

Engineering Challenges Faced by Elementary Education Majors

Logan Angstead, Kelvin Miskowiec, Hubert Ooi, Dagney Paskach, Grace Wilkins, Devayan Bir Faculty Mentor: Benjamin Ahn

Introduction

It is essential that elementary students are exposed to engineering at an early age to help build a base of knowledge that they can expand on later in their schooling. With the world constantly advancing in terms of technology, Elementary Education (ELED) teachers are not well equipped to teach engineering to elementary students. With this in mind ISU has offered a course, Toying with Technology (TwT), for the past two decades for ELED majors which addresses the issue at hand. The course not only teaches basic engineering but also trains the students in building lesson plans and teaching it to elementary students. The goal of the research is to identify the challenges faced by ELED majors when learning these new concepts.

Research Design

Research Question

What are the challenges encountered by ELED students while learning about engineering in TwT course?

Sample Codebook

Question 2: When you hear the word "engineering," what do you think of?
Q2T1: Engineering concepts
- Responses which relate to knowledge, skills and applications pertaining to engineering. These include problem solving, inventing, creating, making objects
- "I think about how to make stuff or make new things."

Sample Matrix

	Question 2: When you hear the word "engineering," what do you think of?
Q2T1	- science
Engineering concepts	- designing, uh, coming up with solutions
	- math
	- how stuff works, making stuff work
	- problem solving and programming

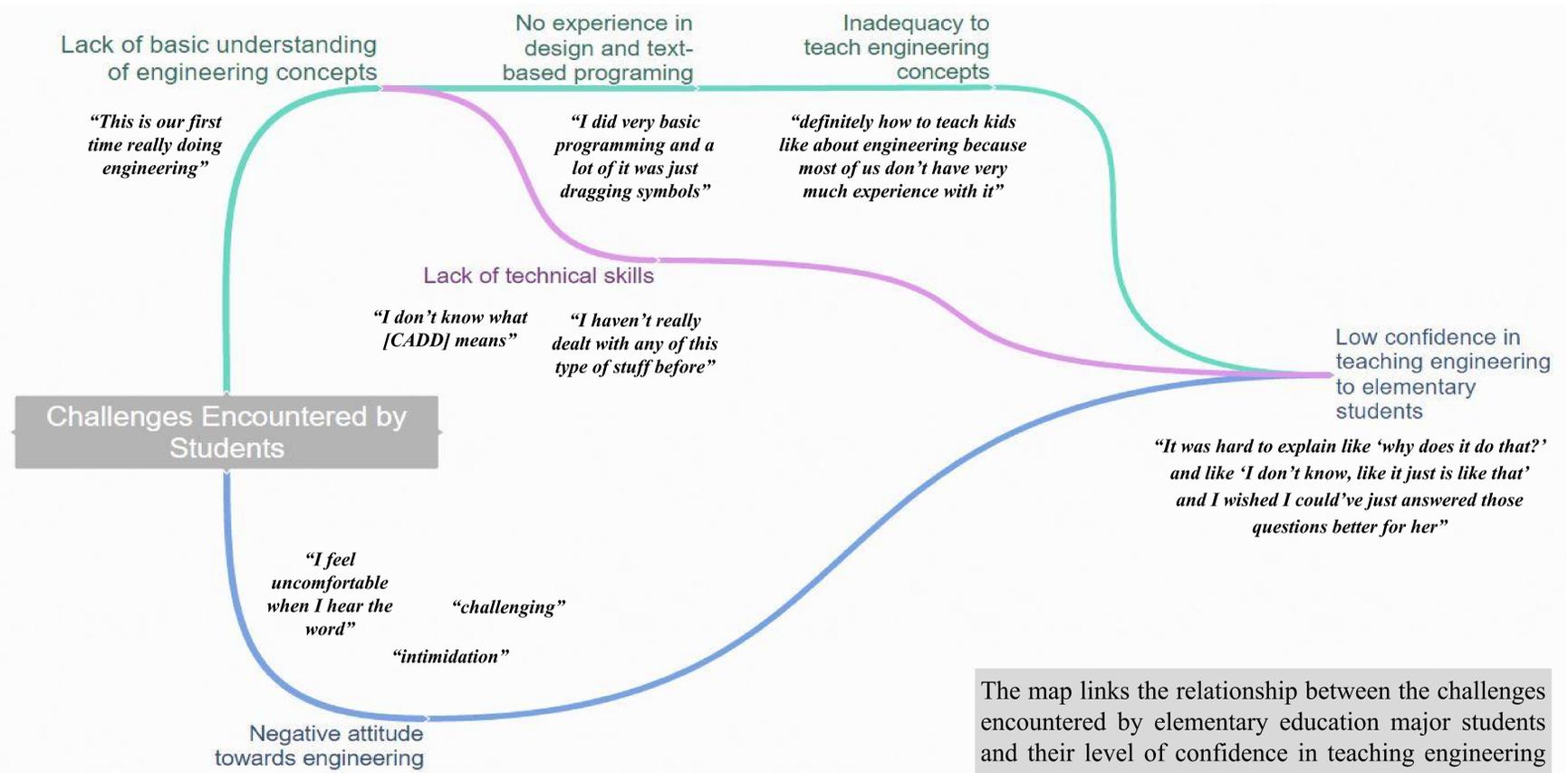
Demographic Information

28 Total Students: 23 Female and 5 Male
5 Focus groups of 5-6 students each

Procedure

Preparation	Pre-interview	Transcription	Coding	Analysis	Post-interview	Analysis	Conclude	Share Findings
- IRB Training - Develop interview questions - Mock interviews -Revise interview questions	- Divide TwT class into focus groups - Record the interviews	- Transcribe interviews - Organize responses into matrices (example above)	- Create initial codebook (example above) - Inter-reliability test - Revise codebook	- Look at individual responses for each question - Look for patterns - Draw connections - Make predictions	- Develop new questions - Revise previous questions - Use same focus groups - Record the audio	- Organize responses into matrices - Connect responses in mind-map	- Were our predictions supported? - Impact of course	- Present at Honors Poster Presentation - Discuss with staff potential changes to TwT

Findings



- The map above shows all responses can be broken into two primary challenges.
- Thinking about engineering negatively can build a mental block for ELED majors
- Insufficient understanding of engineering concepts means ELED majors haven't had experience with 3D design and/or text-based programming.
- Both the mental block and the lack of prior experience affected the ELED majors' confidence in teaching engineering to elementary students.

Future Directions

Conclusions

- Many non-engineering majors find engineering intimidating, time-consuming, and strenuous. These attitudes and ideas formed before being introduced to the topic makes learning the material difficult.
- Research also showed where students identified strengths: soft skills. This is the ability to communicate, problem-solve, and work together on problems: all things needed to teach engineering.
- The biggest challenges they predicted to face were technical. Ability to code was low due to lack of experience or a negative attitude towards it. They felt uncomfortable with this new material and not confident in teaching it.