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Evaluating the Effect of Project Frame on Communicative Patterns in Capstone Design Pitches

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ABSTRACT

Effective communication is an integral part of engineering design and leads to successful design outcomes. While there have been extensive calls to equip novice designers with effective communication skills, there is only a limited body of work that has attempted to characterize the communication patterns of novice designers, particularly when engaging with external audiences. This work seeks to characterize how the project type, or the nature of design problem, shapes the communicative patterns of novice designers when communicating design outcomes to external audiences. Presentations of design solutions from 46 teams were collected at the end of a semester-long capstone design program. These presentations were then characterized as industry- and human-centered projects. Analysis was conducted using topic modeling and Linguistic Inquiry and Word Count analysis to identify differences in linguistic patterns of novice designers between the two project types. Contrary to prior findings, no significant differences were found, implying that the communication patterns of novice designers are not affected by the type of project (or design problem being solved).

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Chapter 1

Introduction

Engineering design is a fundamentally social process, and communication is a critical aspect of engineering design [1]. Effective communication is linked with increased team cohesion and higher quality design outcomes [2–5]. Much of the prior work however, has focused on communication *within* design teams [5,6]. We highlight that effective communication is also necessary between design teams and external audiences [7,8]. External audiences may lack familiarity with the design project or may not hold similar technical backgrounds as design team members, creating communicative barriers between the team and external stakeholders. It is critical that designers are equipped with the skills needed to bridge these communicative gaps to effectively convey design concepts and build buy-in and trust with external stakeholders [9]. This is especially true for novices, for whom communication skills determine success as a newly graduated designer in the workplace [10]. The Society for Manufacturing Engineers has cited a lack of communication skills to be one of the largest gaps in an engineer's education [11]. The current work builds upon prior research to characterize the communication patterns of novice designers, specifically during communicative acts with external audiences. We seek to understand what factors may shape the communicative patterns of novice designers. We are particularly interested in the effect project framing may have on resultant communicative patterns between design teams and external audiences during a design pitch. We hypothesize that the nature of design projects may elicit unique communicative patterns, based on prior work conducted in management sciences [12]. Understanding if and how the framing of student design projects may affect communicative patterns will build fundamental knowledge educators can use to create specific pedagogical interventions to equip novices with the skills needed to effectively communicate project outcomes.

Chapter 2

Literature Review

2.1 Communication in Engineering Design

Design is defined as a socio-technical activity [13] and is one of the central tasks within engineering [14]. Social and technical elements of design interact in complex ways, and the study of either element cannot be conducted independently. Communication plays a critical role throughout engineering design processes, and is the fundamental mechanism the drives both social and technical interactions [1]. Design consists of a number of stakeholders within and outside of design teams [15], and effective communication between these stakeholders is critical [5]. As engineers design and develop ideas, information about the problem and solution are uncovered in parallel [16]. Effective communication is critical to ensure new ideas and information are continuously distributed to other individuals in the design process [5]. Prior research has highlighted how effective communication within teams leads to better outcomes at the end of the design process for the user [7], detection of issues sooner in the design process [17], and increased sharing of knowledge and ideas in the design team [18]. On the other hand, ineffective communication can lead to catastrophic outcomes. For example, a study found that a history of miscommunication within and between engineering teams contributed to the Challenger explosion [19]. Without every member of the team knowing the discoveries and changes made throughout the design process, time may be wasted and inaccuracies in the design solution may arise [20].

Although effective communication is an integral part of the design process, much of the prior work done in this topic has focused on studying only the communication of designers within their respective design teams [2–4,6]. However, at some point in the design process, it is likely that the members of the design team will have to interact and communicate with external audiences, such as stakeholders or users [8,20]. As stated by Bucciarelli [21], different individuals involved in the design process have different skills, responsibilities, and competencies, or live in different "object worlds". This means that a designer and external stakeholder may come from different technical backgrounds, have different skills, and as a result, interpret a design solution in unique ways. Hence, it is important for designers to have the skills to translate technical information, to ensure external audience members hold accurate mental models of the design concept. Inaccuracies in mental models between team members and external audience members can lead to user dissatisfaction, misuse, or failure to accept the design entirely [22].

2.2 Communication in Engineering Education

Communication skills are critical to the success of novice designers once they transition into industry [10]. However, prior work has discovered that recently graduated engineering students feel they do not have the skills needed to excel at oral technical communication [23]. The gaps between the communicative practices of novice and professional designers have been highlighted in multiple studies. For example, Atman et al. [24] conducted a study to compare the design process of novice and expert designers and found that experts tended to spend more time on communicating elements of the design process and solution. In addition, recent work by Lauff et al. [25] highlighted that novice designers often fail to see the effectiveness of prototypes as tools for communication. In contrast, in design practice, professional designers used prototypes to communicate design ideas throughout the design process [26,27]. Recent work by Krishnakumar et al. [28] found that novice designers' communicative patterns and argumentation strategies were influenced by prototyping when explaining design decisions. In this work we seek to understand how problem framing shapes the communicative patterns of novice designers when presenting design outcomes to external audiences.

Prior research has highlighted how problem framing shapes designer behavior. For instance, problem framing is known to shape the creativity of design solutions [29], the idea generation process [30], and designers' knowledge about the problem being solved [31]. In capstone design programs novice designers solve a range of real-world design problems brought to them by industry sponsors [32]; these projects can range from machine design to more human-centered projects [33], such as the design of children's toys or medical devices for patients with unique needs. Shah et al. [34] found that the type of design problem solved by a capstone team affects designer behavior. The authors found that students who worked on a project classified as industry sponsored showed increased motivation over the course of the yearlong capstone design project in comparison to those with a non-industry sponsored project. On the other hand, the students working on projects classified as non-industry sponsored generally started the capstone design course with more motivation. Further, project type has been linked with distinct communicative patterns, specifically in crowdfunding platforms. Parhankangas and Renko [12] classified Kickstarter campaigns as social (projects focusing on social good) or commercial (projects focused on creating new products for consumers) and found that each project type was associated with unique communicative patterns. For example, the researchers found that successful social projects used language to establish a personal connection with the audience. In the current work, we sort projects into two categories: industry projects or human-centered projects; definitions for each category are provided in Section 3.1.

Other work has additionally verified that different project types affect behavior and communication patterns [35]. In R&D project groups, it was seen that development projects performed better when members had increased communication with members of the R&D staff and other members of organizational divisions related to the project. It has also been noted that research projects where group members have high levels of direct communication with external professionals perform best. Another connection between communication patterns and project type can be seen in the length of a project. For longer group projects, group members communicate less within the design team and with external professionals [35]. This effectively may lead to lower performance of these groups in their final outcomes. Both the type of project and the length of the project may lead to different communication patterns in a design team. Based on this prior work, we hypothesize that distinct project frames will result in distinct communicative patterns between capstone design teams and external audiences. Building this fundamental knowledge will help design educators tailor pedagogical interventions on communication to the specific needs of student teams, based on project and individual student traits.

2.3 Research Questions

Synthesizing the research cited above, we note that communication is important throughout the design process, and it is imperative for designers to effectively communicate with external audiences. We also note that the way a project is framed has a significant effect on designer behavior. While it is important that novice designers learn to effectively communicate, little work has been done on characterizing the communicative patterns of novice designers. More specifically, we lack an understanding about if, and how, the framing of problems solved by novice designers shape their communicative patterns when communicating their design solutions. To close this gap, the current work is motivated by the following research question:

How does the type of the design problem shape novice designers' communication of design outcomes to an external audience?

Here, type refers to classification of the design problem based on the initial project requirements and description, provided to students at the start of a capstone course. Based on prior work by Parhankangas and Renko [12], we hypothesize that more human-centered design projects may elicit unique communicative patterns as compared to design projects that are more focused on non-social elements.

Chapter 3

Methods

3.1 Data Collection and Categorization

To answer our research question, we collected the pitch presentations of 46 capstone design teams from the Fall 2020 Capstone Showcase at the Pennsylvania State University. The Showcase event is the culmination of the capstone program at this university. During the Fall 2020 semester, the Showcase was conducted virtually due to the COVID-19 pandemic. Teams uploaded short videos of their pitches – presentations where the team detailed their design problem, solution, and process. Teams generally include visuals of their final prototypes in their pitches. These videos were uploaded to a portal, and these videos are accessible to the general public [36]. A graduate student aiding in this work scraped all the data (the project name and video) of each pitch from the Showcase portal leveraging automated methods. These pitches were then transcribed using a third-party transcription service. The author later verified the accuracy of these transcripts and corrected any discrepancies identified.

Next, we sought to develop a taxonomy to categorize projects based on the type of design problem being solved by the design team. Similar to work by Shah et al. [34], in this work, projects were categorized as human-centered and industry-centered, the definitions and examples for which are reviewed below. The author coded the entirety of the dataset. To ensure the validity of the categorization schema, the author and a graduate student coded 25% of the dataset independently. The interrater reliability was .895, indicating an acceptable level of agreement. 25 projects were categorized as human-centered, and 21 were categorized as industry-centered.

Human-centered project: Projects were classified as human-centered if the objective of the project involved some benefit to an end human user and if the design problem mentioned the presence of a user or specific user needs. An example of a human-centered project was the development of an assistive chair for a child with cerebral palsy. The objective of this project was to personalize an assistive chair for a girl with cerebral palsy, so as to improve her posture and range of motion.

Industry-centered project: Projects were classified as industry-centered if the objective of the project was related to the operation, efficiency, or optimization of a mechanical system or product, and interactions between the system and a specific user were not mentioned in the design problem. An example of an industry-centered project was the creation of an Arduino to Arduino and LR110 Communication System. The objective of this project was to use a Bluetooth-capable Arduino microcontroller to facilitate the secure exchange of information between multiple Bluetooth-enabled LR100 sensors and a central hub IoT2040 device across a serial bridge.

3.2 LDA Topic Modeling

To analyze the differences that may exist between designers based on project type, topic modeling was conducted on the transcriptions. Natural language processing provides an automated way to extract meaning from large corpuses of documents [37]. Within natural language processing, topic modeling is a commonly used method to extract the topics being discussed in a given corpus and within each document [37]. Prior research in engineering design has leveraged topic modeling to study capstone team performance [38] and to identify larger trends in design team communication, mental models, and overall team performance [39].

In this work, each transcript of a project pitch is considered as a document. Based on the categorization scheme, two corpuses were obtained (human-centered and industry centered). Two topic models were trained in this work, one on each corpus. Latent Dirichlet Allocation, or LDA, was used to train the topic models. LDA is an analysis which discovers the hidden topics which best represent the inputted documents [40]. In LDA, each document is a sequence of tokens with each token representing a word in the document [41]. LDA assumes a corpus of documents consists of N topics, with each of these topics being represented by a probability distribution of words. LDA yields the hidden semantic structure, or the topics that characterize a corpus of documents. In the context of this work, we sought to determine if the semantic structure of design pitches differed between project types (i.e., if pitches in each project type were characterized by unique topics).

Prior to the analysis, the transcripts were sorted and cleaned. The transcripts for each project category were imported as a single document, and punctuation and stop words were removed from the documents. Words that were generic to both types of projects were identified by the author and a graduate student and were added to the list of stop words. These included but were not limited to 'design', 'team', and 'sponsor'. Next, the functions for bigrams, trigrams, and lemmatization were processed for the transcripts. Then, the document frequency term was created, and the LDA model was built using 10 topics as a baseline start for both the human-centered and industry-centered transcripts. To uncover the appropriate number of topics for the models, topic coherence was used. The coherence score is representative of the interpretability of the topics using each topic's descriptor words [42]. A coherence score was calculated in this analysis using pointwise mutual information and cosine similarity, and the values for document-topic density (alpha), word-topic density (beta), and the number of topics (N) were iterated over to find the combination that yielded the highest coherence score.

The values which were used to create the final LDA model were as follows: for the human-centered transcripts, the number of topics was nine, the alpha value was 0.91, and the beta value was 0.61; for the industry-centered transcripts, the number of topics was nine, the alpha value was 0.91, and the beta value was 0.01. Lastly, all the topics were analyzed by each topic's top 10 words and their corresponding weights to qualitatively assign labels to topics.

3.3 Linguistic Analysis Using LIWC

Linguistic Inquiry and Word Count (LIWC) is a program which is able to process text files and then analyze these files word by word, and measures the degree to which each word falls under certain categories of language, or psychologically meaningful categories [43]. Prior work in design has used LIWC to create better models for selecting decision support tools [44], to understand changes in communication patterns on a crowdfunding website [45], and to understand conflict within multicultural design teams [46]. In the context of this work, leveraging LIWC allows us to identify if novice designers in human-centered and industry-centered capstone teams used distinct linguistic patterns.

Thirteen LIWC variables were chosen to analyze the human-centered and industry-centered design transcripts. There are a vast number of LIWC variables which could have been analyzed, but most are not relevant to our research question or are not supported by prior work. As these are unlikely to result in meaningful analysis, these dictionaries were not included. Following discussions as a research team, we chose to leverage the LIWC categories of affective processes, perceptual processes, analytical thinking, clout, emotional tone, and authentic language. The affective processes category consists of the subcategories of positive emotions (love, nice, sweet), negative emotions (hurt, ugly, nasty), anxiety (worried, fearful), anger (hate, kill, annoyed), and sadness (crying, grief, sad). The perceptual processes category refers to human perception and senses and consists of the sub-categories of hear (listen, hearing), see (view, saw), and feel (feels, touch). The summary language variables of analytical thinking, clout, authenticity, and emotional tone were also included; however, the LIWC Development Manual [47] does not provide example words for these categories.

LIWC yields the percentage of words in a corpus that correspond to a specific category in the LIWC dictionary. Once these percentages were obtained, t-tests were performed to identify if differences existed between the percentages of words corresponding to categories between project types. All statistical analysis was conducted in R version 4.1.2. The assumptions of normality and homogeneity of variances were verified prior to running any analysis. If one or both assumptions were not met, the non-parametric Mann-Whitney U-test was performed.

Chapter 4

Results

After LDA and LIWC analysis, comparative quantitative and qualitative analysis was conducted to identify differences between human-centered and industry-centered design projects.

4.1 Topic Modeling Results

Results from LDA revealed a list of topics and their respective descriptor terms with associated weights for both industry- and human-centered projects. The weights and topics provide insight into the content that characterize the two categories of projects. The most appropriate number of topics for both the human-centered and the industry-centered projects was nine. Within each of these topics, the words listed were then each assigned a weight to represent how significant the word was in the topic. The results showing the topics and the weights associated with them for each respective project category can be seen in Appendix A (human-centered) and Appendix B (industry-centered)

Based on the results in Appendix A and B, we could not assign coherent topic labels to each topic, as little commonality was found between words within a topic. This may be a facet of the nature of the design pitches and capstone projects. While projects were categorized as human-centered or industry-centered, each project was quite distinct with respect to the design problem being solved and the solution generated. It is likely the LDA algorithm was unable to uncover coherent topics due to the unique nature of each project.

We do, however, note some interesting observations from the topic models. Understandably, in the topic model for human-centered projects, we note the presence of words that refer to an end-user or user experience, such as user, ergonomic, patient, and cyclist; and these words were not present in the topic model for industry-centered projects. Further, we note the presence of technical or discipline-specific language in both the human-centered and industry-centered topic models. For example, technical language such as 'PIR', 'Simscape', 'Transducer', 'Firmware' appeared in both topic models. While our results do not indicate if teams in one category relied on technical language more than the other, we highlight that this should be explored in greater depth, possibly through qualitative analysis of student pitches. Future analysis could specifically evaluate the presence of disciplinary discourse within these projects, as reliance on highly technical language without appropriate context can act as a barrier to the communication of concepts to non-technical audiences.

4.2 LIWC Analysis Results

To understand what difference may exist in linguistic characteristics due to project framing, an independent samples t-test was run for each of the LIWC variables. Only the variables clout, emotional tone, and affect met the assumptions of homogeneity of variances and normality, and no significant differences were identified between project type on any variable. The non-parametric Mann-Whitney U test was conducted to identify if there were significant differences between project type in the LIWC variables: analytical, authentic, positive emotions, negative emotions, anxiety, anger, sadness, seeing, hearing, and feeling. No significant differences were identified between the groups. Results are displayed in Table 1, along with effect sizes. These findings suggest that project framing did not result in significant differences in terms of the linguistic characteristics of students' pitches to external audiences as defined by the LIWC variables of interest.

Table 1. P-value results from the affective and perceptive psychological tests using LIWC.

Variable	P-Value	Effect Size
Analytical	0.1253	-0.227
Clout	0.5773	0.167
Authentic	0.7913	0.0407
Tone	0.8672	-0.0492
Affect	0.1485	0.432
Pos. emotion	0.5296	0.0944
Neg. emotion	0.116	0.233
Anxiety	0.3604	0.137
Anger	0.8461	0.0313
Sad	0.7046	0.0579
See	0.1742	0.202
Hear	0.05461	0.285
Feel	0.3621	-0.136

Chapter 5

Discussion

We found that there were no significant differences indicated between the communication patterns to an external audience based on a project type of human-centered or industry-centered projects. This itself was an interesting discovery, as prior work suggests that project frame significantly affects student behavior within capstone design teams [34]. Our findings show that this effect of project framing on student capstone teams does not extend to communication patterns, however. Reviewing the LDA results, we do see a prevalence of technical language in both human-centered and industry-centered projects. We highlight this as a particularly critical area for future work, as the use of discipline-specific, technical language can significantly hinder the ability of non-technical audiences to absorb and understand information [38,39]. We also observed that the topic model for the human-centered projects consisted of words that referred to an end-user or user experience. This may be a facet of students in these projects leveraging narratives around their users to communicate their design outcomes—a communicative pattern of novice designers that has been identified in prior work [48].

We note our initial hypothesis that human centered projects would leverage more emotional language, was incorrect. This is an interesting finding as prior work has shown that projects focusing on social issues relied on more personalized language [12]. Extending the results from this work, we posited that human-centered projects may be characterized by distinct semantic structures and linguistic patterns, such as more affect-related language. However, in the analysis done, no significant differences were found between the communication patterns of human-centered and industry-centered projects. We do acknowledge that this work relied on automated methods, and with in-depth qualitative analyses, differences in communicative patterns within the groups may be identified. We highlight this as a critical area for future work.

Chapter 6

Limitations and Future Work

This study is limited by the nature of the data; specifically, due to the COVID-19 pandemic, student pitches were conducted virtually. Because students were not pitching to an in-person external audience, but instead to a more generalized virtual audience, communicative patterns may have been influenced above and beyond the project frame. Additionally, due to this virtual format we highlight that the communicative patterns may not be representative of “natural” communications between design teams and external audiences. As the students had to submit a video presentation of their design pitch, they had the opportunity to revise their pitches and videos before submission. This means the language was carefully constructed by each team prior to submission, likely influencing the results and the authenticity of the communicative patterns themselves. In future work, comparisons between virtual and in-person pitches should be conducted to identify if the virtual format may have acted as a confounding variable. Finally, a limitation of this work is in the definition of a project as being human-centered or industry-centered. Having only two categories to separate all the design pitches may not yield interesting results due to the granularity (or lack thereof) of categories. Additional categories that are more representative or descriptive of unique groupings of projects may yield additional insight into the effect of framing on communication. In future work, it may be advantageous and more informative to include more categories to differentiate project types. Separating the projects into categories which are more descriptive than those used here (human-centered and industry-centered), may give rise to more significant results. In addition, in analyzing the linguistic characteristics of the project types with LIWC, only the affective and perceptive psychological tests and variables were tested. Although these were the only variables which we felt would present a difference between the project types in this analysis, in the future more variables could be tested to understand if any unexpected differences between these linguistic characteristics of the project types exist.

Chapter 7

Conclusions

Communication in engineering design is crucial, and it can be an important aspect in the presentation of a design pitch to an external audience. Communication between designers and stakeholders in a design process is necessary, and as a result the communication patterns between designers and external audiences is an aspect of design communication which should be analyzed. In this work, we aimed to understand the differences, if any, which existed between student designers' communication to an external audience based on different project types.

After performing analysis on human-centered and industry-centered project pitches, we found no significant differences in the communication patterns to an external audience. However, future work should consider a more in-depth qualitative analysis, rather than relying on automated methods, to confirm if any differences in communicative patterns exist between the two groups.

Appendix A

Topic Model for Human-Centered Projects

Topic Number	Top Ten Keywords	
0	Challenge (0.012)	Food (0.009)
	Student (0.007)	Page (0.006)
	Event (0.006)	Volunteer (0.006)
	Power (0.005)	User (0.005)
	Post (0.005)	Website (0.004)
1	User (0.012)	See (0.009)
	Use (0.008)	Create (0.008)
	Information (0.007)	Also (0.007)
	Drum (0.006)	Start (0.005)
	File (0.005)	Part (0.005)
2	Test (0.012)	Fixture (0.006)
	Add (0.006)	Material (0.004)
	Level (0.004)	Go (0.004)
	Device (0.003)	Final (0.003)
	Get (0.003)	Ahead (0.003)
3	Cyclist (0.008)	Sensor (0.007)
	Time (0.006)	Bike (0.006)
	Trial (0.005)	Reaction (0.005)
	Datum (0.004)	Record (0.004)
	Setup (0.004)	Hand (0.003)
4	Heart (0.012)	Conduction (0.007)
	Hand (0.007)	Biometric (0.006)
	Datum (0.005)	Use (0.005)
	Latch (0.005)	Sensor (0.005)
	Point (0.005)	Vehicle (0.005)
5	Sensor (0.014)	Use (0.009)
	Datum (0.007)	Table (0.005)
	Model (0.005)	Indexing (0.005)
	Index (0.005)	Simscape (0.005)
	Pir (0.005)	Occupancy (0.005)
6	Student (0.007)	Make (0.007)
	Chair (0.007)	Use (0.006)
	Able (0.005)	Dashboard (0.005)

	Puncture (0.005) Need (0.004) Csv file (0.004) Different (0.004)
7	Image (0.011) Disaster (0.009) Network (0.005) Classification (0.005) Base (0.005) Natural (0.004) Density (0.004) Use (0.004) Display (0.003) Set (0.003)
8	Table (0.011) Use (0.010) Patient (0.007) Show (0.005) Ergonomic (0.005) Blade (0.005) Cost (0.005) Datum (0.005) Filter (0.005) Easily (0.004)

Appendix B

Topic Model for Industry-Centered Projects

Topic Number	Top Ten Keywords	
0	Torque (0.026)	Transducer (0.018)
	Use (0.016)	Model (0.012)
	Prototype (0.012)	Test (0.012)
	Seal (0.012)	Bear (0.012)
	Term (0.011)	Turn (0.010)
1	Cart (0.036)	Panel (0.027)
	Body (0.021)	Solar (0.018)
	Use (0.018)	Battery (0.014)
	Sponsor (0.012)	Vehicle (0.012)
	Car (0.012)	Also (0.011)
2	Use (0.019)	Prototype (0.016)
	Print (0.015)	Printer (0.013)
	Slurry (0.013)	Need (0.011)
	Ink (0.011)	Test (0.011)
	Make (0.010)	Bracket (0.010)
3	Datum (0.027)	Power (0.022)
	Use (0.022)	Electrical (0.022)
	Collect (0.021)	Process (0.017)
	Work (0.017)	See (0.017)
	Sensor (0.016)	Result (0.016)
4	Test (0.002)	Prototype (0.002)
	Use (0.002)	Create (0.002)
	Work (0.001)	See (0.001)
	Allow (0.001)	Datum (0.001)
	Component (0.001)	Able (0.001)
5	Use (0.018)	Datum (0.013)
	See (0.013)	Flight (0.012)
	Create (0.010)	Weight (0.010)
	Sensor (0.010)	Research (0.009)
	Alert (0.009)	Power (0.009)
6	Nozzle (0.035)	Test (0.023)
	Firmware (0.022)	Use (0.018)
	Output (0.018)	Rotate (0.018)
	Motor (0.018)	Make (0.014)
	Look (0.014)	Say (0.014)

7	Use (0.015) Work (0.013) Assembly (0.013) Magnetic (0.011) Fuel (0.010)	Seal (0.014) Rod (0.013) Material (0.011) Test (0.011) Cylinder (0.010)
8	Datum (0.019) Air (0.012) Permit (0.010) Take (0.009) Decide (0.009)	Opioid (0.014) Scale (0.010) Student (0.009) Create (0.009) Build (0.009

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ACADEMIC VITA

SAMANTHA LINK

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QUALIFICATIONS

- Proven ability to work independently
- Effective communication, listening, and interpersonal skills
- Prompt, punctual, and highly dependable
- Familiar with SOLIDWORKS and MATLAB programs
- Proficient in Microsoft Word, Excel, and PowerPoint

EDUCATION

The Pennsylvania State University Anticipated Graduation: May 2022
Major: *Mechanical Engineering*
Honors: Penn State Abington Honors Program, Schreyer Honors College, President's Freshman Award, President Sparks Award, Evan Pugh Scholar Junior Award, Evan Pugh Scholar Senior Award
Relevant Coursework: Engineering Design Graphics, Chemical Principles, Calculus Analytical Geometry, Physics Mechanics, Design Methodology, Fluid Mechanics, Machine Design, Computer Science, Vibrations, Material Science

EXPERIENCE

SAFE Highway Engineering LLC, Trevose, PA July 2018 – August 2019
Data Collection Technician
- Completed measurements of major roads and highways in Pennsylvania to update state intersection records
- Assembled and disassembled technology to obtain an accurate road curvature
- Recorded vehicle speed data for civil engineering study

Weis Markets, Huntingdon Valley, PA
Front Office and Sales Associate May 2017 – September 2020
- Provided exceptional customer service while processing customer sales transactions
- Maintained accurate cash handling of drawer balance
- Recognized by management for reliability and professionalism

EXTRACURRICULAR

The Pennsylvania State University
NCAA Division III Women's Volleyball Team – Abington Campus Fall 2018 – Spring 2020
- Developed ability to work with others in a team atmosphere to achieve a common goal
- Demonstrated a balance of academic and athletic responsibilities
- Learned about the value of hard work to be successful in any application

Lion Ambassadors – Abington Campus Fall 2018 – Spring 2020
- Treasurer and on the Executive Board of organization

- As Treasurer worked with budget and financial aspects of organization
- Worked with the Admissions Office to give tours and foster relationships with current and prospective students, faculty, and community

Student Athlete Advisory Committee – Abington Campus Fall 2018 – Fall 2019

- Helped to do charitable work for school and community as a student athlete

Student Initiated Fee Board – Abington Campus Fall 2019 – Spring 2020

- Aided with being in charge of and distributing a budget of a million dollars to clubs and organizations on campus

Engineering Club – Abington Campus Fall 2019 – Spring 2020

- Active in the campus Engineering Club

Women in Engineering Design Competition Spring 2019

- Finalist in the Women in Engineering Design Competition

Engineers Without Borders – University Park Campus Fall 2020 – Spring 2021

- Helped to work on creating a better living situation for a community in Uganda

Mechanical Engineering Scholar Program – University Park Campus Fall 2020 – Spring 2022

- Working on research related to natural language processing with an advisor

Monarch THON Organization – University Park Campus Fall 2020 – Spring 2022

- Helped to participate in and raise money for Penn State THON