instruction in your engineering classes?

The next group of questions will address professors' role in the classroom.

4. What types of writing assignments do you assign?
    a. What prompts you to choose these particular assignments?
5. What do you generally expect from students' writing submissions?
6. According to question 18, what would you say is the main factor limiting the allocation of writing instruction time during class?
7. Most professors responded to question 20 by checking _____. Why do you think students struggle with writing in the engineering discipline?

The next group of questions will address ideologies towards writing.

8. In regard to question 18, do you believe that writing instruction should be taught in a different class? If so, why?
9. Based on survey result answers to questions 26-27, why do you think students and TA's value writing _____?
10. (Based on questions 12 and 28) Can you elaborate on how writing plays a role in the engineering field, whether that's in the labor force or academia?

The final group of questions will focus on what types of improvements professors prefer moving forward.

11. Per question 22 on the survey, you checked _____. How do you envision writing instruction being incorporated to benefit you?
    a. Can you share anything that you had in mind to include in _____?
    [insert workshops, writing center tutors, or class instruction]
12. What do you think should be a goal(s) for your TA's and for your students regarding writing?