



# Empowering high school students to build their engineering self-efficacy through a culturally relevant context

Arlett Perez-Rios, PhD  
Noel Hennessey, PhD

# goals for today

Facilitate a discussion with HSI educators about partnerships that:

- Broaden participation in STEM disciplines
- Respect and uphold the cultural identities and values of historically excluded communities in STEM

Share promising early results of our project and research

- Increased knowledge about and self-efficacy in engineering education
- Connects engineering education and practice to students' lived experiences

Freedom dreaming... what are we doing next

- Program plans for this summer
- The writing we are manifesting
- Dreams for our future

# who are we?



**Arlett Perez, PhD**  
Director | Upward Bound  
College of Education  
University of Arizona



**Noel Hennessey, PhD**  
Director | ENGAGED  
College of Engineering  
University of Arizona

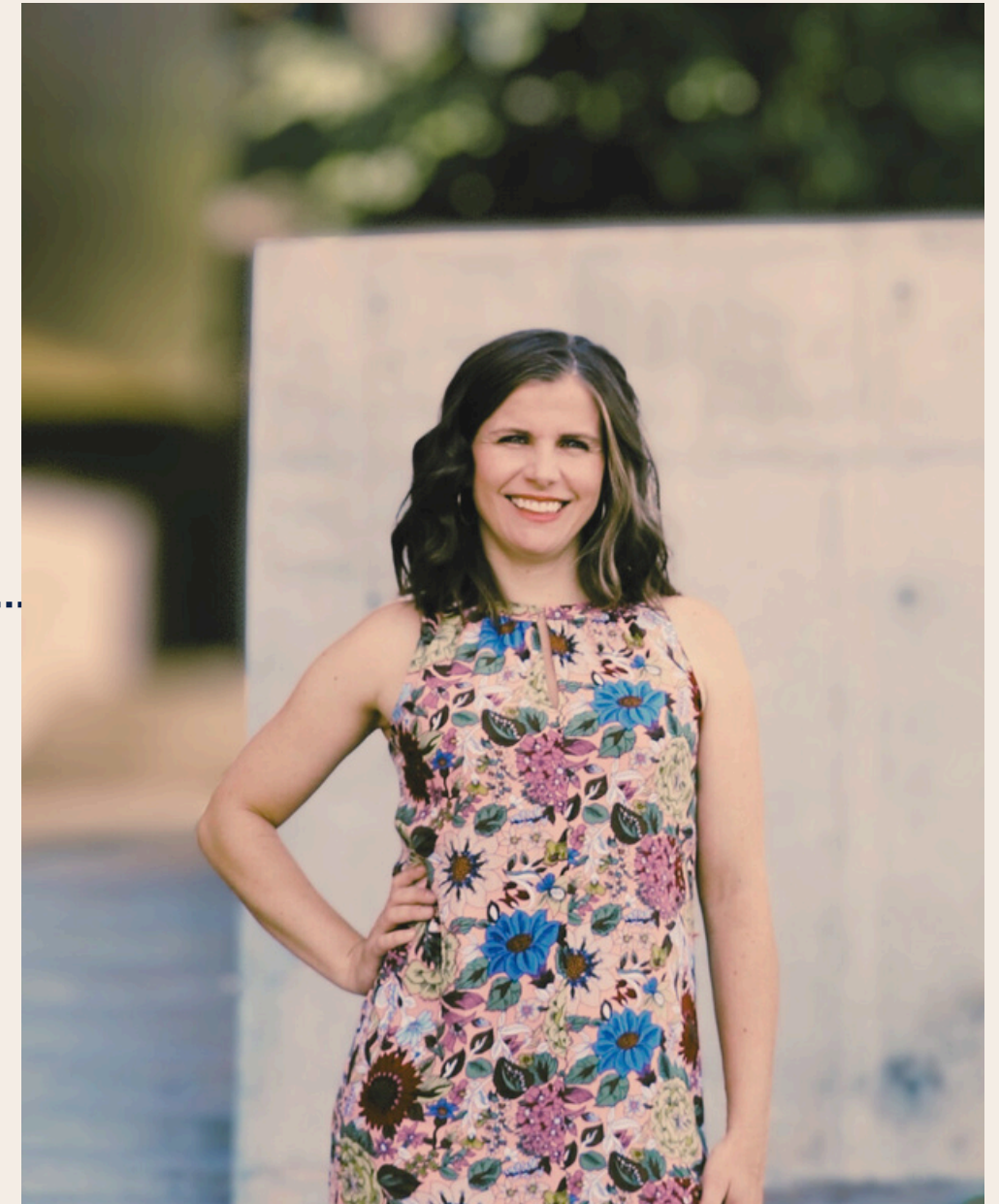
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our teams



Ensure first-generation and low-income students are **eligible** and **prepared** for **post-secondary education**...

through year-round programming that promotes **funds of knowledge**, and personalized access to **social and cultural capital building**.



**ENGAGED**  
**Engineering Access,  
Greater Equity & Diversity**

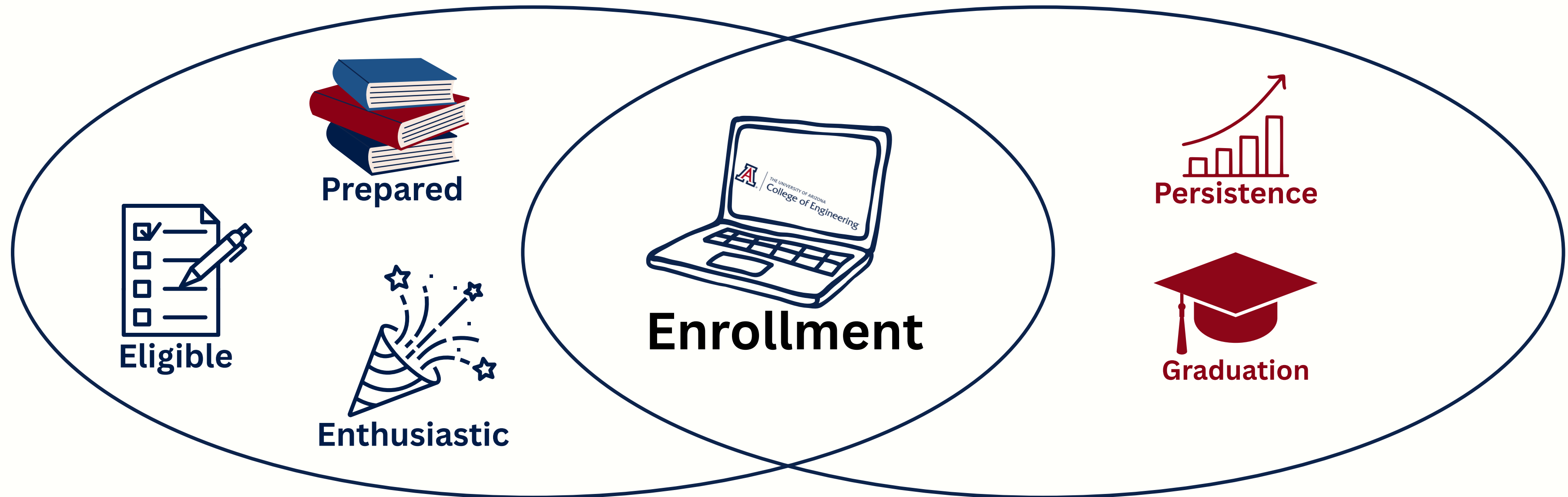
Increase **enrollment, persistence**, and **graduation** of students from historically marginalized backgrounds in engineering...

through programming that promotes **sense of belonging, engineering identity**, and **critical leadership development**.

our teams



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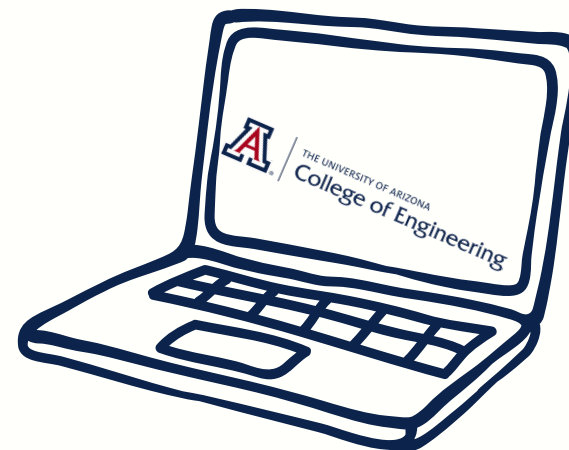
Eligible



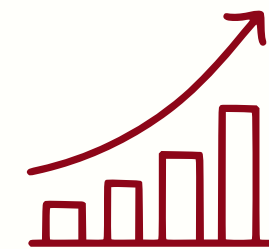
Prepared



Enthusiastic



Enrollment



Persistence



Graduation

# collaborations from sporadic to intentional



## workshops

### EXPLORING CAREERS

#### JOAQUIN MARTINEZ

Returning from spring break, Upward Bound continued our virtual Saturday Academies with UArizona Alum, Joaquin Martinez joining us in April. Joaquin shared about being born and raised in Tucson and entering the workforce after graduating with a degree in Civil Engineering. A former General Manager, Director, and employee with Hess Corporation and ExxonMobil, Joaquin gave advice on pursuing career goals while staying connected to your family and community.



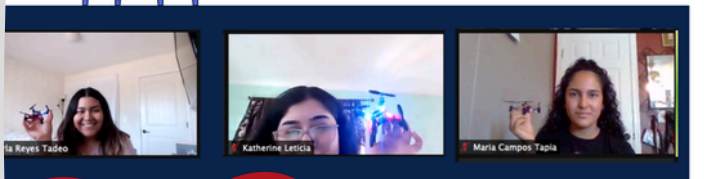
#### NOEL HENNESSEY, PH.D.

Dr. Hennessey, Assistant Director of Student Success & Engagement in the College of Engineering at UArizona, also joined us in April after Joaquin. Dr. Hennessey briefly talked about her academic journey, specifically speaking to the importance of engaging in extracurricular and experiential activities. Speaking to her passion for paving the way for future engineers, Dr. Hennessey shared STEM education opportunities available to local high schoolers and community members.



### HANDS ON, CAM ON

Following Dr. Hennessey's talk, current UArizona undergraduate students from the College of Engineering guided our students in a virtual but hands-on Build-A-Drone activity. While building, UB students took the opportunity to ask Ryan and Collin about their courses, future plans, and career goals relevant to the STEM field.




## students

funding  
proposal teams



AZ HSI CONSORTIUM

AZ GATE Program

# our AZ GATE award

jan 2025 to dec 2025



## culturally responsive outreach and recruitment

- **Centered validating relationships** between undergraduate engineering students and high school seniors in Upward Bound
- Integrated with existing five-week Upward Bound Summer Program through two phases
  - Phase I: Learners completed a community project that highlighted the **societal impact** of engineering
  - Phase II: Featured hands-on **engineering design thinking** and technical skills training
    - 3D printing
    - Laser cutting
    - Soldering
    - Coding
    - Prototyping

# Phase I: Las Milpitas



COMMUNITY  
FOOD BANK  
OF SOUTHERN ARIZONA



# Phase II: Engineering Design Center



# Phase III: Upward Bound Student Showcase

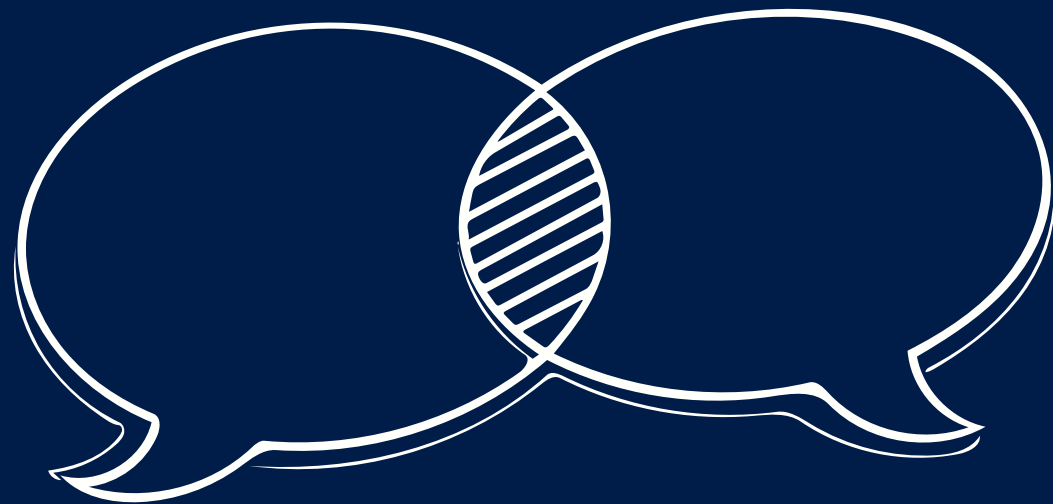


# Research Question(s)

- How does **culturally responsive recruiting** influence Latinx high school students' educational aspirations in engineering?
- What meaning to do students make from incorporating **validating relationships** into the college recruitment process?

## Data

### *Family Interviews*



### *Retrospective Pre- and Post-Surveys*

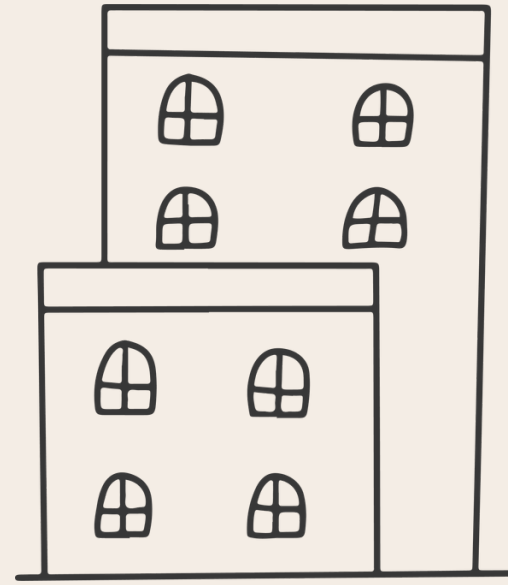


- Engineering self-efficacy scale (LAESE) (Yoon & Sorby, 2019)
- How well do students understand what engineers do?
- Have students engineering aspirations shifted?
- How do students perceive the connection between math and science ability and interest and engineering?

# Background Theory



Validating Relationships  
Rendon, 1994

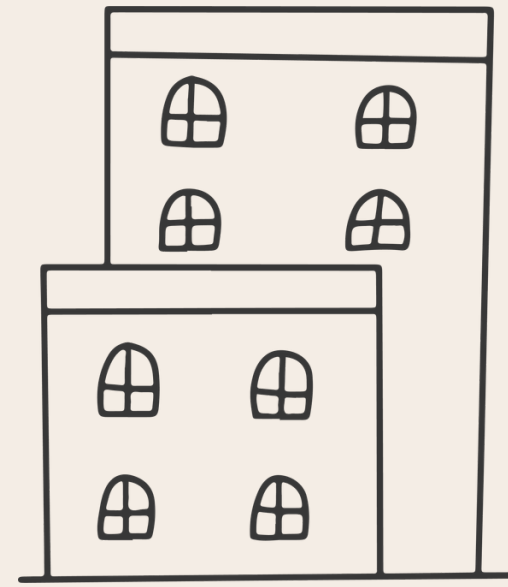


Community Cultural Wealth  
Yosso, 2005

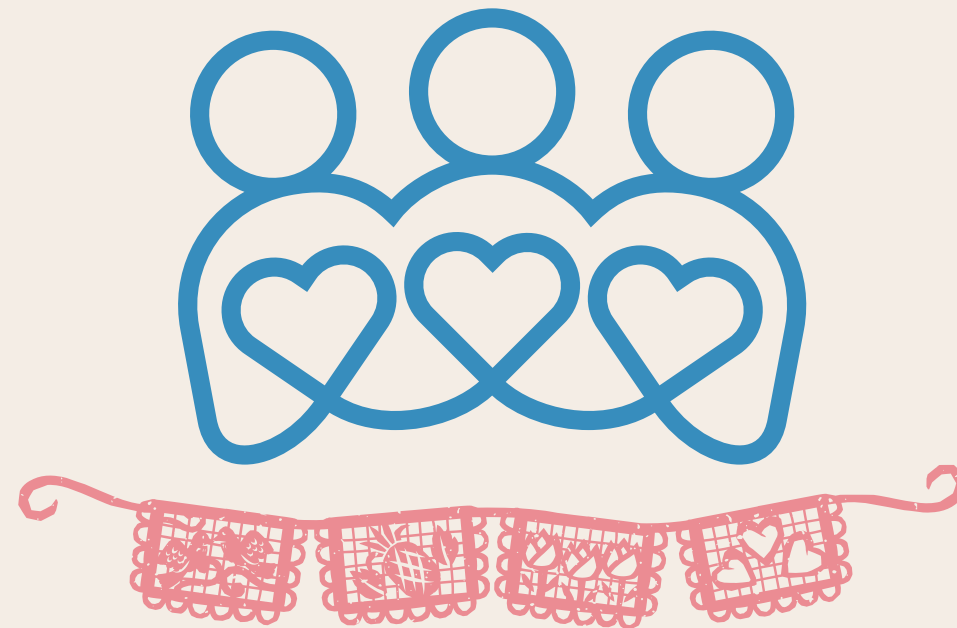
# Background Theory



Validating Relationships  
Rendon, 1994



Community Cultural Wealth  
Yosso, 2005



Scholar Practitioner  
Cultural Intuition  
Rocha, Coronella, Reyes, & Romasanta, 2024



Strategic Partnerships  
Rocha, Castillo-Lavergne, Byrd, Carnethon,  
Miller, Lin, & Yancy, 2022

genuine connections with validating agents create a counterspace

I feel like **I can contribute a lot of community aspects to engineering to students like me**, and even just connecting with others, I think, is really fun, and I really enjoyed being interested in engineering, **connecting with professors and coordinators and outreach directors** through engineering, especially at the U of A.

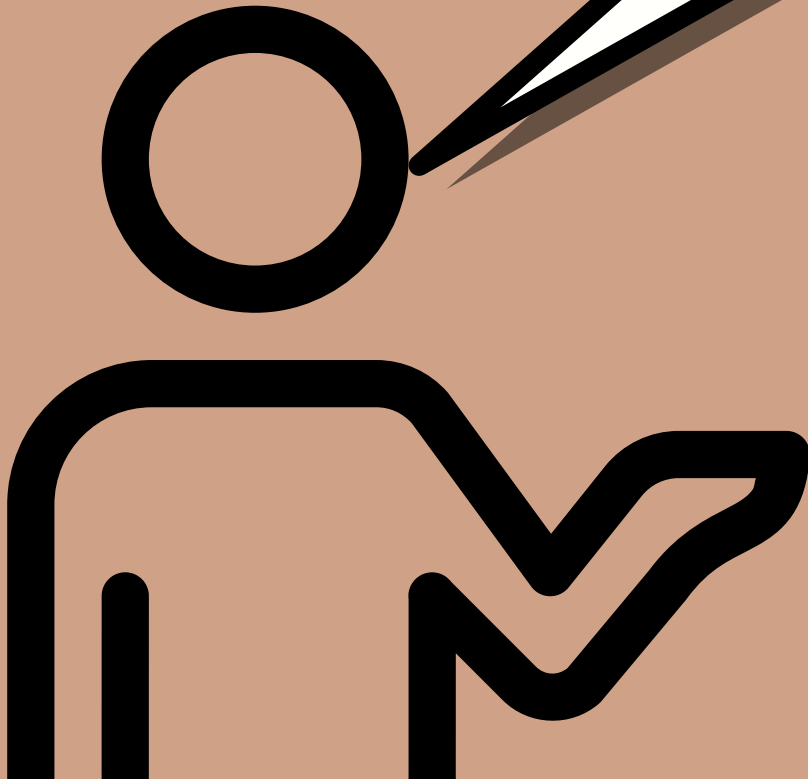
**-Alan, 17**

- higher education can be a space where people-- especially upon first entering-- do not feel welcomed or like they belong
- authentic connections counter this messaging/feeling

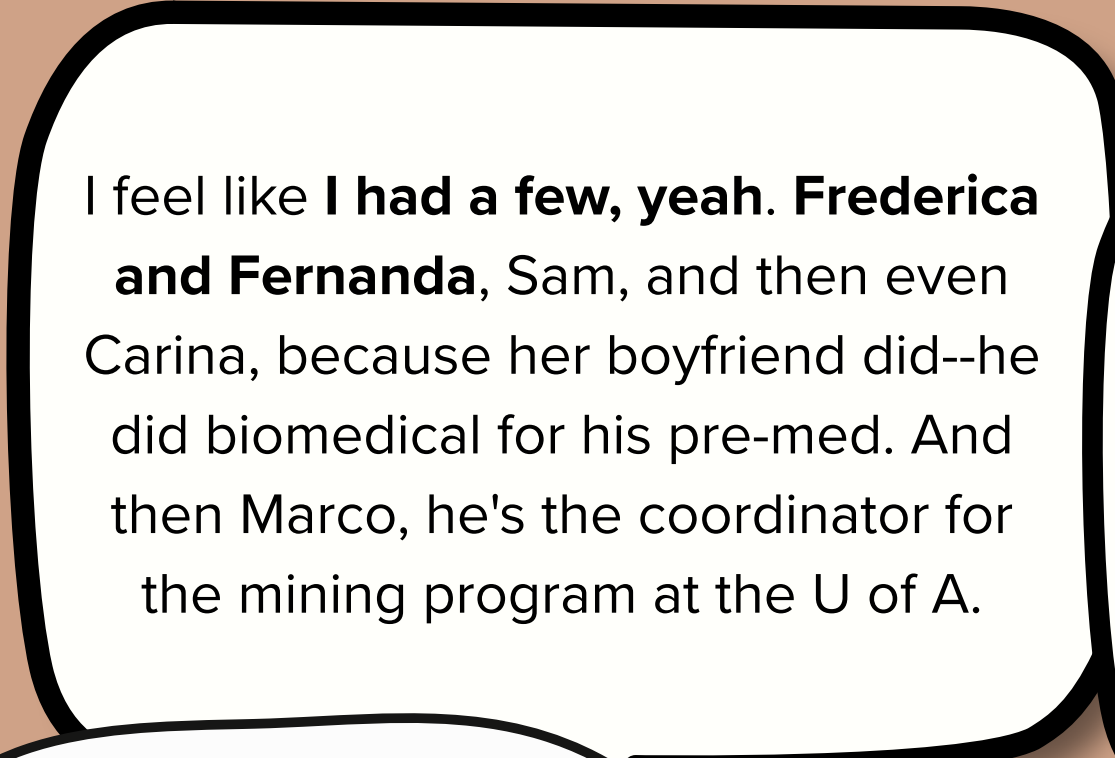


# relationships build pathways into exploring engineering

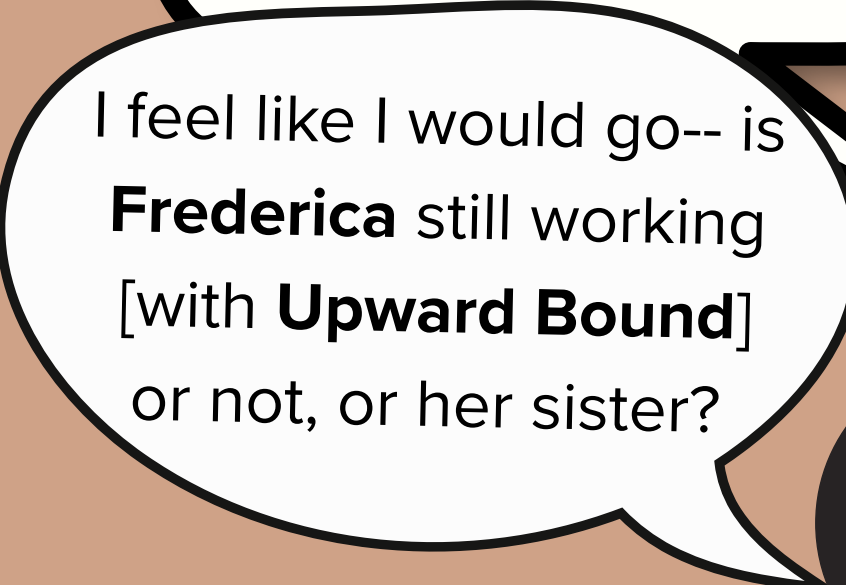
Students and their families knew **who** to ask when they had questions, and it was people they knew well



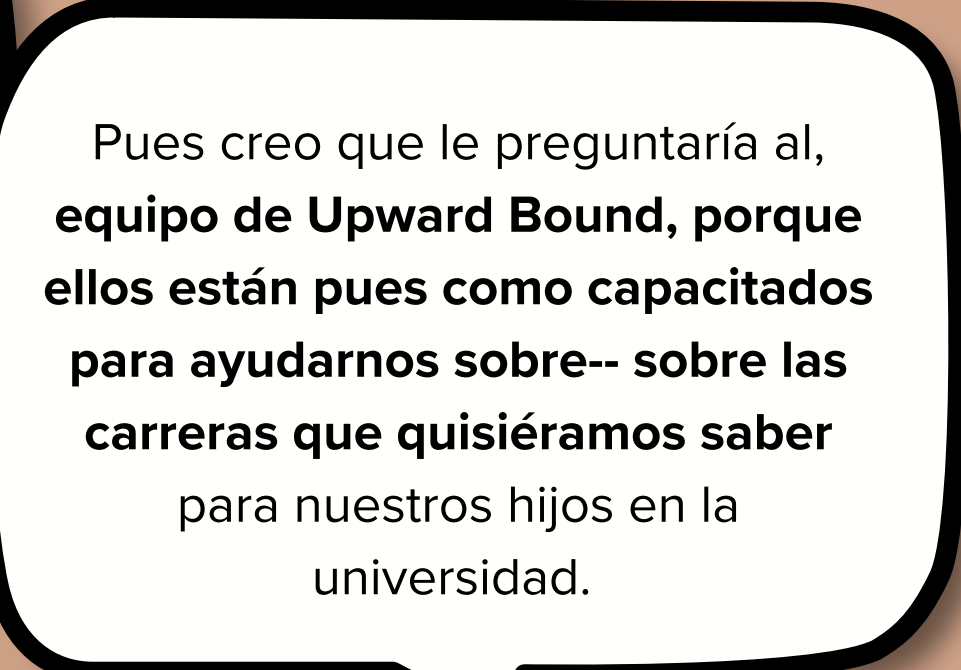
if you had a question about engineering as a major at the university, where would you go and who would you ask?



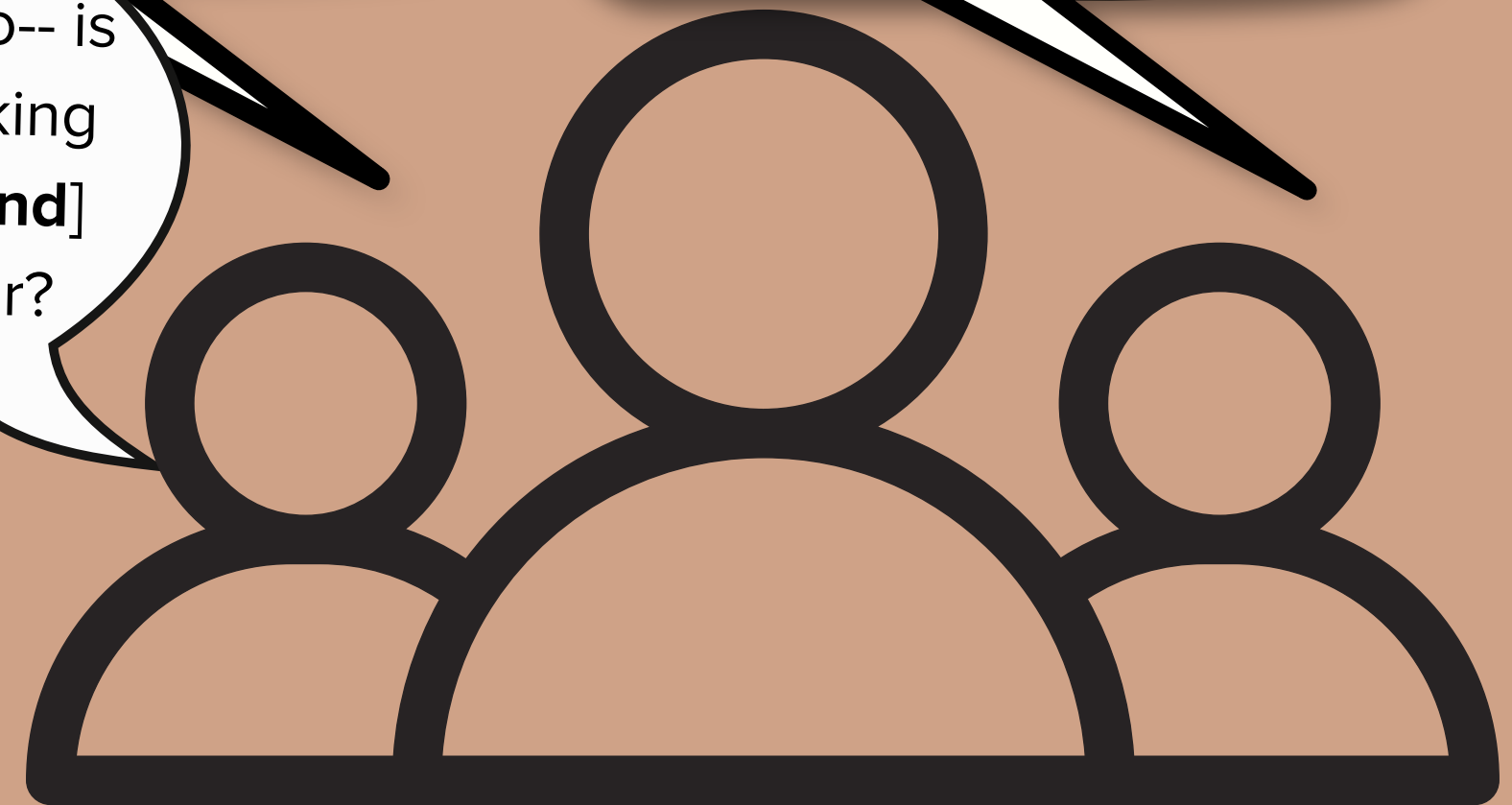
I feel like I had a few, yeah. **Frederica and Fernanda**, Sam, and then even Carina, because her boyfriend did--he did biomedical for his pre-med. And then Marco, he's the coordinator for the mining program at the U of A.



I feel like I would go-- is **Frederica** still working [with **Upward Bound**] or not, or her sister?



Pues creo que le preguntaría al, **equipo de Upward Bound**, porque ellos están pues como capacitados para ayudarnos sobre-- sobre las carreras que quisiéramos saber para nuestros hijos en la universidad.



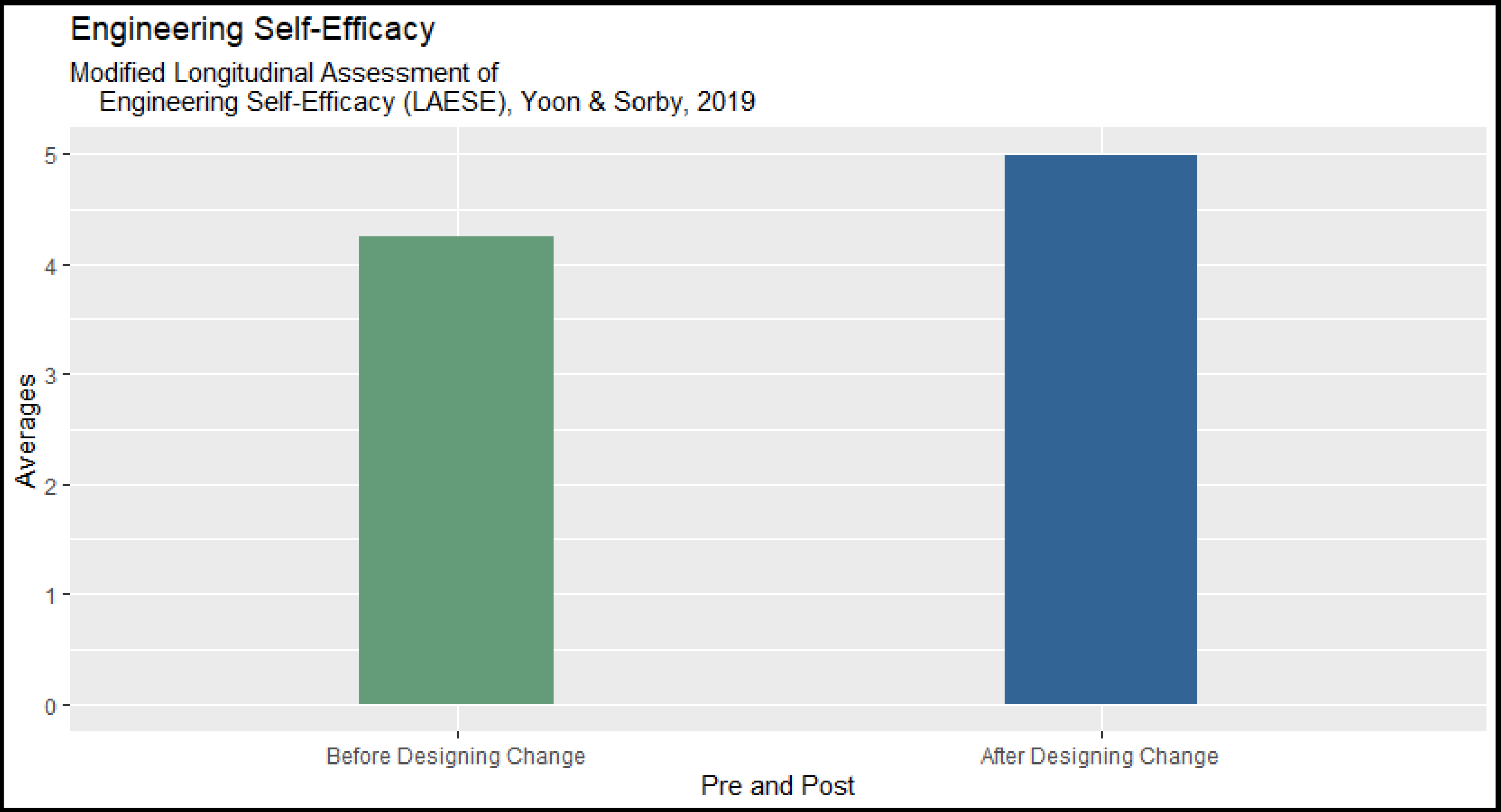
students see themselves as having skills that would benefit the profession

- They know they have something to bring to the table
- They might see themselves as different, but no less belonging
- If they don't see themselves in engineering, it isn't because they don't think they can do it. They think of themselves as worthy of the major

I'm kind of like a, like outgoing person, I feel like **I could, you know, maybe cheer people up and stuff like that in engineering. Because I know, I know a lot of people stress a lot.** And I'm a person that looks more at the bright side more than the negative side.

**-Esteban, 15**

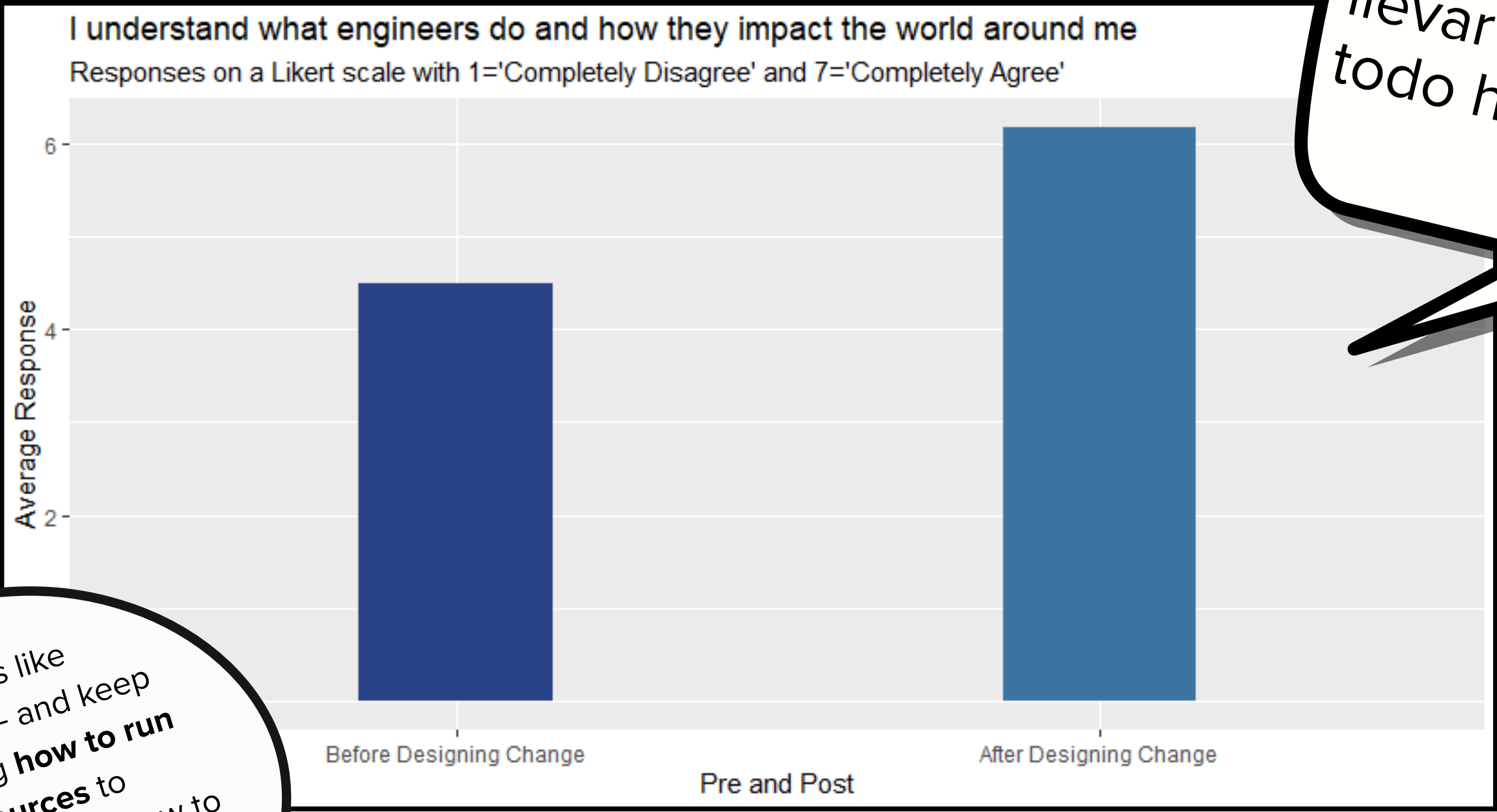
# Preliminary data shows elevated self-efficacy



☑ A self-efficacy scale measures students' overall belief in their ability and capacity to perform in engineering

☑ Results indicate increases in culturally relevant and validating exposure connected to increases in self-efficacy

# Students reported better understanding of engineering work and societal impact



Puede **construir**, **hacer casas** o sea **llevar proyectos** **todo hacer**.  
-Silvia, 17

I think **they impact everything**. It's like building-- knowing **how to build**-- and keep those buildings lasting. Knowing **how to run power**, and **mining for the resources** to make a building, and to give us power how to build-- like **literally everything I think is revolved around engineering** in some way.  
-Alan, 17

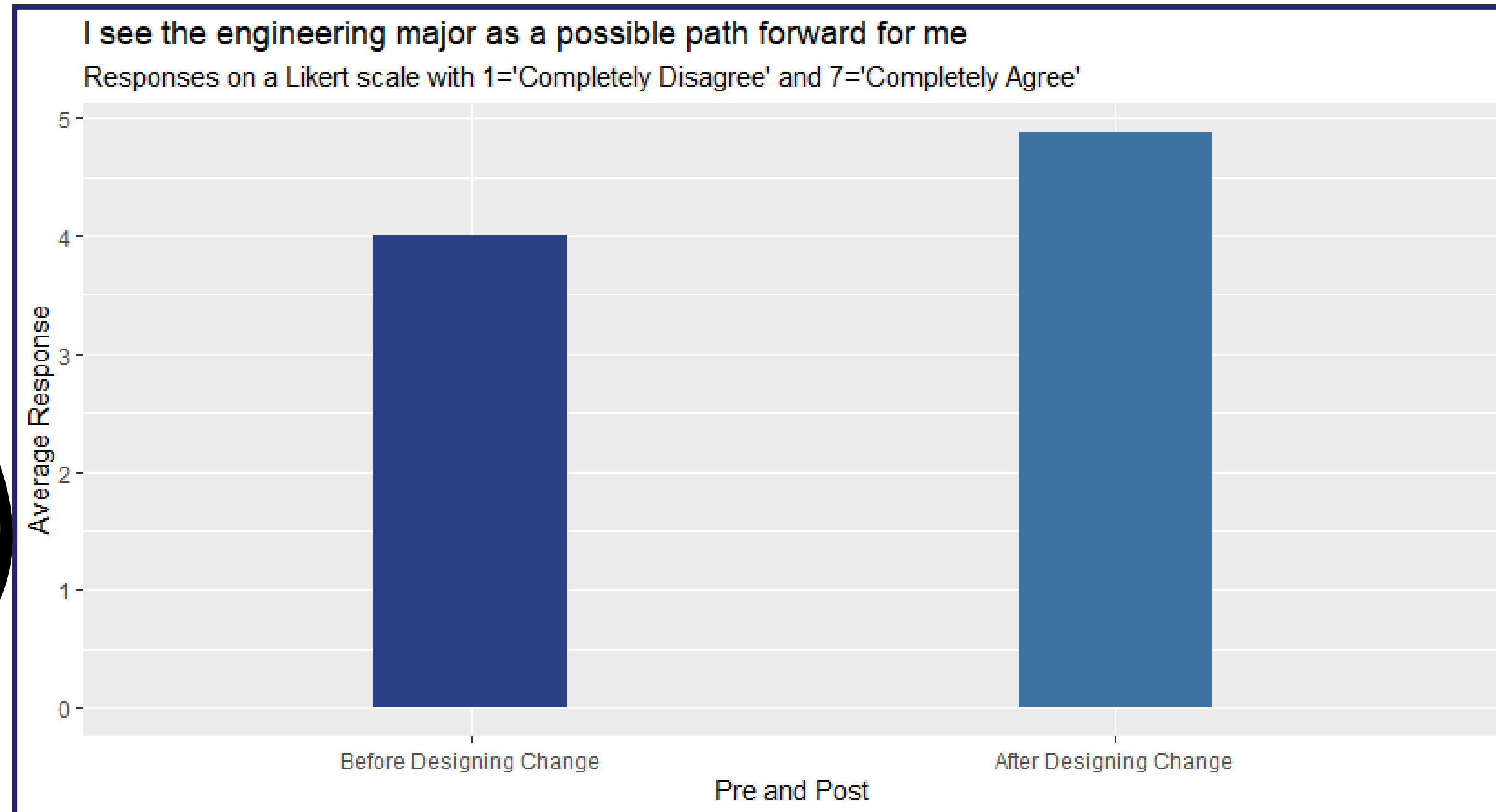
I do feel interested in engineering as a profession because **I think it's a very accessible career** to have, but also **it has an important role in everything and how our world functions now**, especially with moving technology.

-Alan, 17

# Elevated understanding of selves as potential engineering students

"I related to one of them the most 'cause...I remember that he said that he didn't really like sitting there and he liked more hands on stuff and I think **I could relate to that a lot** because I like a lot of hands on stuff and when I went there was there's these specific people that just interested me a lot."

-Esteban, 15



# Clearer understanding of engineering orientation towards math and science

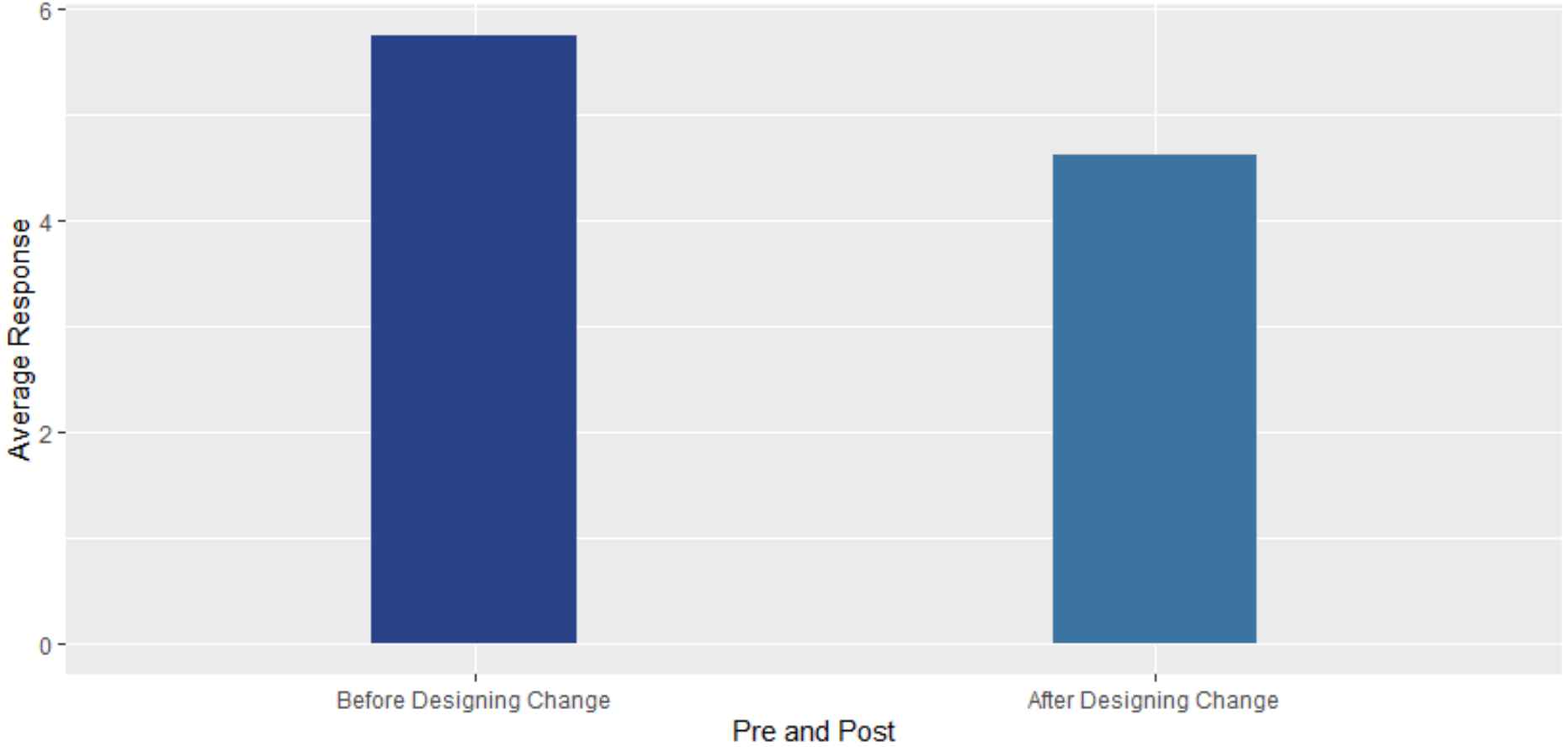
...having to work harder in math than others have to. And the field being so math-heavy is, like, really, like, intimidating. I feel like **as long as you want it, you can get it.**

**-Alan, 17**

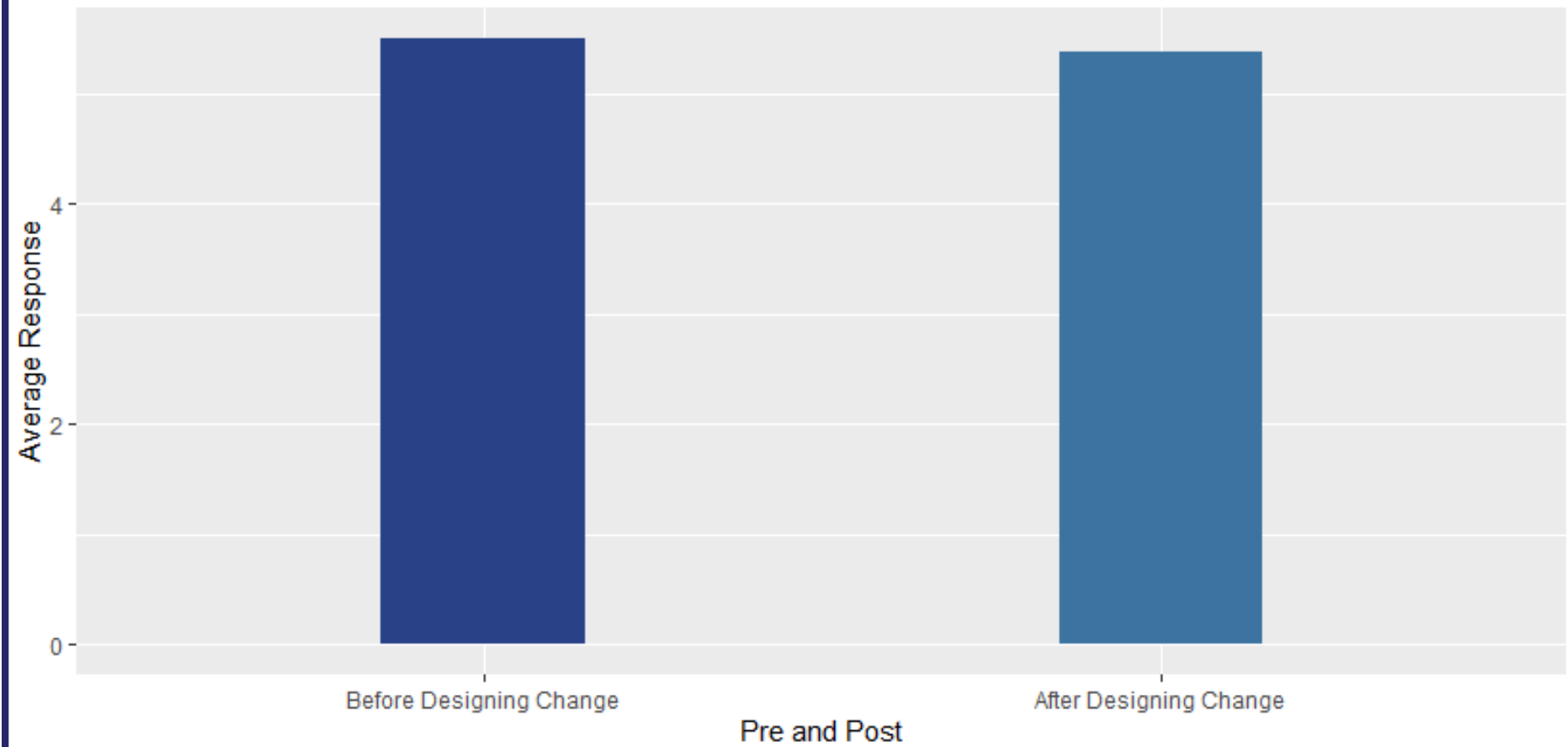
Okay, pues they talked to us about the experience of being engineering, like the different things that they would do, like it's **more than just math--** [it's] collaboration, thinking.

**-Silvia, 17**

Engineering majors have to love math and science  
Responses on a Likert scale with 1='Completely Disagree' and 7='Completely Agree'



Engineering majors have to be good at math and science  
Responses on a Likert scale with 1='Completely Disagree' and 7='Completely Agree'



# key takeaways

- ✓ who was working with the students mattered
- ✓ you don't have to foreground the math and science
- ✓ find engineering in their zip code; an introduction to engineering doesn't have to be an engineering company (we worked with the food bank)



**we need to respect and uphold the cultural identities and values of historically excluded communities in STEM**

summer 2026

# LIVE-ON PROGRAM

# ENGINEERING DESIGN CENTER

- residential education program
- engaging partnerships
- expanding participation



SOCIETAL  
IMPACT

# cultivating



We've invested for a long time and a lot of care in each of our respective programs.

We've also spent a long time cultivating this partnership.

A plentiful harvest doesn't come solely from the work of a single season, but from cultivating the earth year over year.



# the cultural values of our partnership

***cariño***: we care about each other as people, and that vibe permeates the programs

***authenticity***: our work is defined through our personal, core values, not through textbook theory



***food!***: we feed people who we care about

# manifesting

what could we cultivate in ourselves?



***innovating***

We are positioned to build new systems that support access, persistence, and growth in education.

***writing***

Our experience and perspectives on carino, authenticity, and partnerships is valuable.



***teaching***

We want to help develop this workforce of caring, partnering, intuitive scholar practitioners.

thank you  
gracias

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