Baskin Engineering Excellence Scholars Bridge Program: Planning, Implementation, & Evaluation

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AGENDA

- Goals of Baskin Engineering Excellence Scholar (BEES) bridge program
- BEES planning
- BEES Implementation
  - Program’s schedule
  - Curriculum
- BEES Evaluation

WHY BEES?

- The program is designed to provide early intervention to reduce or eliminate achievement gap in the School of Engineering by focusing on CS and Mathematics placement of students.
- We have previously observed FOUR main achievement gaps:

  1. female vs. male,

  2. first-generation (are first in their family to attend a four-year college) vs. non-first-generation,

  3. LatinX vs. non-LatinX, and

  4. Educational Opportunity Program (EOP) students vs. non-EOP

  at our institution, an EOP student is one who has been identified as having educational disadvantages via family income, first-generation status, attended historically under-performing schools, are currently in the military, were raised in a foster family, or are undocumented students.

PROGRAM GOALS

- Preparing students for core engineering and computer science programming courses such as CS1 and CS2,
- Providing students with the required mathematics preparation for engineering majors,
- Learning to develop a growth mindset,
- Helping students build self-efficacy and confidence,
- Bonding with the cohort & peer-mentoring opportunities, and
- Campus belonging.

PROGRAM IMPLEMENTATION

- The program was hosted beginning September 13, 2020, and concluding September 26, 2020 through Zoom.
- The first day was allocated for student on-boarding and orientation, and the last two days were dedicated to introducing students to campus resources and a team-based programming hackathon.
- 43 eligible students from all engineering majors (Computer Science, Computer Engineering, Electrical Engineering, Technology and Information Management, Robotics Engineering, and CS Game Design)

PROGRAM COMPONENTS

***Lectures*:** Two faculty from the CS department taught programming lectures, and a former community college Math professor was hired to design and teach mathematics lectures.

Problem-Solving Sessions: Two graduate instructional assistant students and six undergraduate tutoring assistants were also hired to facilitate problem-solving sessions to reinforce concepts introduced in the programming and Math lectures.

Mentor Check-in: Each day of the program was wrapped up by students checking in with their peer-mentors or undergraduate advisors.

PROGRAM SCHEDULE

9 AM - 10:30 AM	Programming Lecture
10:30 AM – 11 AM	Break
11 AM – 1 PM	Programming Problem-solving Session
1 PM – 2 PM	Lunch Break
2 PM – 3:30 PM	Math Lecture
3:30 PM – 4 PM	Break
4 PM – 5:30 PM	Math Problem-solving Session
5:30 PM – 6 PM	Mentor Check-in

PROGRAM CURRICULUM

Mathematics	Programming
Numbers, set theory, and functions	Introduction to Python
Solving equations & inequalities	Variables, expressions, and operators
Trigonometry	Conditional control flow
Solving trigonometric equations	Control flow continued
Summation notation and probability	Functions
Linear algebra	String
Intuitive calculus	List
Derivatives and Newton’s method	Tuple & Set
Integrals	Modules
Fundamentals of calculus	Programming wrap-up

ASSESSMENT METHODS

Program Goals	Assessment Method(s)
Programming Preparedness	1) Academic Self-Description (Self-Concept) Assessment [1] 2) Science Motivation Assessment [2] 3) Qualitative Program's Effectiveness Assessment (Post-Survey Only)
Mathematics Preparedness	Same as the above (adapted for Mathematics)
Growth Mindset	1) Growth Mindset Assessment [3] - [5] 2) Help-Seeking Assessment [6] 3) Concealment Assessment [6]
Self-Efficacy	1) Academic Self-Description (Self-Concept) Assessment [1] 2) Science Identity Assessment [7] - [8]
Peer-Community	Peer Community Assessment [9]
Campus Belonging	Sense of Belonging to Campus Scale [10]

ACADEMIC SELF-DESCRIPTION

Mathematics (programming) is one of my best subjects.	I often need help in mathematics (programming).	I look forward to mathematics (programming) classes.	I have trouble understanding anything with mathematics (programming) in it.	I enjoy studying for mathematics (programming).
I do badly in tests of mathematics (programming).	I get good marks in mathematics (programming).	I never want to take another mathematics (programming) course.	I have always done well in mathematics (programming).	I hate mathematics (programming).

- There was also no main effects of Gender or EOP status on mathematics and programming self-concept.
- Overall, students had a positive mathematics and programming self-concept.

SCIENCE MOTIVATION

Factor 1: Intrinsic Motivation & Personal Relevance

- The science I learn is relevant to my life.
- The science I learn is more important to me than the grade I receive.
- The science I learn relates to my personal goals.
- I find learning the science interesting.
- I enjoy learning the science.
- Understanding the science gives me a sense of accomplishment.

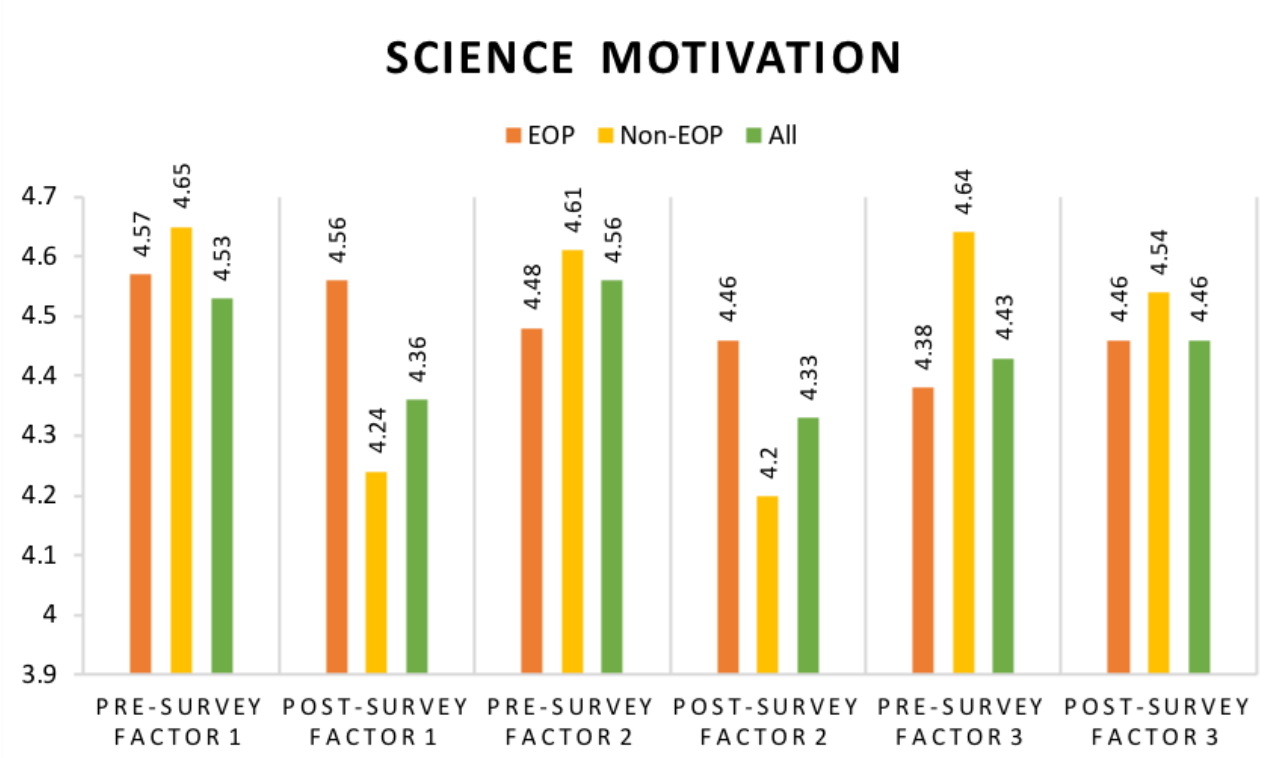
Factor 2: Self Determination

- I put enough effort into learning the science.
- I prepare well for the science tests.
- I use strategies that ensure I learn the science well.
- If I am having trouble learning the science, I try to figure out why.

Factor 3: Career Motivation

- I think about how learning the science can help my career.
- I think about how learning the science can help me get a good job.

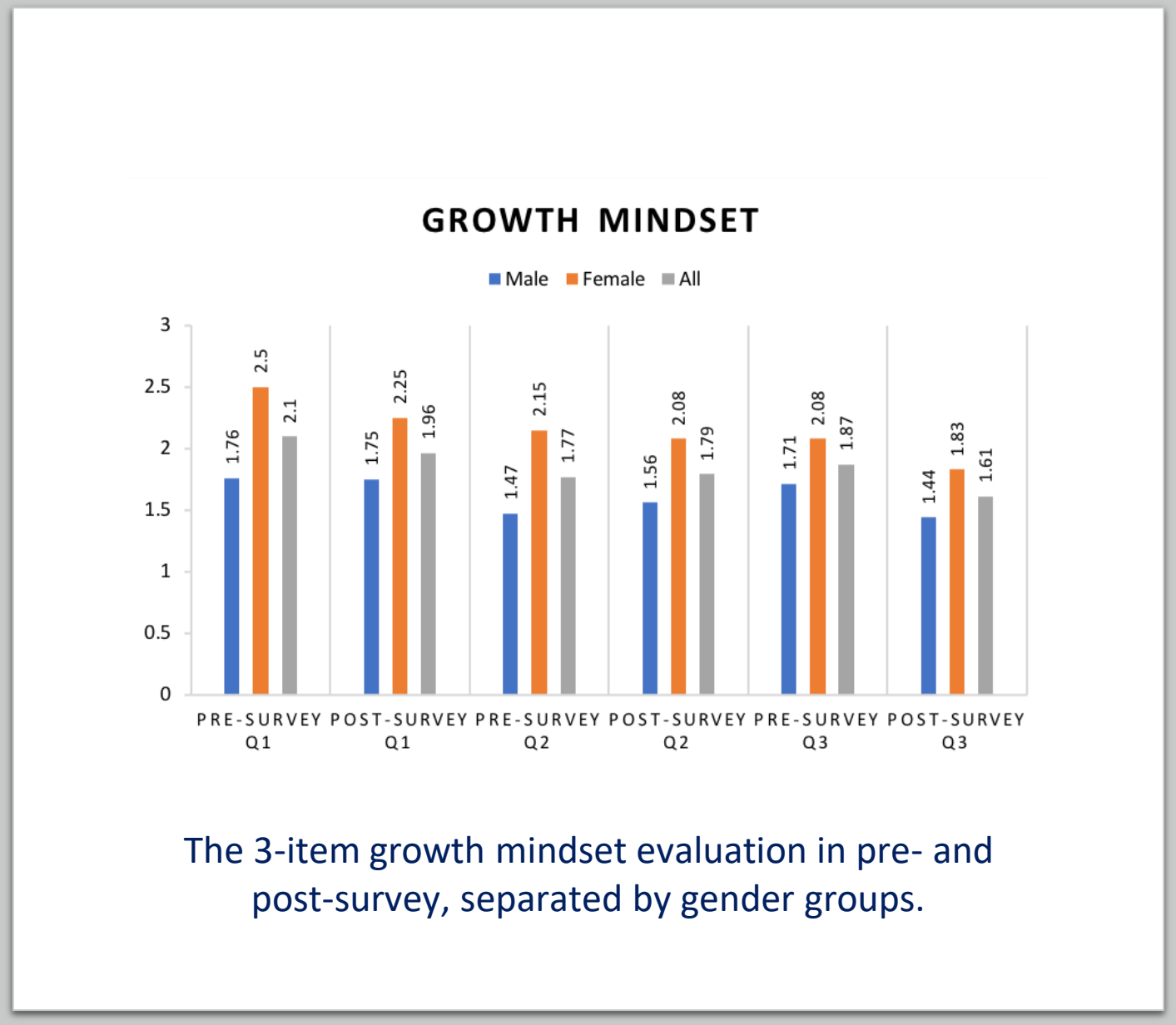
SCIENCE MOTIVATION



Analysis of the effect of the program on students' self-reported science motivation, separated by EOP status. The scale is from 1 (lowest motivation) to 5 (highest motivation)

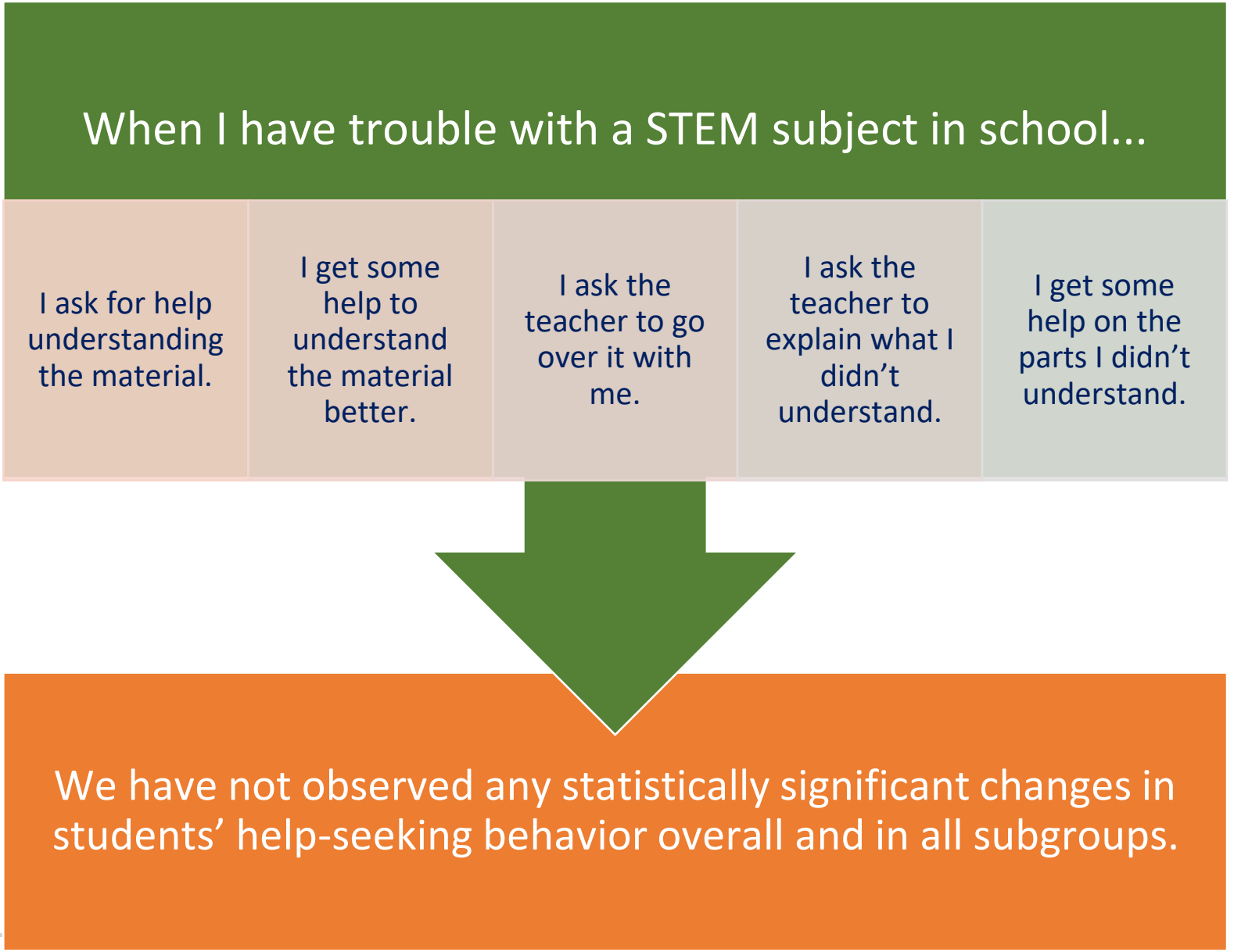
GROWTH MINDSET

- Used implicit theory of intelligence to get students' responses:
  - You can learn new things, but you cannot really change your basic intelligence.
  - Your intelligence is something about you that you can't change very much.
  - You have a certain amount of intelligence and you really can't do much to change it.



The 3-item growth mindset evaluation in pre- and post-survey, separated by gender groups.

HELP-SEEKING ASSESSMENT

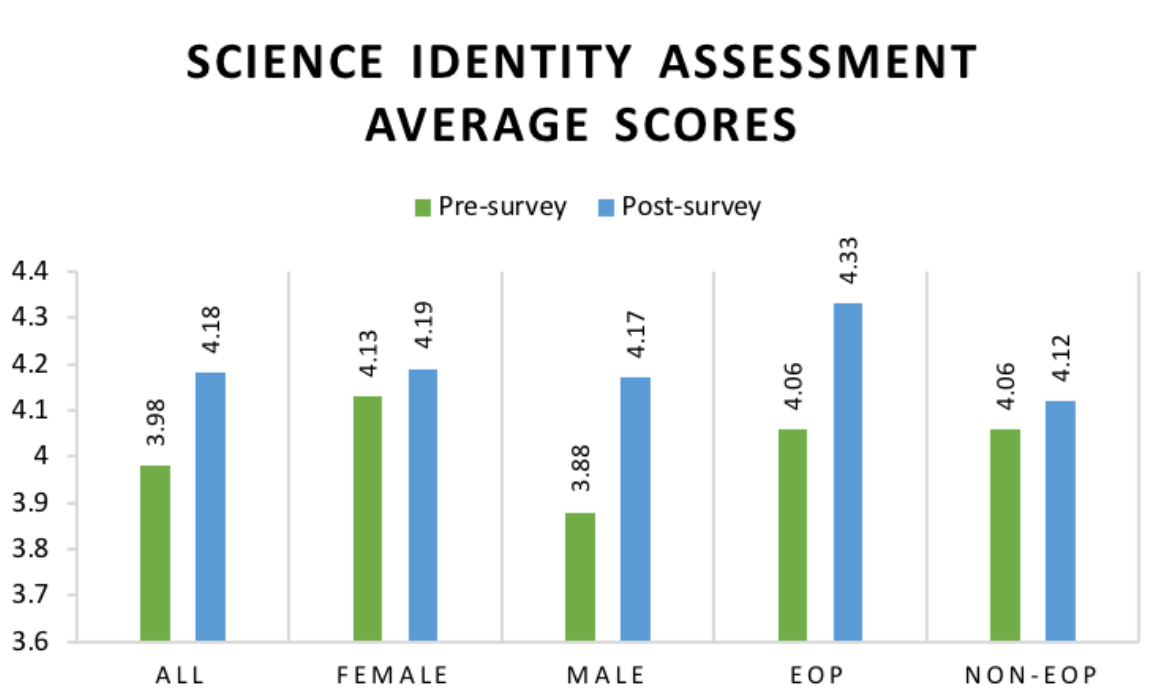


CONCEALMENT ASSESSMENT

- When something bad happens to me in school (such as not doing well on a test or not being able to answer an important question)...
  - I stay away from people.
  - I don’t want to see anyone.
  - I don’t want to talk to anyone about it. I don’t want to talk about it.
  - I try to keep people from finding out.
  - I make sure nobody finds out.
  - I try to hide it.
  - I don’t tell anyone about it.
- We observed that female students and non-EOP status students tend to conceal problems more compared to their peers.
- The average concealment tendency of both groups (female and non-EOP status students) has improved after the program.
- We observed no significant difference in students’ overall tendency to concealing their problems ($\mu_{pre} = 1.87$, $\mu_{post} = 1.88$).

SCIENCE IDENTITY ASSESSMENT

- In general, being a (Science, Technology, Engineering, Mathematics) STEM scientist is an important part of my self-image.
- I have a strong sense of belonging to the community of STEM scientists.
- Being a STEM scientist is an important reflection of who I am.
- I have come to think of myself as a ‘STEM scientist’.



Average science identity scores of the pre- and post-survey data for all students as well as different student sub-groups.

PEER COMMUNITY & CAMPUS BELONGING

Peer community questions:

- I anticipate feeling connected to my peers in the school of engineering community.
- I anticipate feeling connected to my peers around me at BEES.

Campus belonging questions:

- I see myself as part of the campus community.
- I feel that I am a member of the campus community.
- I feel a sense of belonging to my campus.

Most of our students (97%) felt that they are connected to their peers in the engineering school and in our campus.

Additionally, students sense of belonging to the campus community have improved from 90% to 97% after the program.

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