

## DEPARTMENT OF ENGINEERING EDUCATION

# First-Year Research in Engineering Education (FYRE) Group

Dr. Krista M. Kecskemety & Students in FYRE

### ABOUT US

- We are an undergraduate and graduate research group in the EED under the advising of Dr. Krista Kecskemety
- We aim to connect research and practice in first-year engineering to improve teaching practices, student learning, and student experiences.

### FYRE TEAM



Dr. Krista Kecskemety  
Assistant Professor  
of Practice, EED



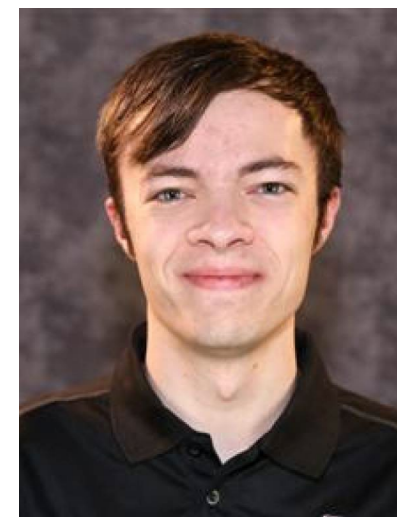
Dr. Meagan Ita  
Postdoctoral Scholar,  
EED



Tyler Milburn  
EED Ph.D. Candidate



Laine Rumreich  
CSE Ph.D Student



Drew Phillips  
EED Ph.D. Candidate



Connor Jenkins  
ECE Ph.D. Student



Michelle Fischer  
EED GRA,  
ME M.S. Student



Ethan Cartwright  
Undergraduate  
Researcher



Richa Mahajan  
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Researcher



Lauren Wagner  
Undergraduate  
Researcher



Jake Rose  
Undergraduate  
Researcher



Josh Marino  
Communications  
Lead

### RECENT PUBLICATIONS

- Desing, R., Kafjef, R.L., Kecskemety, K.M., and Grzybowski, D.M., "Intersections between Entrepreneurial Minded Learning, Identity, and Motivation in Engineering," International Journal of Engineering Education, Vol. 38, No. 5(A), 2022, pp. 1389–1407.
- Cartwright, E., Ita, M.E., and Kecskemety, K.M., "Analyzing Various Scoring Methods for Fill-In Concept Maps," 129th American Society for Engineering Education Annual Conference & Exposition, Minneapolis, MN, June 2022.
- Gunawardena, S. and Kecskemety, K.M., "Gender Differences in First-Year Engineering: Peer Connections in the time of COVID-19," 129th American Society for Engineering Education Annual Conference & Exposition, Minneapolis, MN, June 2022.
- Jenkins, C. and Kecskemety, K.M., "Instructional Feedback Practices in First-Year Engineering Technical Writing Assignments: Qualitative Coding Synthesis, Analysis and Comparison," 129th American Society for Engineering Education Annual Conference & Exposition, Minneapolis, MN, June 2022.
- Ita, M.E., Rumreich, L., Kecskemety, K.M., and Kafjef, R.L., "Preparing Instructors to Encourage an Entrepreneurial Mindset," 129th American Society for Engineering Education Annual Conference & Exposition, Minneapolis, MN, June 2022.

### CURRENT PROJECTS

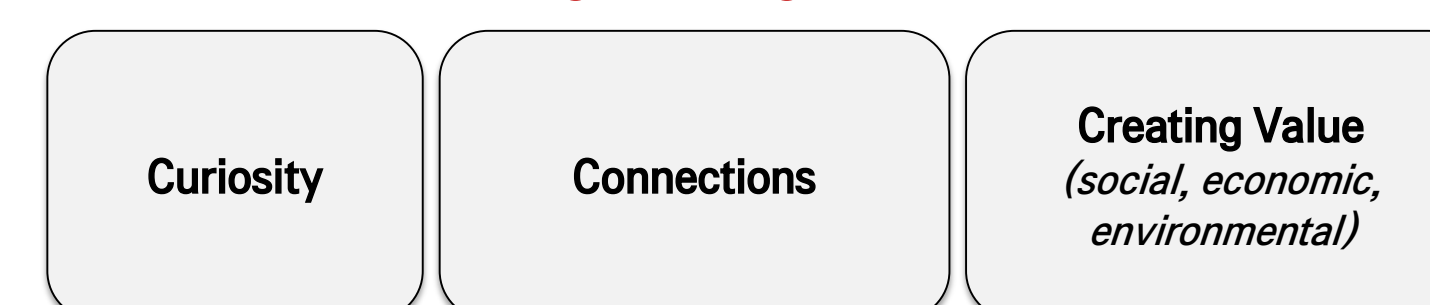
#### Integrating the Engineering Mindset into Curricula & Instructional Training

The Engineering Mindset (EM) is a collection of mental habits that focus on societal impact and value creation. Our overarching goal is that all undergraduate students in the College of Engineering will improve their EM mastery throughout their undergraduate careers. To accomplish this requires:

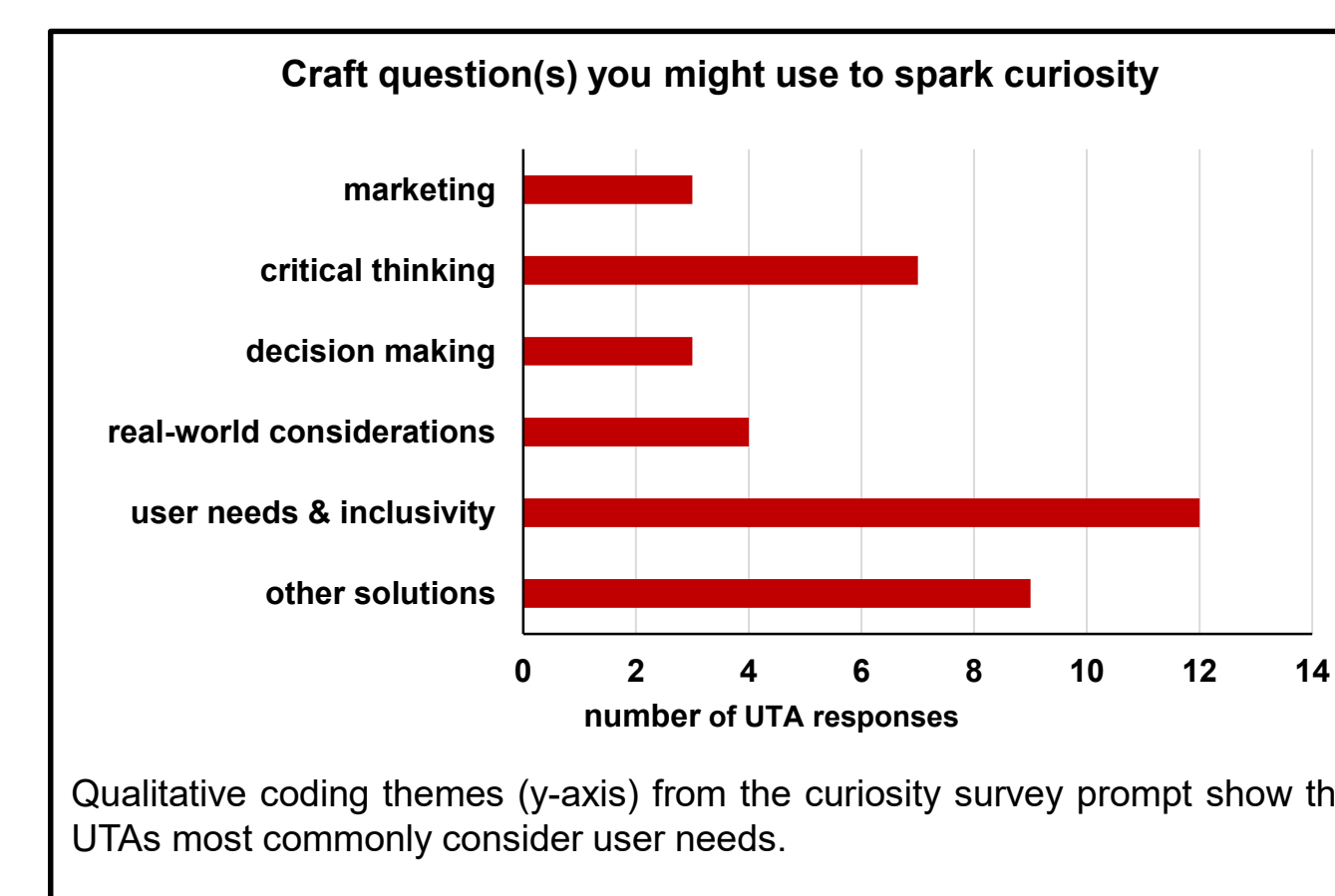
##### Implementing EM-learning into formal learning

We have established EM Learning Objectives (EMLO) & rubrics to assess students' EM mastery. We have supported faculty in identifying EMLO alignment with existing content and modifying curricula from small language modifications to large project redesigns. We have also aligned the EM Learning Outcomes with ABET outcomes to formalize the connection between EM and both academic and industry objectives.

##### Engineering Mindset



open-ended prompt (1 of 3) from Spring 2021 pilot



##### Training the instructional team to encourage an EM

We have developed instructor training modules and led Instructor Learning Communities to encourage faculty and TAs to develop their Engineering Mindset and have confidence in teaching it. The asynchronous training modules include videos, scenario questions, and open-ended prompts to engage instructors and develop their mindset. Preliminary results of the training revealed themes about instructor perceptions of what an EM means such as: user needs, inclusivity, social and environmental considerations, and economic feasibility of products.

### Undergraduate Theses

#### Undergraduate Teaching Assistant Written Feedback: Analysis and Comparison

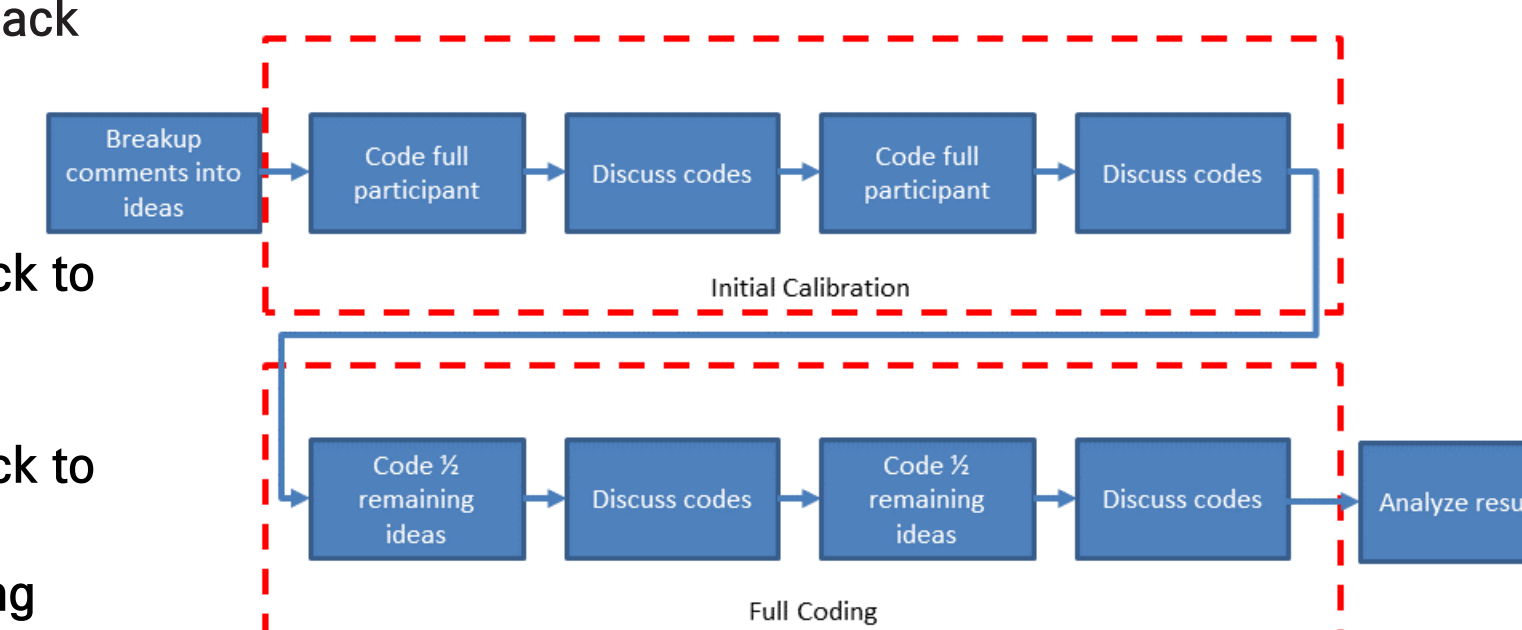
Connor Jenkins

##### Motivation

- Current undergraduate teaching assistant training focuses primarily on scoring student work and not on written feedback methods

##### Goals

- Compare undergraduate teaching assistant written feedback to the written feedback left by technical writing experts and engineering experts
- Compare undergraduate teaching assistant written feedback to known best practices
- Understand experiences that inform undergraduate teaching assistant written feedback methods
- Inform future training on written feedback methods for undergraduate teaching assistants



#### Gender Differences in First-Year Engineering: Peer Support Networks in the time of COVID-19

Sery Gunawardena

##### Motivation

- Explore the differences in the social networks of male and female first-year students in online first year engineering classes

##### Goal

- Understand the role of peer support on the persistence of first-year engineering students.

##### Methods

- 3 sections of FEH and 2 sections of FE were surveyed about their connections to each student in their class and their perceptions on belonging in engineering

##### Current Work

- Understand the role of peer support on the persistence of first-year engineering students.

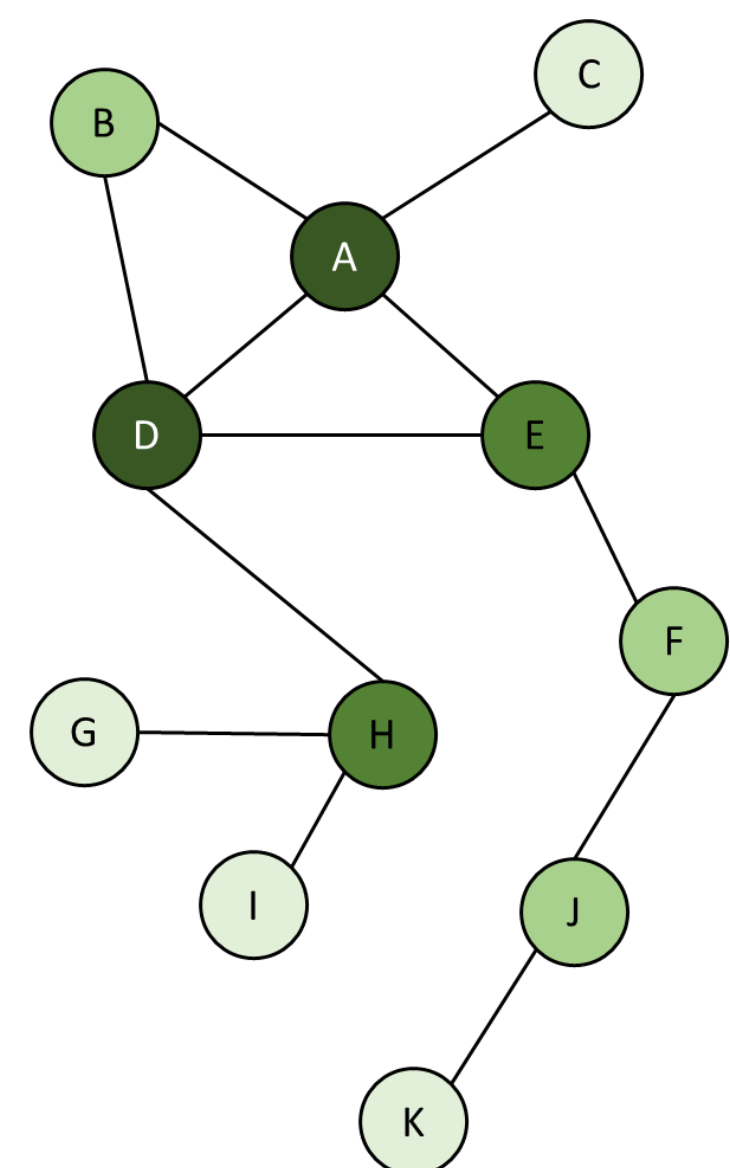


Figure 1: Example of a Classroom Social Network

### Concept Mapping in Engineering Education

We are working as a part of a multi-institution study looking into the extent to which the Engineering Mindset (EM) is begin infused in coursework for undergraduate engineering educations. At various points in undergraduate learning, EM will be assessed through the completion of an EM concept map.

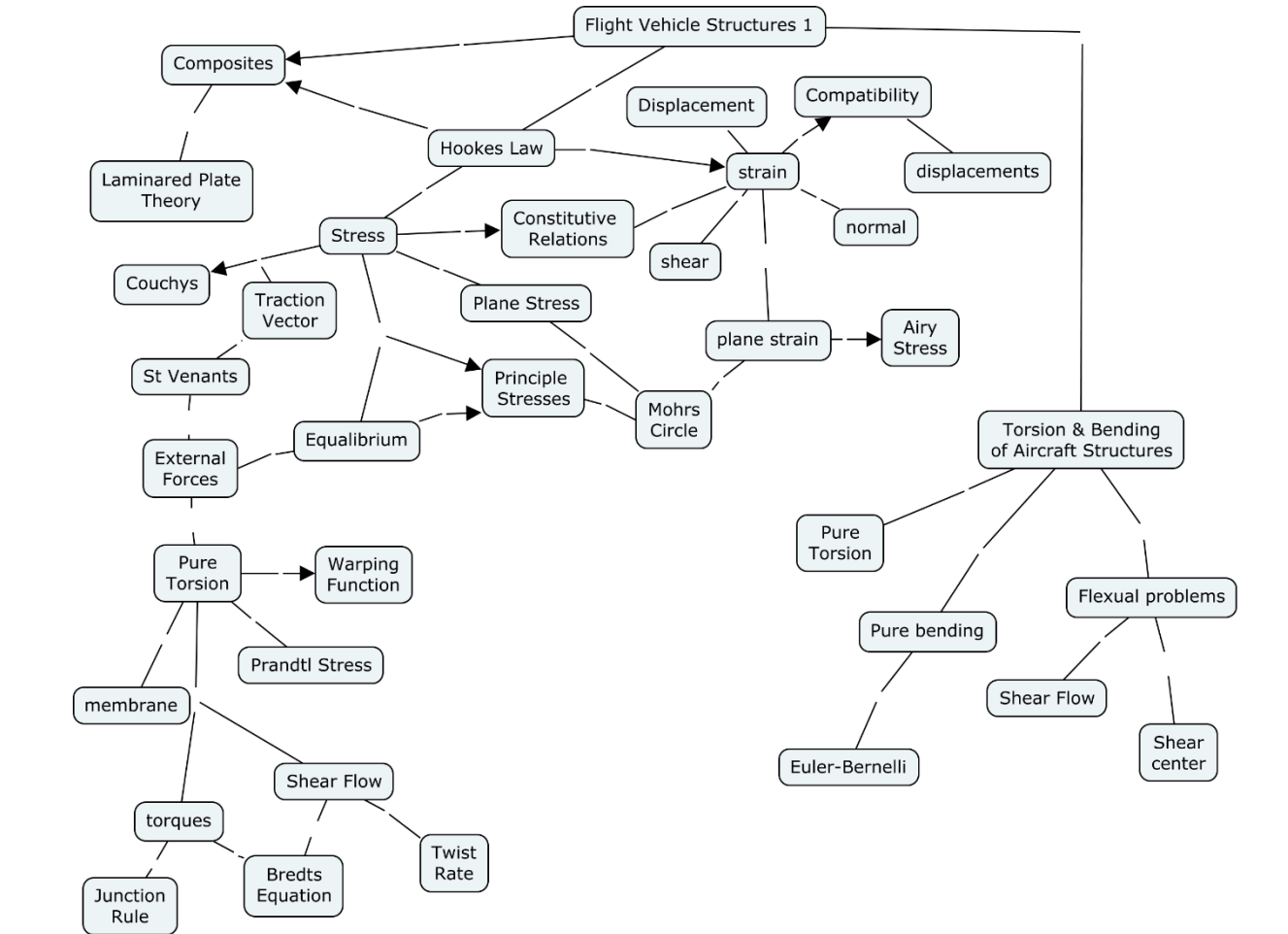
##### Research Questions

- What gaps exist between students' perception of entrepreneurial mindset and the "master" EM concept map?
- How does a student's engineering mindset change over the course of their engineering degree program?
- How does student's perception of engineering mindset change over the course of a semester?

##### Scoring Concept Maps

We adapted three primary concept map scoring methods (traditional, categorical, and holistic) to fit a fill-in concept map and then observed trends that arose in the scored results. Current results suggest that there is poor reliability across the methods in resulting scores, but iterations may help each method cater to specific circumstances

- The traditional method struggled to allow for a gradient of correctness but was particularly easy to implement
- The categorical method introduced punishment for breadth of categorization but is well suited for assessing highly interconnected topics
- The holistic method was resource intensive but may be a more generalizable scoring method



##### Introducing Concept Maps into Technical Curriculum

We are also exploring how well concept mapping can be introduced into aerospace engineering and other technical curriculum. Students in an aerospace structures course complete an unstructured concept map summarizing the whole class material and scored them using the three primary methods. Currently we are summarizing the results found in scoring across methods to understand how the various methods may assist instructors when implementing concept maps in their courses.

### Ph.D. Dissertations

#### A Mixed-Methods Approach to Understanding the Effects of Rejection from an Academic Major on Students' Motivation to Continue Studying Engineering

Tyler Milburn

##### Motivation

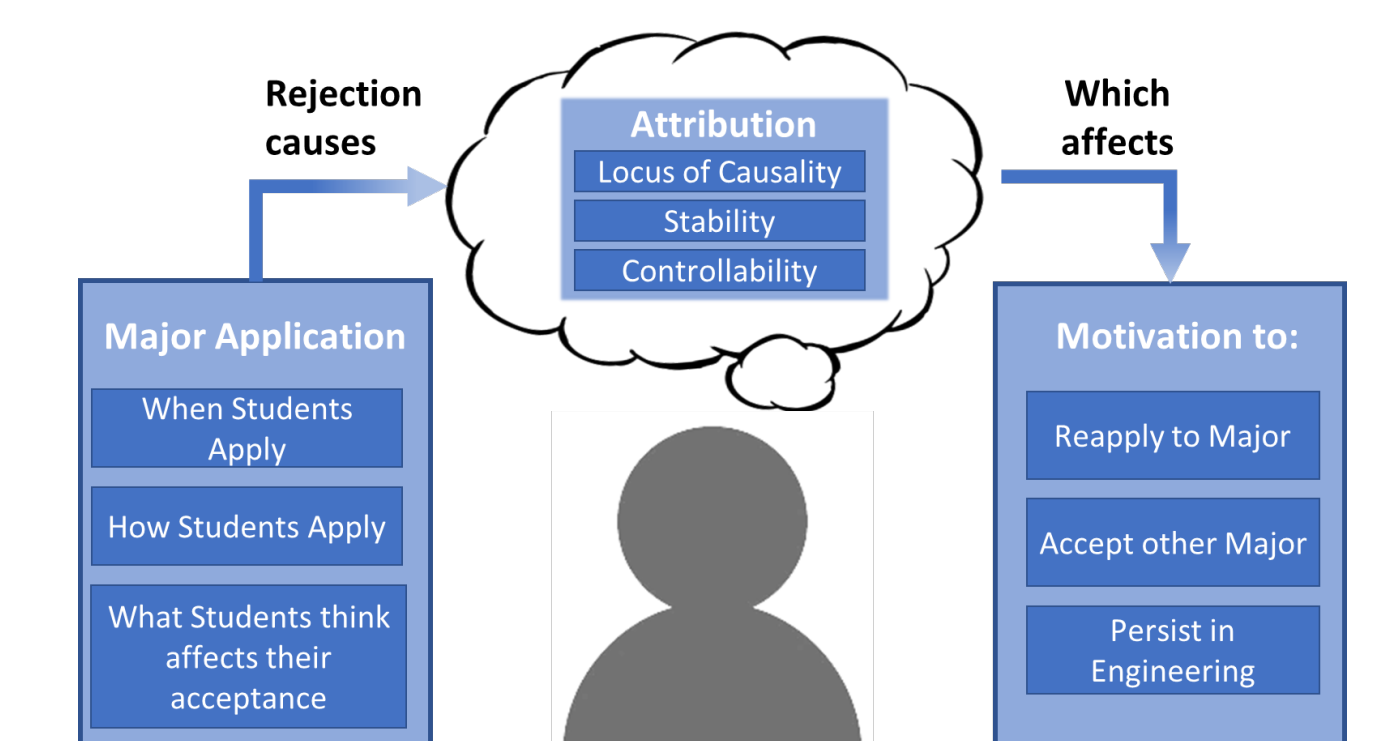
- Students may face rejection when applying to engineering majors, potentially impacting their motivation to persist in engineering

##### Goals

- Improve the retention of engineering students by better understanding the experiences students face after being rejected from an engineering major.
- Characterize which students are being rejected from engineering majors
- Explore the impact of rejection from an engineering major on students' motivation to persist in engineering

##### Methods

- Collect quantitative data from the application-to-major process to determine which students are being rejected from their first choice of engineering major
- Collect quantitative data on rejection sensitivity and qualitative data from interviews to better understand the rejection they faced and how it affected their motivation to continue in engineering



#### Investigating Teaching Assistant Roles and Personality Behaviors in STEM and First-Year Engineering Classroom Contexts

Drew Phillips

##### Motivation

- Developing a personality behavior instrument contextualized for TAs interacting with students in first-year engineering classrooms will allow for future analyses on effects of TA personality behaviors on student outcomes and may have implications for TA training

##### Research Questions

- What roles do Teaching Assistants play in undergraduate STEM courses?
- How are personality traits currently recognized in the roles of Teaching Assistants in undergraduate STEM and first-year engineering courses?
- How can personality behaviors of Teaching Assistants in the social context of interacting with students in first-year engineering be measured?

