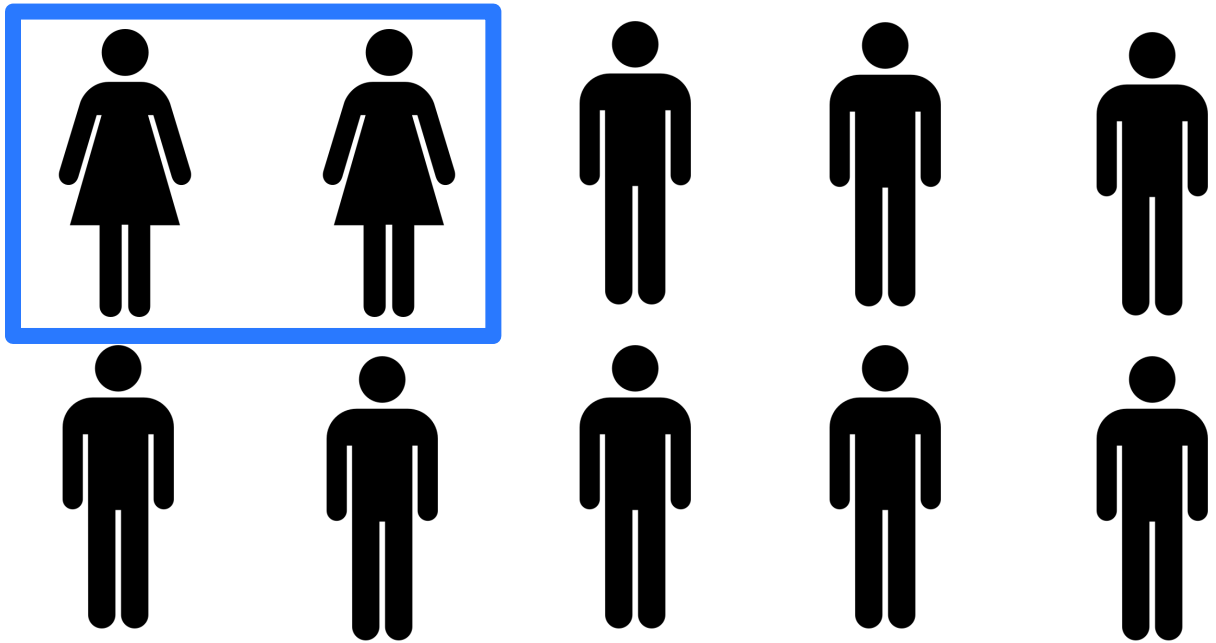

Beautiful Patterns
http://dreamers.mit.edu

In the U.S., *just* **20%** of tech jobs are held by women

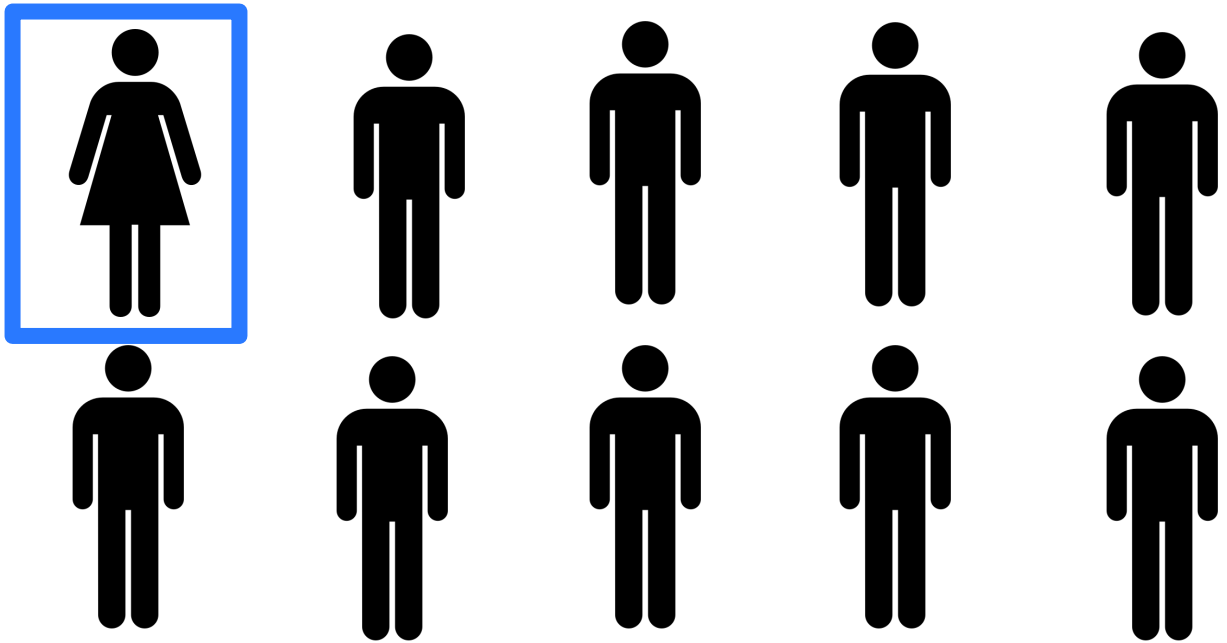


In LATAM & Mexico, the numbers are far worse
Only **10%** of tech jobs are held by women

10%, Argentina

10%, Mexico

9%, Colombia



https://news.sap.com/latinamerica/files/2020/02/Laboratoria_El-futuro-es-diverso-Mujeres-en-tech-en-Mexico.pdf
http://noticias.perfil.com/2017/01/29/informatica-la-nueva-carrera-elegida-por-mujeres/
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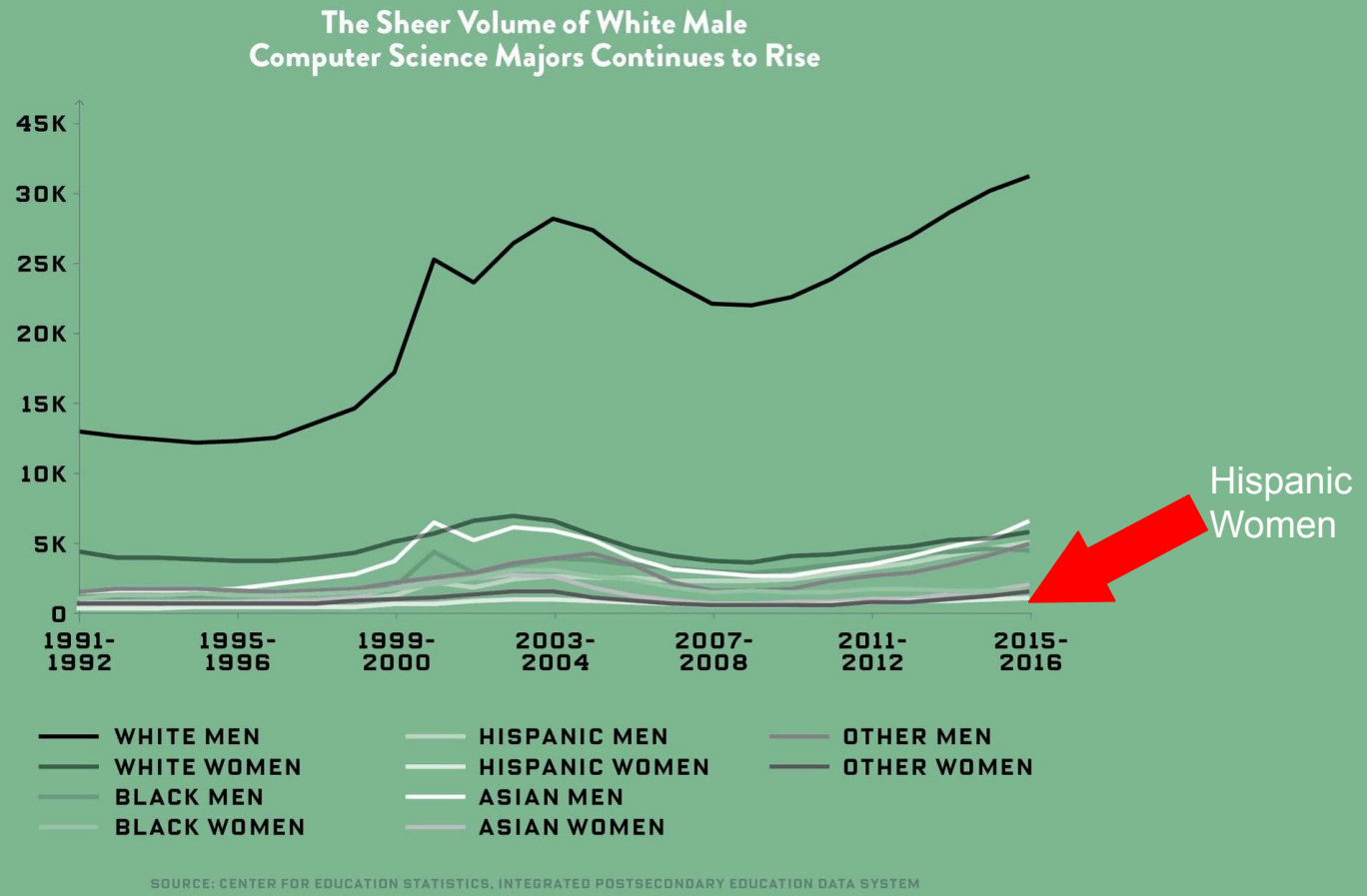
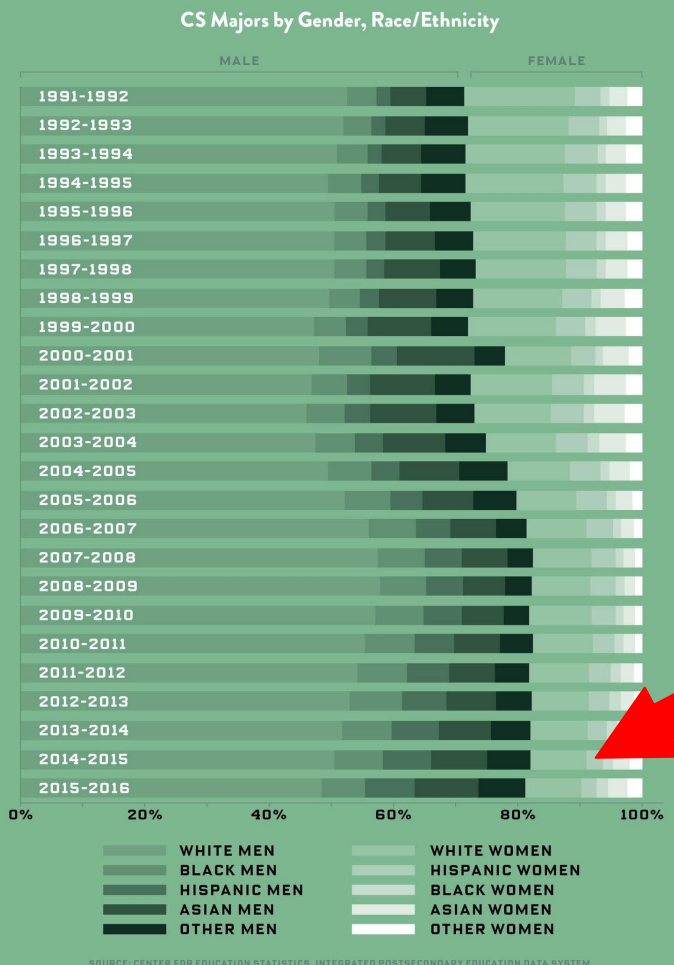


https://www.wired.com/story/computer-science-graduates-diversity/



Hispanic women numbers getting smaller

These numbers are consistent across STEM fields

Agenda

Mission and Vision

Motivations

2018 Overview

Research Efforts

Our Goal

MISSION

Develop algorithmic thinking skills of young women, through a high level program, taught by women students of MIT and other prestigious universities, which allows them to expose their talent internationally.

VISION

Promote the transformation of the economy through talented young people, whose skills developed within the program allow them to compete globally and access better education and work opportunities.

Motivations

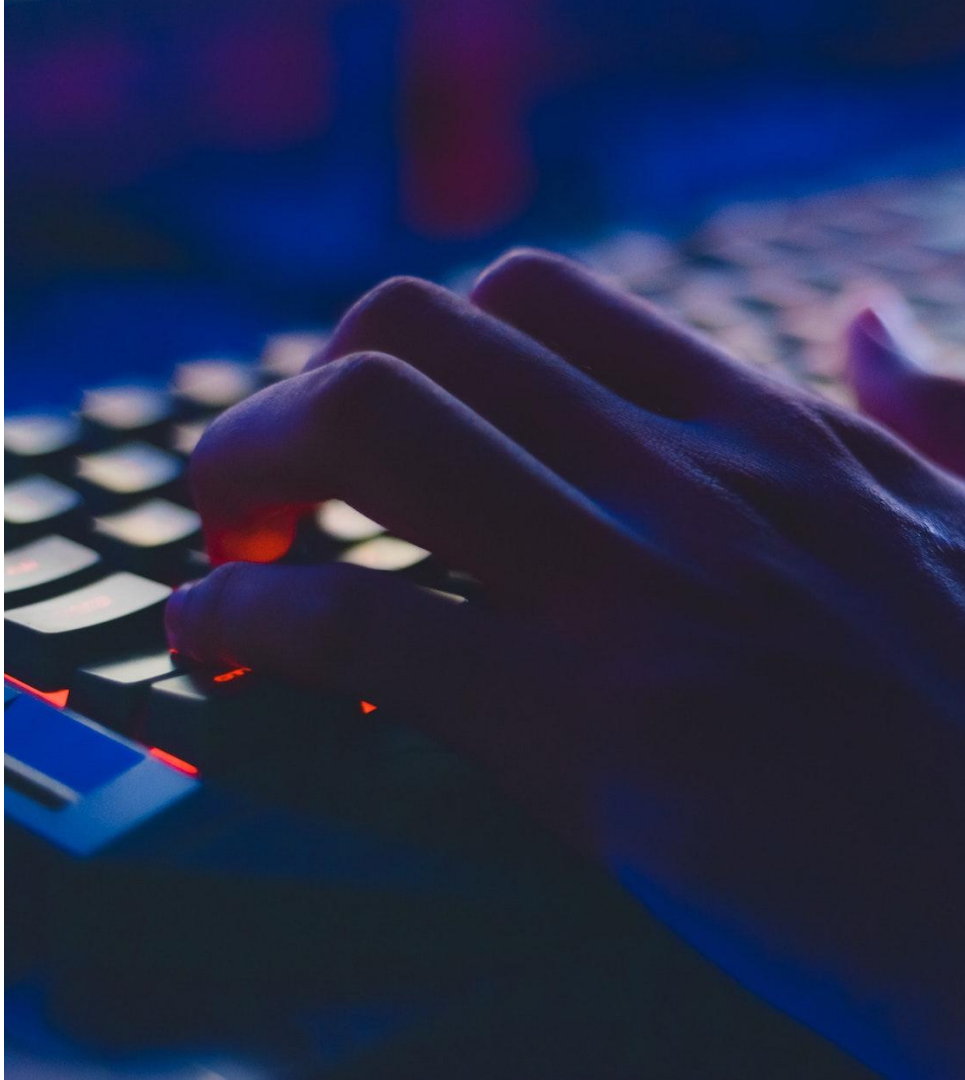
Why is this work important?

Students celebrate after the Towers of Hanoi competition

A new basic skill

Our economy is rapidly shifting, and both educators and business leaders are increasingly recognizing that computer science (CS) is a “new basic” skill necessary for economic opportunity and social mobility.

Unfortunately, in the developing world, the access to computational thinking education is rare. **For high school young women, the access is practically non-existent.**



The numbers

In México women:

- Represent 19% of STEM workforce

- **Make up only 10% of computer science students**

Research shows that diversity is beneficial for a variety of reasons; increased diversity leads to better decision-making, more innovation, and generally improved outcomes. Gender is an important aspect of diversity, the numbers show we still have a long way to go.

Our objective

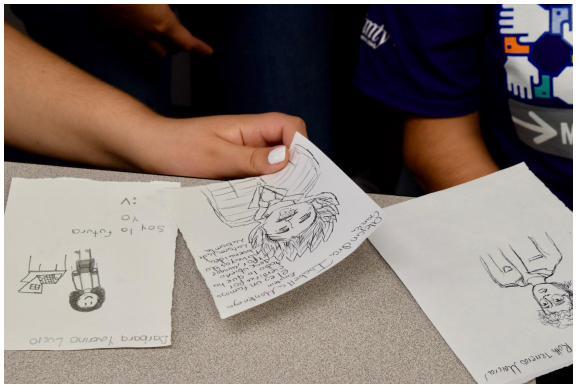
The goal of this project is to deliver computational thinking workshops to high school young women in Mexico… **to reach young women before they make career decisions and motivate them to consider careers in computation**.

For an entire week, the Mexican high school students get to learn from women who are studying Computer Science at an elite U.S. college -- the curriculum is specifically designed to engage them in computational concepts and to foster relationship among students and instructors alike.

Gender stereotypes

This program is unique because it's **women teaching other women**. We want the high school students to **see people like themselves studying Computer Science, so that they can imagine themselves doing it, too.**

We intentionally bring the issue of gender to the forefront; on the first day, we ask the students to *"draw and describe an engineer."* Then they share their drawings and discuss the patterns. The exercise is not only a great artistic outlet for the students, but also the perfect opportunity to illuminate gender stereotypes.



Friendships & a learning community

Learning doesn't happen in isolation; it occurs within learning communities. Over the weeklong program, all participants - high school students, U.S. college instructors, and Mexican college TAs - build **long-lasting bonds and friendships** with each other.

For everyone, the program is a unique opportunity to learn about another culture; to gain exposure to different realities; and to learn and teach side-by-side. It's not only the students who benefit, but the instructors and TAs too.

Overview

What did we do this year?

Students draw their own binary clocks

We have had 100x growth in 2 years

ACROSS MEXICO...

2000+ students

(private and public high school students)

300+ instructors

(undergraduate and graduate students from US universities, including MIT, Wellesley & Stanford)

600+ TAs

(undergraduate students from Mexican universities)

55 supporting staff members

(teachers, directors of research, campus directors, department directors, researchers, & more...)

30 universities, 23 cities

(in Aguascalientes, Chihuahua, Guadalajara, Mexico City, Monterrey & Puebla)

Tec de Monterrey, one of 23 sites for the 2019 program

Network of **30** universities, **23** cities in Mexico

A few faces: instructors - MIT / Wellesley


Abigail Choe


Aliza Camacho


Becky Bell


Chessa Hoekstra


Daniela Ganelin


Donna Gan


Dorothy Sun


Emily Rogers

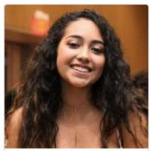

Erica Yuen


Erica Santana


Janelle Sands


Lwin Moe


Melody Cao


Navil Perez


Emma King


Nidhi Sharma


Nomi Vilvovsky


Olivia Siegel


Olivia Waring


Pankhuri Sen


Priya Kher


Pushpita Bhattacharjee

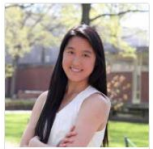

Randi Williams


R'mani Haulcy


Silvia Vazquez


Sophie Mori


Stephanie Hu


Veronica Lin


Alyssa Dayan


Heather Hausladen


Peniel Argaw


Kasturi Shah

A few faces: Mexican TAs


Alejandra Arriaga


Alejandra Savage Briz


Alejandra Velasco


Ana Lucía Rodríguez Hernández


Ana Robles


Anasofia Ordaz Estrada

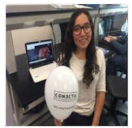

Andrea Alejandra Mondragón Olivoss


Carolina Barreiro Valdez


Carolina Castañeda León


Carolina Jiménez Rossainz


Cinthya Rosasa Casanova


Daniela Abigaíl Parrales Mejía


Daniela Ortiz Bibriesca


Denise Enkerlin


Dianne Villicaña


Estefanía Botello Ramírez


Estefanía Pitol Martínez


Fatima del Rosario Arámbula Coronado


Fatima Ramirez


Gabriela María Garza Cantú


Gladys Garza Ortega


Jeanette Mosqued Cruz


Jenifer Alondra Romero Flores


Jessica Guadalupe Sánchez Martínez


Jessica Janeth Cisneros González


Karla Alejandra Pedroza Bonilla


Karla Esbeidy Zamora Ferniza


Karla Michelle Márquez Ruiz


Lizzeth Muñoz


Lourdes Beatriz Cajica Maceda


Maria Aracelia Alcorta Garcia


María Fernanda Pérez Rodríguez


María Inés Mendoza Rodríguez


Mariana Valdez Díaz


Mariana Delavega


Marijose Davila


Mirian del Carmen Hipólito García


Monserrat Navarrete


Natalia Serrano


Paola Garzon Villar

Sarahí Aguilar González

Sofía Durazo

Sofía Durazo Angulo

Sonia Ramírez Sánchez

Tabatha Tabeli Acosta Pastrana

Valeria Rodríguez Espinoza

Verónica Rodríguez Rico

Shareni Berenice Ortega Guerra

Sample Host, ITESM Guadalajara

Hands-on activities

Rationale

Students learn best when constructing knowledge themselves. Hands-on activities, both individual and in groups, help students internalize the computational thinking concepts. They're engaged and motivated in different ways than they're used to, creating a learning environment that is **supportive, enjoyable, and effective.** Students are presented with challenges and asked to discover and test a variety of algorithms and strategies; instructors and TAs serve as mentors in this process.

Examples of activities:

Stable marriage algorithm -- kings & queens making pairs card activity

Binary counting & binary clocks activity

Cyphers activity

Towers of Hanoi activity

A group of students works with a jumbo set of K & Q playing cards to discover the stable marriage algorithm.

The class practices binary counting together, before a class competition.

Coding activities

Rationale

After doing hands-on activities in the morning, students put these concepts to use at the computers. Students are walked through carefully-scaffolded coding exercises throughout the afternoon, with **a mix of instruction and learning-by-doing**. They are also tasked with a weeklong final project, which they work on for a few hours each afternoon and present at the end of the week. Each group gets to choose a topic that they're passionate about, and apply the algorithms and coding skills that they've learned.

Examples of activities:

Creating patterns of colored balls

Mona Lisa activity

Animating balls

Final project

Two students work together to code their website for their final project.

Classroom instructors and TAs help students with the coding activities.

Research Efforts

What data did we collect?

“Don’t be afraid of something going wrong… everything is an experience.”

Methods

PRE- & POST- SURVEYS

Who: students & parents

What: ~15 min questionnaires using Google forms

Why:

1) Measure changes in interest, confidence, identity, & usefulness, as they relate to attitudes towards Computer Science
2) Collect demographic data, such as level of English, public vs. private school, parent occupation

DRAW AN ENGINEER TASK

Who: students

What: draw an engineer and describe what you drew

Why:

1) Illuminate perspectives about gender stereotypes and identity
2) Allow students to express themselves using artistic means

DAILY REFLECTIONS

Who: students & instructors

What: submitted at the end of every day via Google forms or self-recorded videos

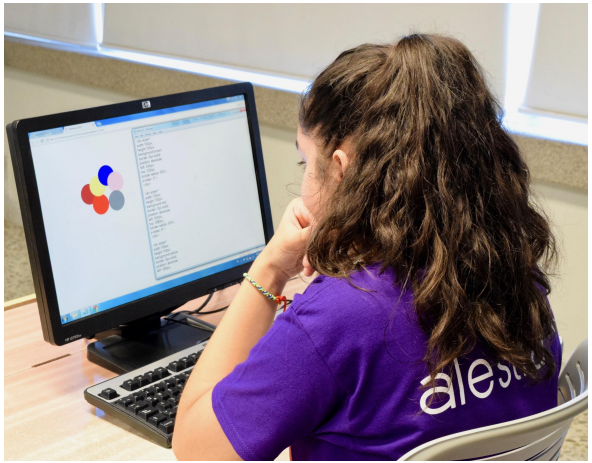
Why:

1) For students: demonstrate learning and areas of confusion
2) For instructors: reflect on own teaching practices and how to improve

Early findings

We helped students learn and apply new skills in computational thinking and programming

Their final projects covered a diverse set of topics, such as transportation, pollution, corruption, and shopping.



"It was a very good opportunity to learn and acquire more knowledge. I would not have been able to pay for that course, it is amazing that there are people who care about teaching other people and for free. Thank you very much." (Parent)

"I was really proud of myself because I didn't think I would be able to do the JavaScript ball task, but after doing the challenge, I was even able to draw flowers, and I really liked it." (Student)

"I think this course had an impact on my life right now because it's something I can apply in everyday life." (Student)

Early findings

We created learning communities, where students, instructors, and TAs learned from one another

"We were inspired by the girls' motivation and potential." (TA)

"This program let my daughter meet girls with similar interests, girls who have managed to excel in the field and have overcome different obstacles." (Parent)

"I was able to form meaningful relationships with my students in just 5 days and I will never forget them. I'm very grateful to have met them and to have been a part of this program." (Instructor)

"In the beginning, I was confused, but then my classmates explained it to me so that I could understand it better." (Student)

Early findings

We empowered students to feel confident with technology and to use their skills towards building a better world

"An invaluable opportunity, she met girls with other interests, instructors from other parts of the world which, in addition to more knowledge, opened a panorama of possibilities." (Parent)

"My personal goal is to make a webpage to help my mom or someone else." (Student)

"My goals are to learn more about technology to develop medicinal things to help people with disabilities or illnesses." (Student)

"This course had an impact on my life right now because it's something I can apply in everyday life." (Student)

"The whole week was powerful experience, I learned a lot of things and I'm also very proud of myself." (Student)

We also changed instructors' attitudes about technology, themselves, and teaching

"Girls were really excited to have female role models, so trying to live up to their expectations made me challenge myself the entire week." (Instructor)

"I really enjoyed sharing with them the concepts that I like and making them more enthusiastic about computing. I am impressed by how quickly they integrated and learned." (TA)

"This experience has shown me that I really enjoy teaching and taught me that I still have a lot to learn about teaching. But seeing the powerful outcomes of the program have encouraged me to continue seeking more opportunities in education, especially in computer science, technology, and engineering education." (Instructor)

"This experience got me thinking about opportunities in the education field, especially mixed with technology." (Instructor)

Early findings

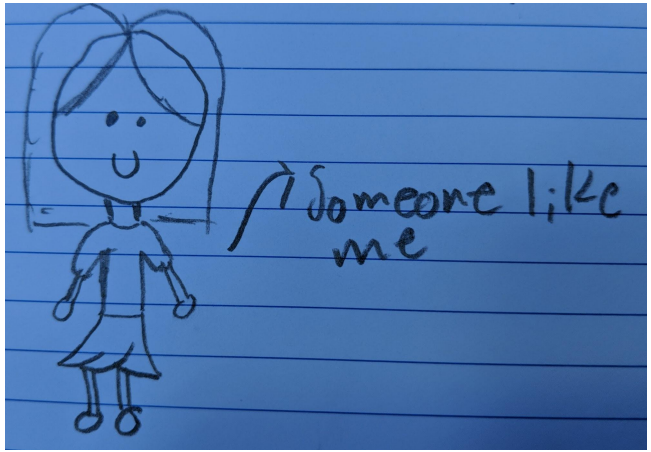
We changed students' attitudes about computing and gender stereotypes

"After the camp, I definitely know that I want to do something with Computer Science -- it's definitely changed my perception on Computer Science and Engineering." (Student)

"My personal goals are to learn more about what technology and computers do." (Student)

"I am proud to do something that not so many women do, and I am really interested in being someone who could motivate girls to do these kinds of activities." (Student)

We asked students to "draw an engineer"... and this is what a student drew:



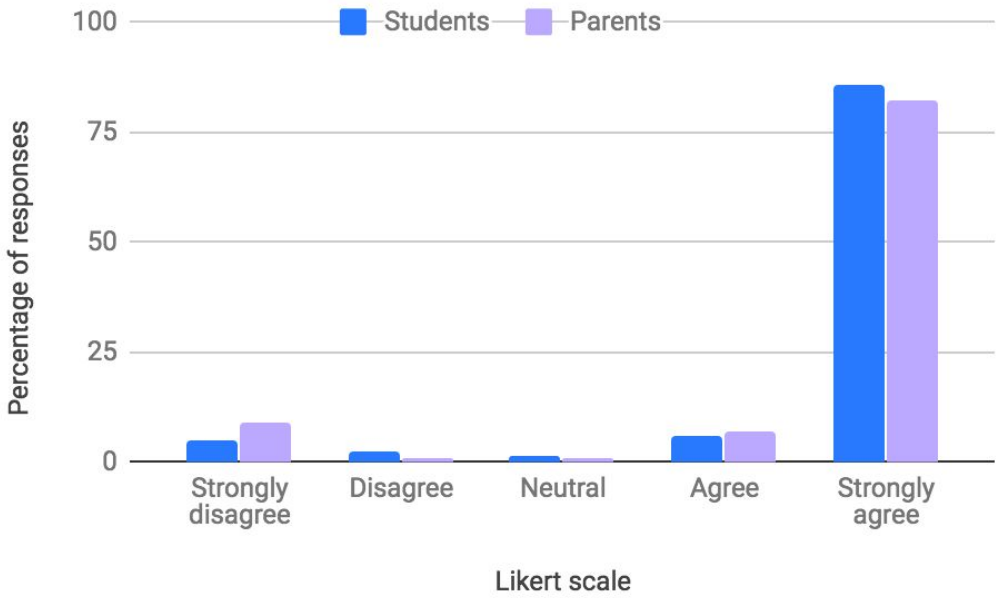
Early findings

We investigated parent and student attitudes about gender stereotypes; our work is cut out for us

In pre-workshop surveys*, we asked both students (n = 355) and parents (n = 647) to answer a Likert scale on a series of statements. For the following two, the responses were nearly identical; see graph to the right.

1. Females are as smart as males.
2. Females are as good as males in computer science.

Almost 100 respondents (approx. 7% of students and 10% of parents) disagreed, revealing a key area for impact.




Thank You!