UF Herbert Wertheim College of Engineering
UNIVERSITY of FLORIDA

ENGAGED QUALITY INSTRUCTION THROUGH PROFESSIONAL DEVELOPMENT
EQuIPD

K-12 Student STEM Identity Development through Participation in Goldberg Gator Engineering Explorers Summer Programs (RTP)

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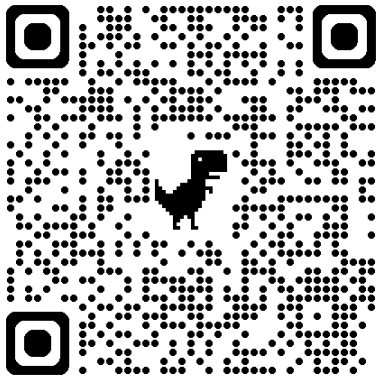
POWERING THE NEW ENGINEER TO TRANSFORM THE FUTURE

Agenda

1. Introduction
2. Goldberg Gator Engineering Explorers
3. Research Aims
4. Methodology
5. Results and Discussion
6. Conclusions and Future Work



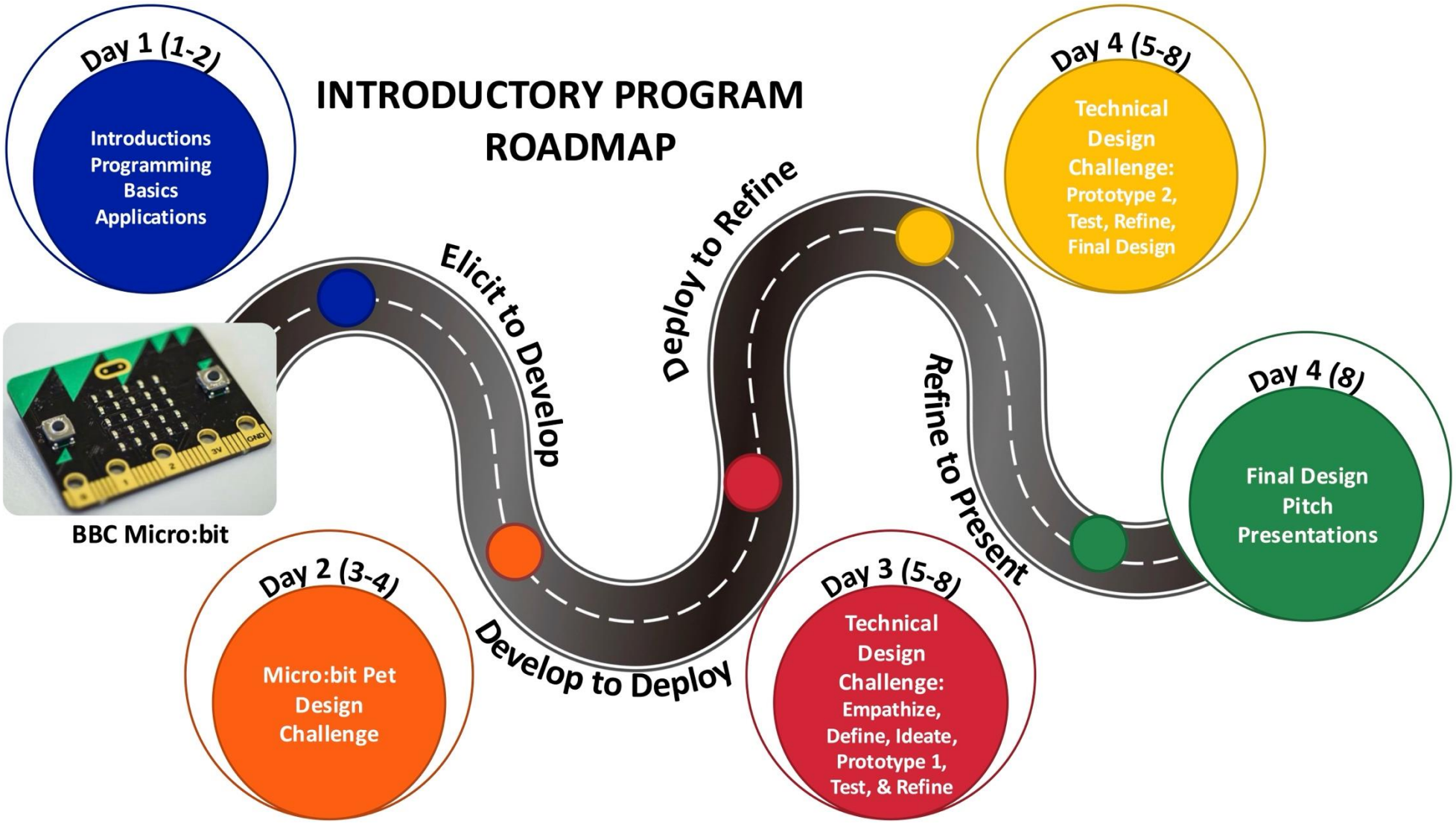
1. Introduction

- Identity is often defined as a "core sense of self," who a person is, and who that person could be [1], [2].
- In the context of STEM, this is how someone views themselves or is recognized by others as a "STEM person."
  - Holistic view of yourself as a STEM person [1-3]
  - Role identities - seeing oneself as a scientist or engineer
  - Social identities - self-concept generated from the group of people around you [2]
  - Attitudes, self-efficacy, and expectancy-value beliefs in a subject [4].

1. Introduction

- It is important to support STEM identity and self-efficacy in students
- Students begin to see themselves as a science or STEM person and develop attitudes and interests toward futures and careers in STEM as early as Elementary school [2], [3]
- Informal summer and afterschool programs offer K-12 students the opportunity to continue developing their STEM attitudes and interests while fostering STEM self-efficacy and career aspirations [5], [6].
  - Smaller group sizes
  - More focused curricula
  - More adaptable to a learner's needs and interests

2. Goldberg Gator Engineering Explorers



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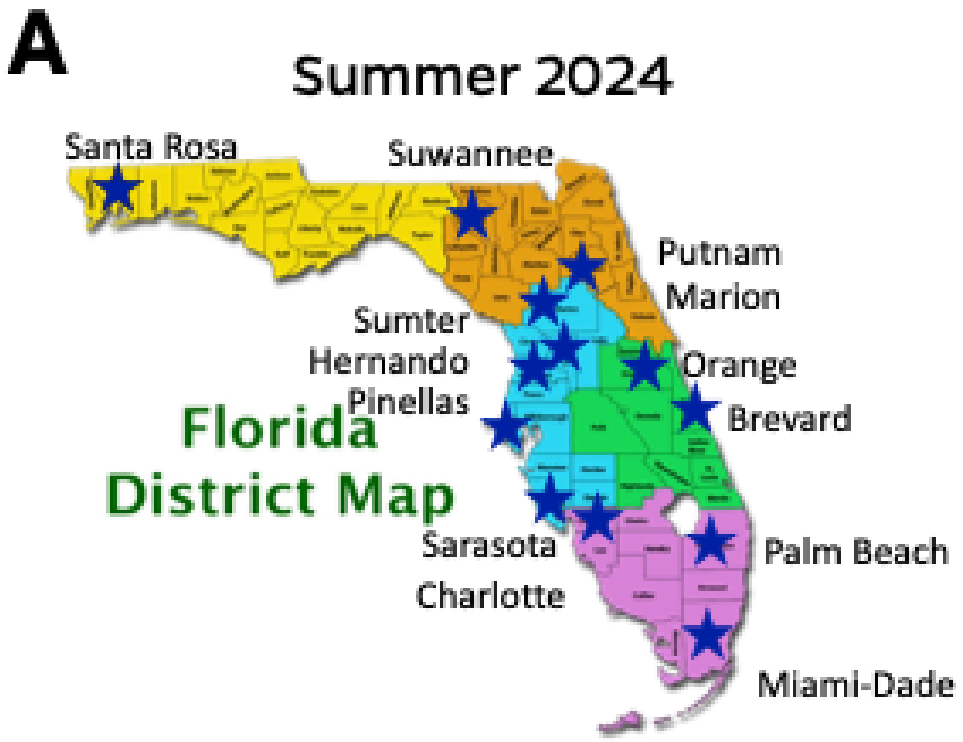
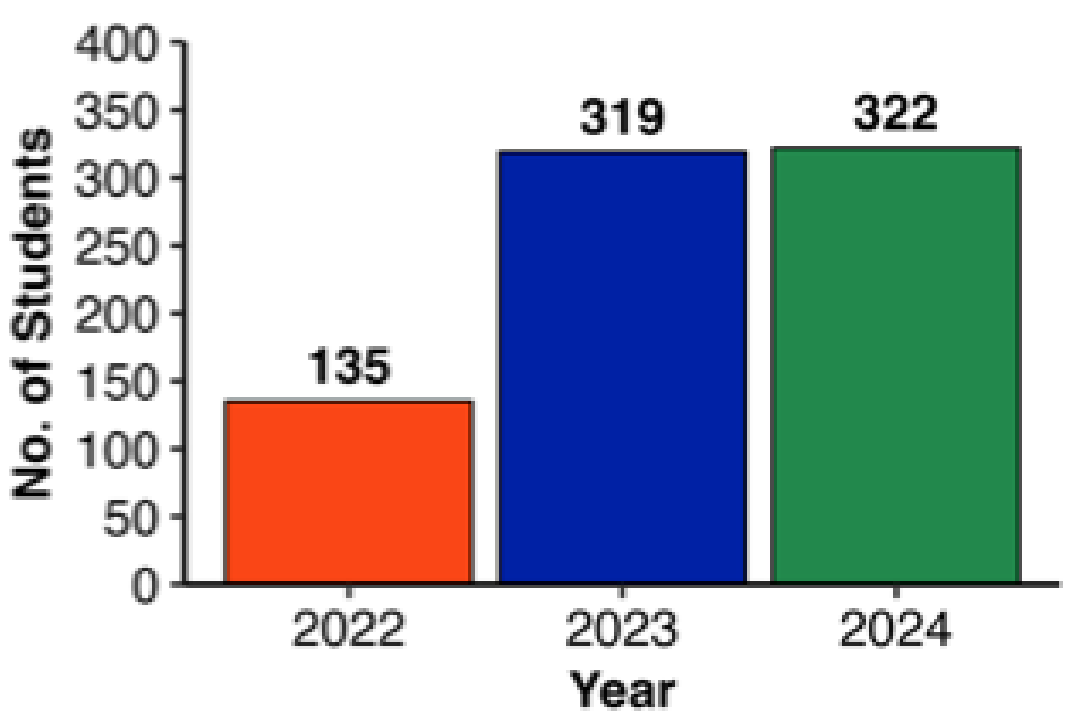
2. Goldberg Gator Engineering Explorers





2. Program Design

Structure

- Funding from multiple donors and a city
- Cost sharing
- Train local teachers and undergrads

Locations

- 13 school districts
- 26 Camp Sessions
- City, Suburban, Town, and Rural

Format Options

- 4 Full Days
  - 7-8 Hours
- 8 Half Days
  - 4 Hours

People

- 23 Teachers
- 22 Undergrad Mentors
- 322 Student Participants Grades 6-9

3. Research Aims

This study aims to investigate the impacts of a STEM summer program on the development of students':

1. *STEM identity as a scientist or engineer*
2. *Role-identity in STEM in terms of interest, competence, and recognition*
3. *Attitudes toward STEM through 21st-century learning skills*

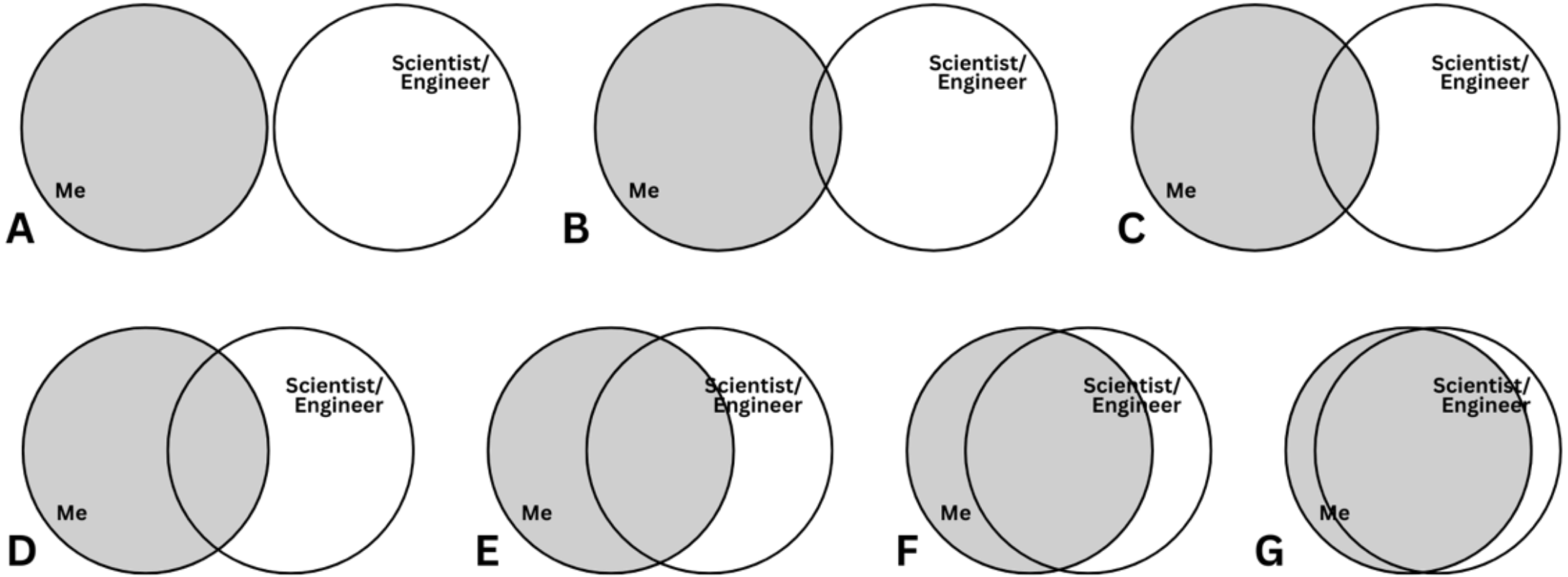
4. Methodology

- Data Collection
  - Pre- and Post-Surveys (Anonymous via Qualtrics)
    - Coding Skills; STEM Identity

4. Methodology

STEM Professional Identity Overlap (STEM-PIO-1) [1]:

Single Item Survey - Overall STEM Identity



4. Methodology

Role Identity Survey – STEM (RIS-STEM) tool [2]:

Assessing students' perceptions of themselves in three facets of STEM role identity:

1. Interest – desire or curiosity in STEM
2. Competence – ability or performance in STEM
3. Recognition – self-recognition and recognition by others as a STEM person.

4-point Likert scale: Strongly Disagree, Disagree, Agree, Strongly Agree.

4. Methodology

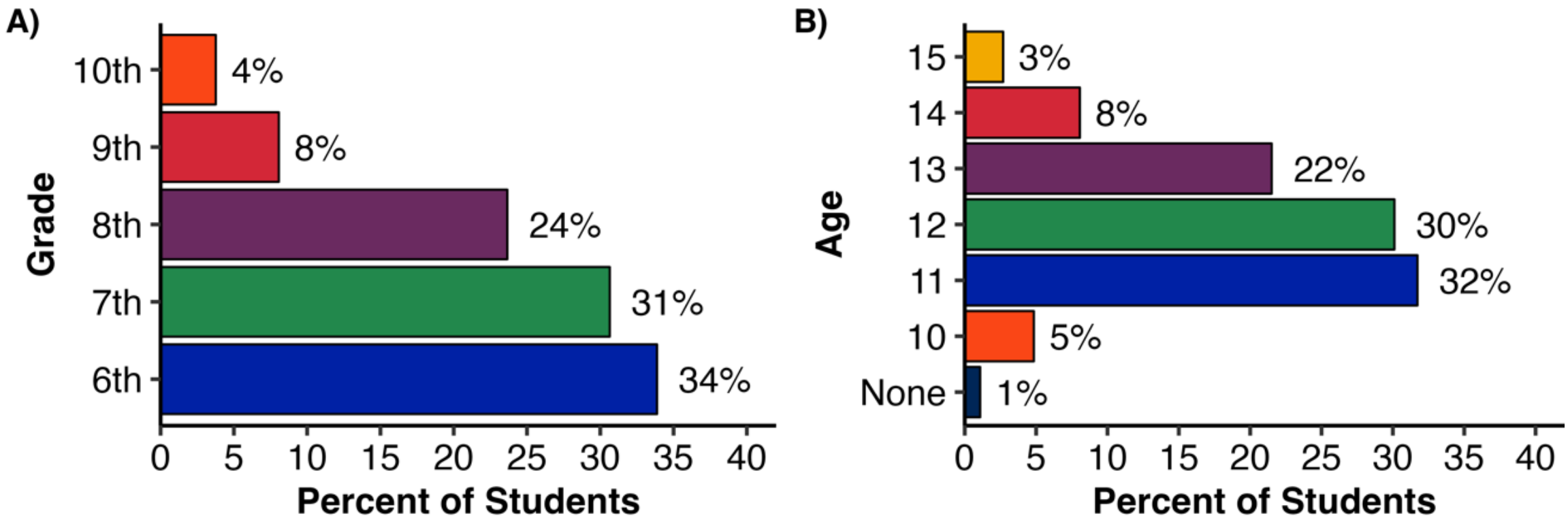
MISO S-STEM – 21st-Century Learning [4]:

Students' attitudes and self-efficacy in STEM by assessing various 21st-century learning skills

A. *I can lead others to accomplish a goal*
B. *I can encourage others to do their best*
C. *I can respect the differences of my peers*
D. *I can help my peers*
E. *I can listen to other people's ideas*
F. *I can work well with students from different backgrounds.*

4-point Likert scale: Confident at All, A Little Confident, Confident, Very Confident

5. Results and Discussion

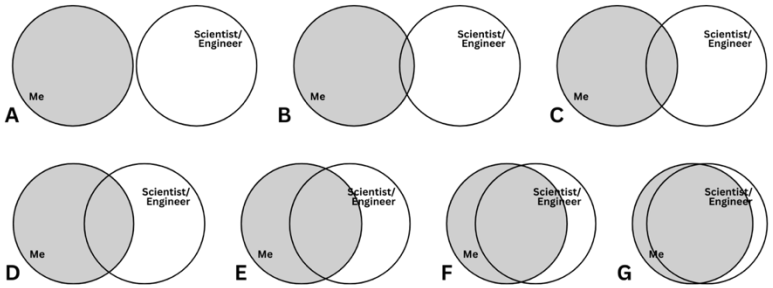


5. Results and Discussion

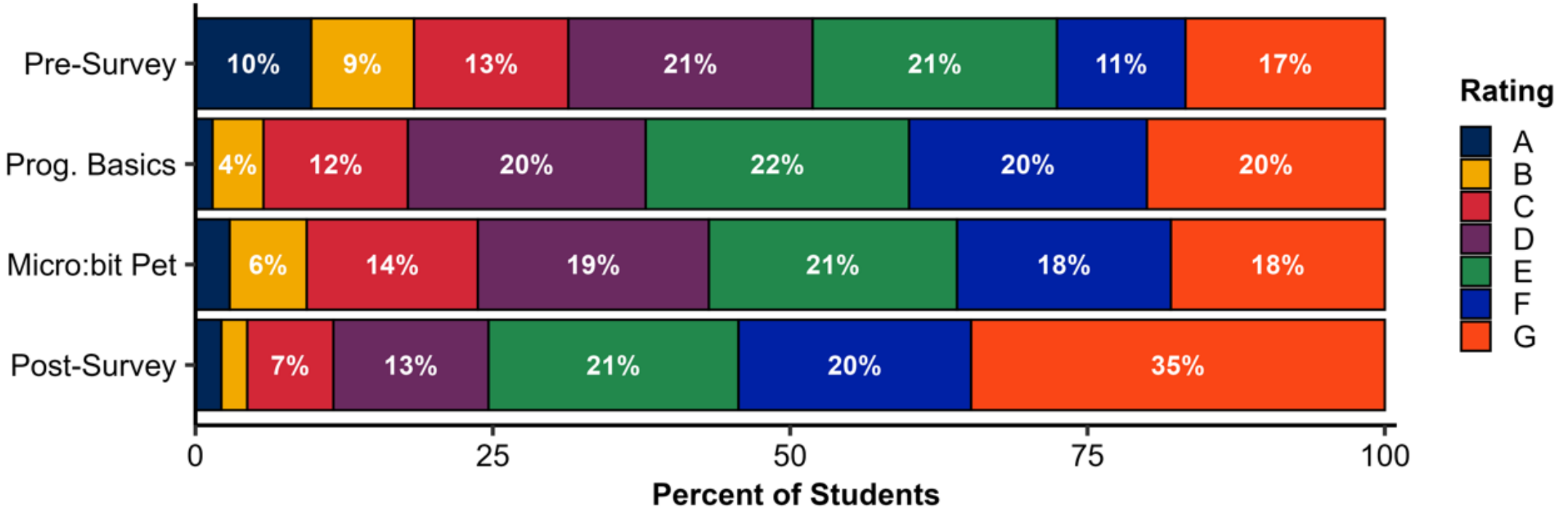
Table 1. Student participant demographics.

Category	Participants
Gender (n=186)	
Female	24.7%
Male	73.7%
Prefer Not To Say/Not Listed	1.6%
Race (n=183)	
American Indian or Alaska Native	0.5%
Asian	1.1%
Black or African American	14.8%
White	63.4%
Other Race Alone or in Combination	6.0%
No Race Selected	14.2%
Ethnicity (n=183)	
Hispanic or Latino	26.8%

5. Results and Discussion



STEM-PIO-1

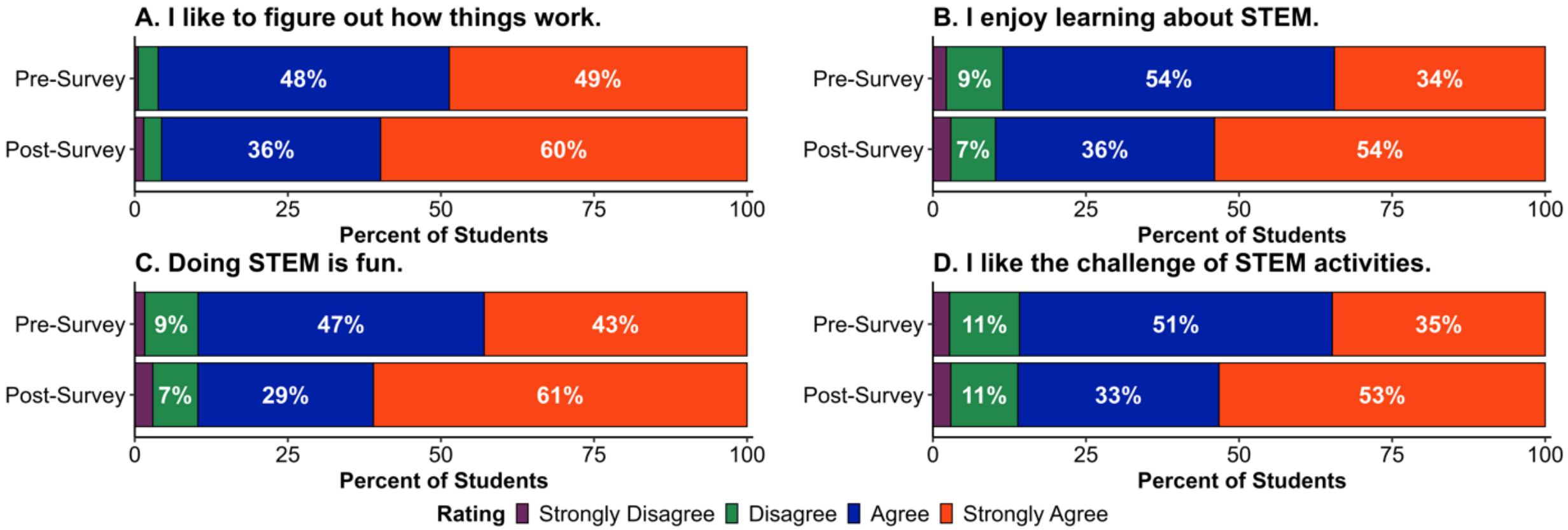


Changes in students' perception of feeling like a scientist or engineer across the duration of the summer program

(n_{pre} = 185, n_{Basics} = 140, n_{MBPet} = 139, & n_{post} = 138)

5. Results and Discussion

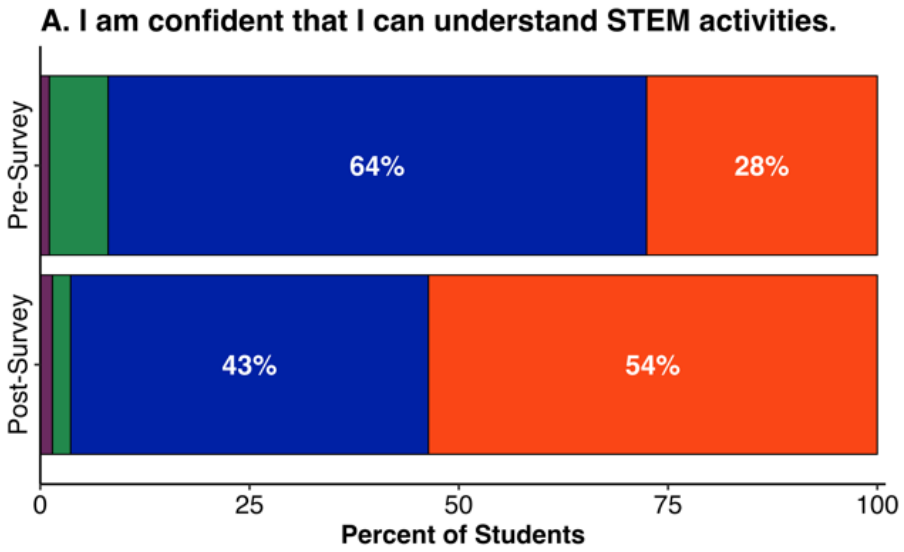
RIS-Interest

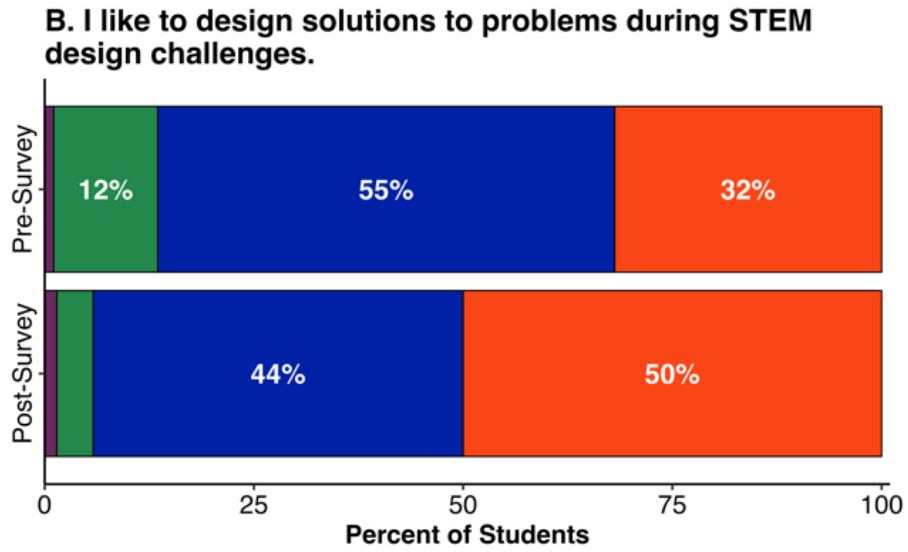


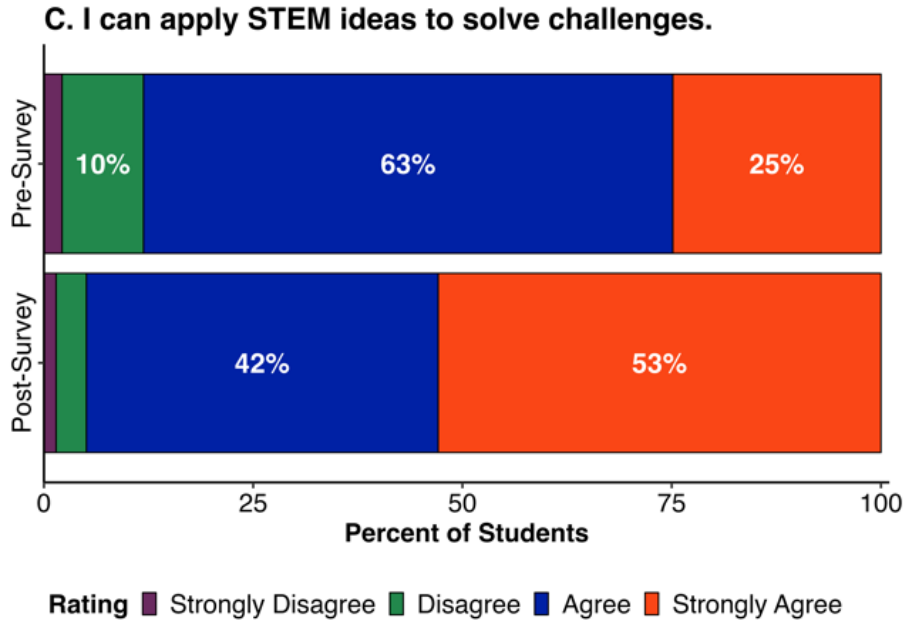
Overall increase in the percentage of students who strongly agree from pre- to post-survey ($n_{pre} = 183$, $n_{post} = 137$)

5. Results and Discussion

RIS-Competence



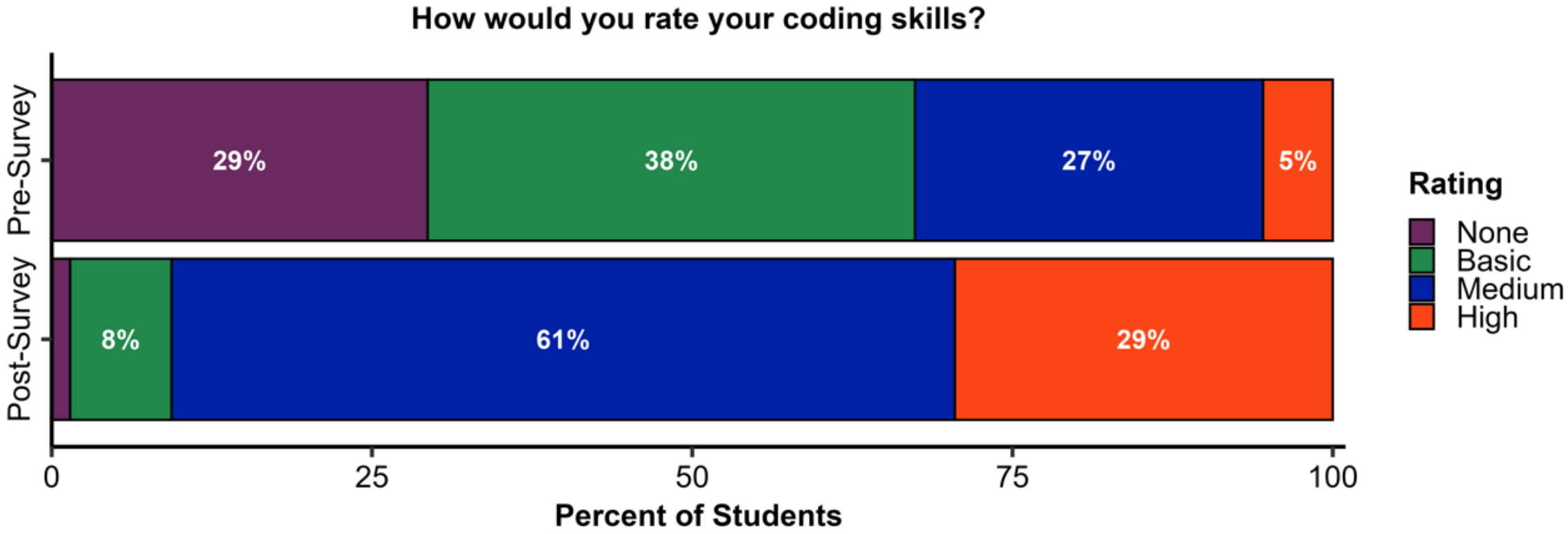




Overall increase in the percentage of students who strongly agree from pre- to post-survey ($n_{pre} = 185$, $n_{post} = 138$)

5. Results and Discussion

Coding Skills

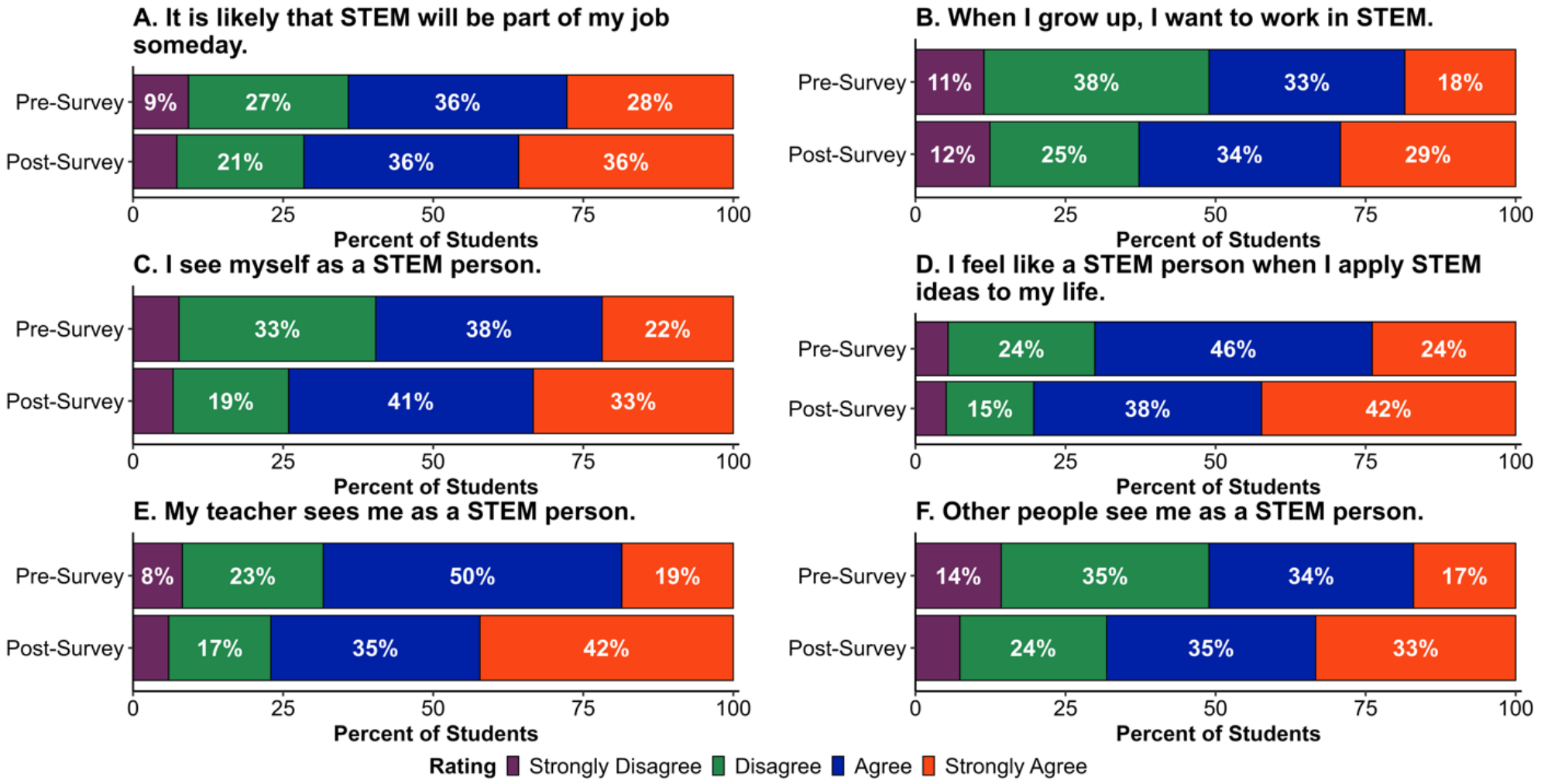


Medium/High Rating Pre-Survey: 32% of students, Post-Survey: 90% of students
(n_{pre} = 184 & n_{post} = 139)

5. Results and Discussion

RIS- Recognition

Overall increase in the percentage of students who strongly agree from pre- to post-survey

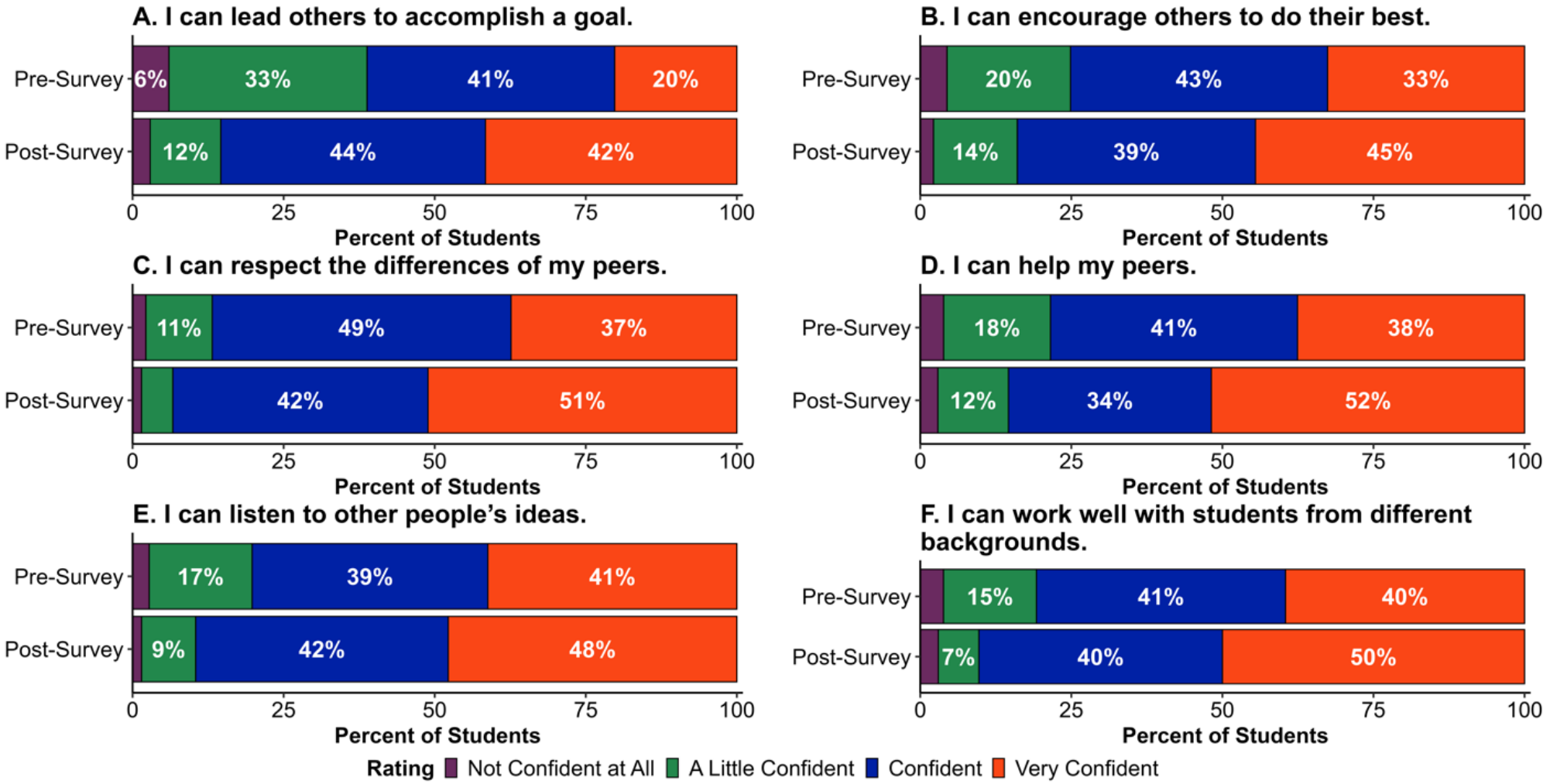


(n_{pre} = 184 & n_{post} = 137)

5. Results and Discussion

MISO S-STEM

Overall increase in the percentage of students who strongly agree from pre- to post-survey



($n_{pre} = 181$ & $n_{post} = 137$)

6. Conclusions

- The results of this study demonstrate that participation in the GGEE program effectively builds student STEM identity, attitudes, self-efficacy, and 21st-century skills.
- The percentage of students selecting the **STEM-PIO-1** option with the highest level of overlap between them and a scientist or engineer **increased by 107%** (pre-survey 16.8% of students, post-survey 34.8% of students).

6. Conclusions

- In all three areas of the **Role Identity Surveys (RIS-STEM)**, **students arrived with some level of role identity in STEM**, and that **identity continued to grow stronger** in the student population after participating in the summer program.
- The 21st-century professional skills measured by the **MISO S-STEM** survey tool demonstrated **increases ranging from 17% to 110%** in the percentage of student participants **who felt "very confident" in using professional skills**.

6. Future Work

- The GGEE research team is completing a thematic analysis of the interview transcripts from participating students to supplement and provide additional context on the impacts of the summer programs assessed through the surveys.
- The GGEE program is also tracking longitudinal data of students to see their STEM course trajectory after the camp, to see if the camp experience has any impact on their academic career towards STEM.

Acknowledgments

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- The opinions expressed in this paper reflect those of the authors and do not represent the views or opinions of other individuals within the University of Florida. All work from this program is original.
- University of Florida Institutional Review Board (IRB202102451)

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THANK YOU!

ANY QUESTIONS?

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