



Young women in STEM

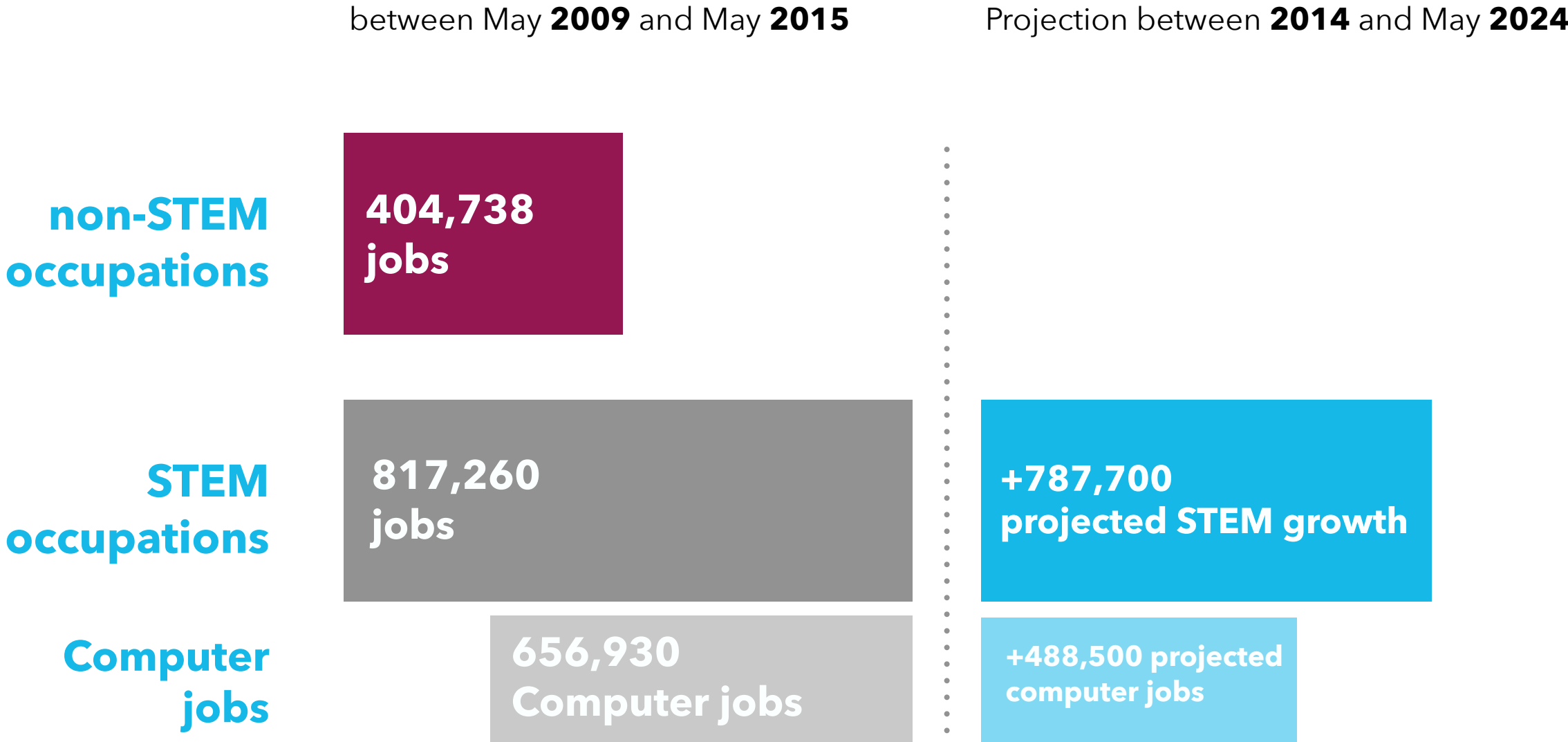
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Research question

How can we foster a sense of belonging for young women in STEM pathways?

Growing demand for skilled workers in STEM



US gender gap in STEM fields

CS Degrees
for U.S. citizens and
permanent residents

37,098

MALE

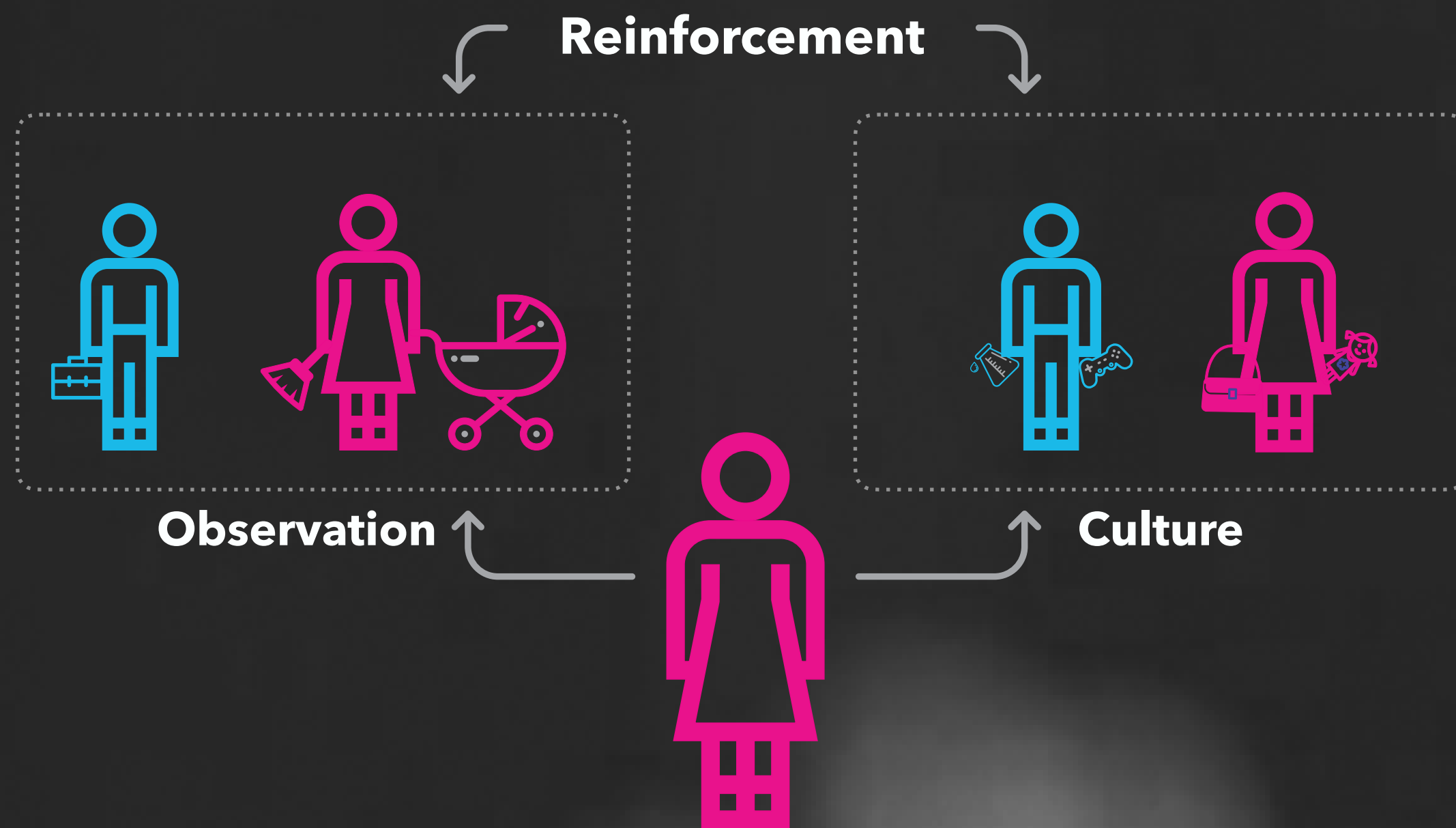
29,611

FEMALE

7,487

- 3,982** - White
- 1,475** - Black or African American
- 870** - Hispanic/Latina
- 497** - Other
- 353** - Asian
- 183** - Multi-ethnic
- 98** - American Indian or Alaska Native
- 29** - Native Hawaiian or Other Pacific Islander

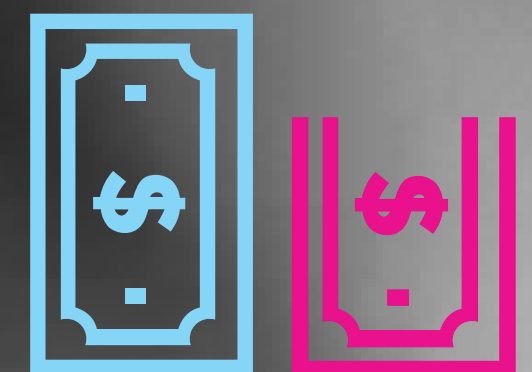
Gender bias: Economic, social, & cultural influence



An **AAUW** study found that among full-time, year-round workers in **2013**, **women** were paid

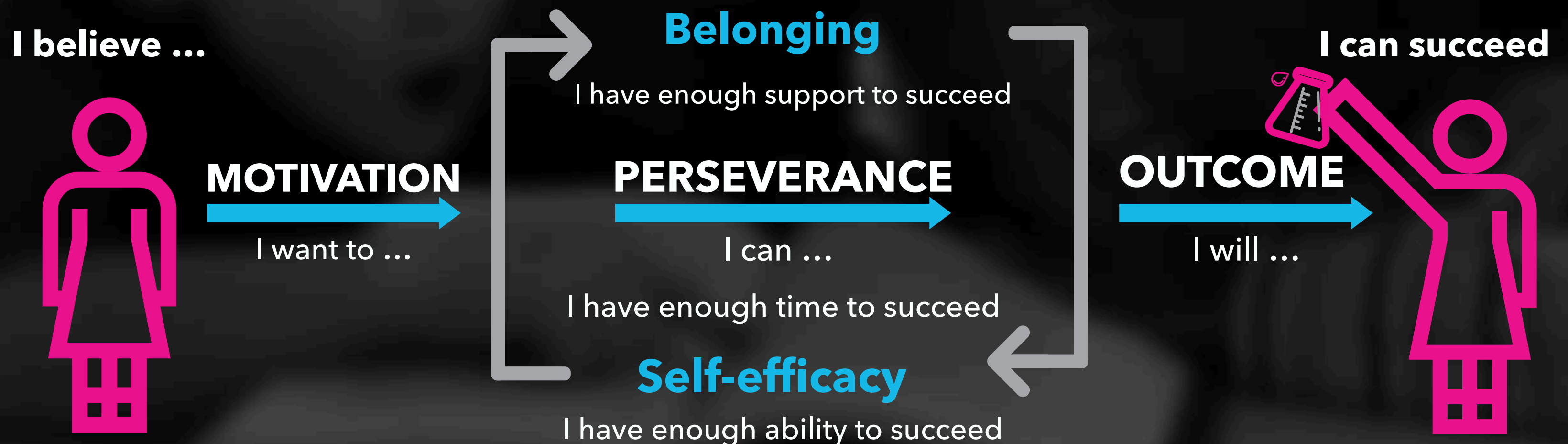
78%

of what **men** were paid



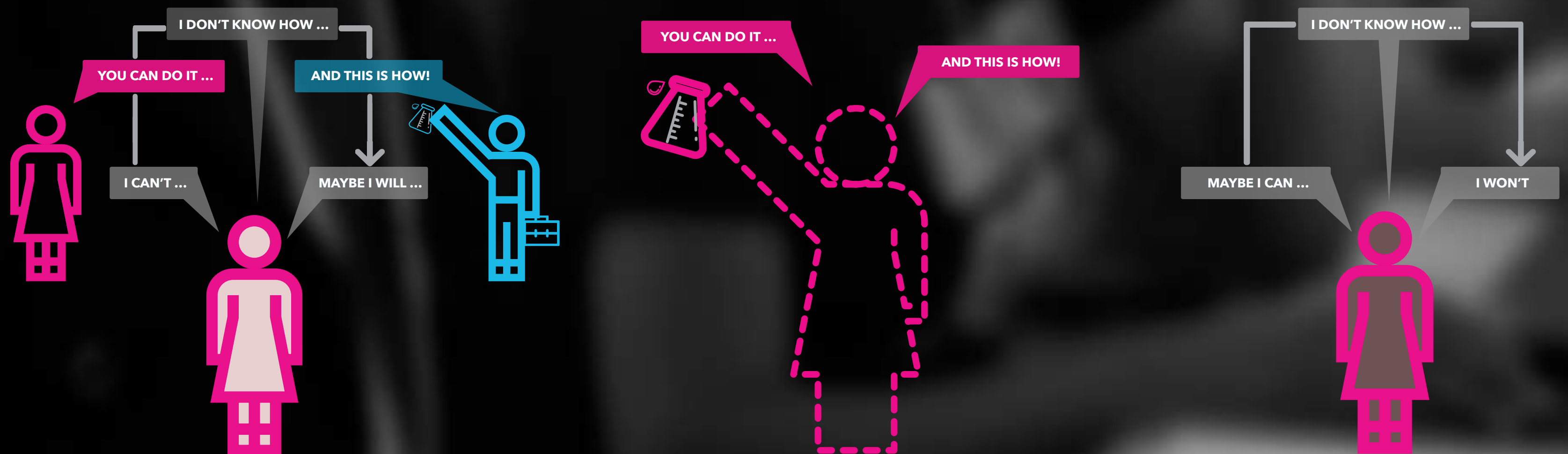
Self-efficacy & belonging

Students' **sense of belonging** plays a critical role in shaping the **motivations, self-efficacy, sense of well-being** and, ultimately, **achievement** of students in STEM disciplines.



Exposure, support, & preference

It has been reported that girls who are interested in STEM are high achievers who have **supportive adult networks** and are **exposed to STEM fields**.



Problem space

- Females are **critically underrepresented** in **Math** and **Computer Science**, the fastest growing STEM fields.
- **Minority women** have been disproportionately **affected by bias** and the constant undercutting and lack of opportunity they encounter in STEM fields causes many qualified workers to **pursue other occupations**.
- Students' **sense of belonging** plays a critical role in shaping the motivations, self-efficacy, sense of well-being and, ultimately, **achievement** of students in STEM disciplines.
- Female disengagement from STEM fields starts during the **middle school years (11-15)**, which are a crucial time for identity formation and occupational motivation.
- Female role models provide **key support** and help foster a **sense of belonging** for girls in STEM.
- Young women are **not** getting enough **practical, hands-on experience** with STEM subjects.



Problem space

Females are **critically underrepresented** in **Math and Computer Science**, the fastest growing STEM fields.

Problem space

Minority women have been disproportionately **affected by bias** and the constant undercutting and lack of opportunity they encounter in **STEM** fields causes many qualified workers to **pursue other occupations.**

A black and white photograph of two young women blowing bubbles. The woman on the left is holding a bubble wand and blowing a bubble. The woman on the right is also blowing a bubble. The background is dark with many out-of-focus light spots, creating a bokeh effect. A blue horizontal line is positioned below the text 'Problem space'.

Problem space

Students' *sense of belonging* plays a critical role in shaping the motivations, self-efficacy, sense of well-being and, ultimately, *achievement* of students in STEM disciplines.



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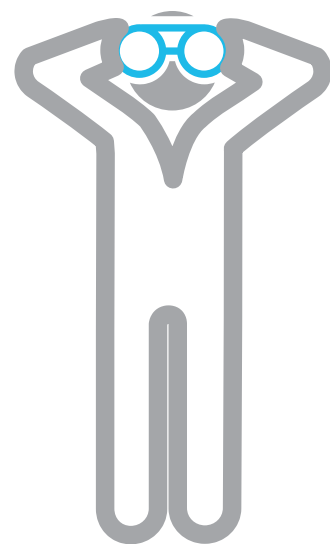
A black and white photograph of two women sitting at a desk, looking at a laptop. The woman on the left has curly hair and is resting her chin on her hand. The woman on the right has long curly hair and is wearing glasses. The laptop is an Apple MacBook. The background is a plain, light-colored wall.

A young woman with dark hair pulled back, wearing a white lab coat and clear safety goggles, is looking directly at the camera with a focused expression. The background is a blurred laboratory setting with a bright light source in the upper left corner.

Problem space

Young women are **not** getting enough **practical, hands-on experience** with STEM subjects.

Primary research: Methods



Observation

Observation of student-mentor relationships was conducted with two classes of students with two different mentors at Summit Sierra Public. Our intention was to observe the girls with their mentors in their natural academic environment. Observation was a way for us to understand the needs and frustrations the girls have with their interactions.



Survey

The survey used short answers and Likert scales to assess their preferences to STEM or non-STEM related subjects, gender biases and personal behaviour towards challenges. Our intention for conducting the surveys was to better understand the girls' attitudes about mentors and reduce the risk of designing an intervention that may not suit their needs.



Focus Group

A focus group discussion was also held with 8 school girls at Summit Sierra Public. The intention of the focus group was to gauge the importance of mentors in the girls' lives and their attitudes towards their mentors.

Primary research: Participants

★ Summit Public Schools

⦿ Girls of colour

⦿ Immigrant backgrounds:

◆ Mainly Somali

- ⦿ 1 freshman + 7 sophomore students (ages 14 - 16)

★ Seattle World School

⦿ Girls of colour

⦿ Immigrant backgrounds:

◆ Somali + Hispanic

- ⦿ 10 students (ages 13 - 19)

Beydaan Mahamud

“ I want it to be more fun. Make it simple for me or relate it to real life problems. ”

“ I feel good that it’s my own goal, and not anyone else’s. ”



Beydaan is a first generation immigrant from Baidoa, Somalia. She's an oldest child who lives with her mother and two brothers in a low-income housing district in South Seattle. She's a hard worker that gets good grades in school and is determined to make her mother proud. She's excited by science and technology, but has

limited opportunity to pursue them in her school district. She believes in her abilities, but worries that no one in her science class looks like her. She feels uncertain about her future because her family has moved around a lot, but she knows that everything will be OK if she just keeps a positive attitude.

Middle School Student

Age: 13

Location: Seattle, WA

ATTITUDES & BEHAVIORS

- She understands the importance of education and wants to make her family proud.
- She's interested in science and technology, but isn't sure that it's the best career path for her.
- She thinks obstacles make her stronger and wants to prove people wrong for questioning her ability.
- She is not native to the language she is learning in and sometimes struggles with meanings.
- She's a hard worker, but gets tired of spending her evenings doing chores and homework.
- She likes discussing problems and collaborating with her friends to solve them.
- She believes she can be successful in STEM, but worries about taking different classes than her friends.
- She is sensitive to stereotypes and worries that she won't be treated equally in a STEM career.

GOALS & MOTIVATIONS

- She wants to be successful in school and get into a good college.
- She wants a career that is enjoyable and pays well.
- She wants to be socially validated and recognized for her achievements.
- She wants to learn and communicate effectively.
- She cares more about process than end goal and wants learning to be fun and creative.
- She is motivated to help people and wants to make a difference in the world.
- She wants emotional support and acceptance.
- She wants others to respect and appreciate her gender and culture.

CHALLENGES/PAIN POINTS

- She doesn't have a stable home life so transitioning between schools can destabilize her support systems.
- She has limited access to STEM classes and doesn't know anyone in a STEM career.
- She needs help setting attainable goals and developing a plan to achieve them.
- Her parent doesn't speak the language and can't help her academically.
- If the work becomes too much of a burden she'll lose interest and take different classes.
- She needs help connecting skills and career goals to STEM occupations.
- She feels socially isolated in classes where she's different than everybody else.
- She needs to know that other people like her have succeeded in STEM careers.

Maria Gonzales

“If it's part of a project, then I'll be motivated to do it.”

“Teaching is the best form of learning.”



Middle School Student

Age: 14

Location: Seattle, WA

Maria is an only child who lives with her grandparents in a middle-class district in North Seattle. She's naturally gifted at Math and always scores at the top of her class. Despite her constant success academically, she's very shy and doesn't have a lot of social confidence. Other students begrudge that it

comes so easy for her, and that makes her feel guilty and ashamed. She knows that she can succeed in whatever she chooses, but hides her abilities to avoid drawing attention to herself. She wants to fit in, but doesn't have much in common with her peers, and sometimes wishes she could just disappear.

ATTITUDES & BEHAVIORS

- She is naturally gifted at Math and excels across the board academically.
- She has high expectations of herself academically and can be unrealistically demanding of herself.
- She's intellectually developed ahead of her peers and doesn't have many interests in common with them.
- She feels bored in most of her classes and doesn't have to work too hard to succeed.
- She has looked up gender bias in Math careers and worries that she won't be treated fairly.
- She likes discussing problems and collaborating with her friends to solve them.
- She believes she can be successful in STEM, but worries about taking different classes than her friends.
- She's not very confident and prefers to avoid social conflict.

GOALS & MOTIVATIONS

- She wants to be appreciated and admired for her natural abilities.
- She wants to get into a top-tier college.
- She wants intellectual connection and stimulation.
- She wants learning to be challenging and creative.
- She wants to be socially validated and recognized for her achievements.
- She is motivated to help people and wants to solve interesting problems.
- She wants emotional support and acceptance.
- She wants to feel emotionally safe and secure.

CHALLENGES/PAIN POINTS

- Her giftedness results in jealousy and contempt from her peers.
- Her expectations are counterproductive and undermine her confidence.
- She has difficulty conversing and bonding with peers of her age.
- If the boredom becomes too much of a burden she'll lose interest and focus on something else.
- She feels socially isolated in classes where she's the only girl and makes herself more masculine to fit in.
- She needs help connecting skills and career goals to STEM occupations.
- She lacks resilience and will stop taking STEM classes if she feels too isolated.
- She hides her abilities and withdraws to avoid bringing attention to herself.

Affinity Diagram



Key Insights

Young women don't see the practical relevance of STEM skills outside of the classroom.

Primary Evidence

"I want math to be more fun.
Make it simple for me or relate
it to **real life problems.**"

—Student, Summit Public School

"You just have to show them
concrete stuff and make
them think, 'I can do this.'
That's all you've got to do."

—Andrew Davidson, UW-HCDE

Secondary Evidence

STEM Girls ...

87%

Like to understand
how things work

85%

Like to **solve problems**

83%

Like to do **hands-
on activities**

80%

Like to **ask questions**

—Girl Scouts

Key Insights

Many young women do not understand how to set realistic and attainable career goals or develop a plan to achieve them.

Primary Evidence

"I have girls who are strong in math and science, but they don't tie it to a professional goal. They don't say I'm going to be an engineer or a doctor...that's the big disconnect. We don't see the disproportionality in the classroom."

—Malia, Principal of Summit Public School

"I feel good that it's my own goal and not anyone else's."

—Student, Summit Public School

Secondary Evidence

81%
of STEM girls
express interest in pursuing
a career in a STEM field.

—Girl Scouts

Key Insights

Young women often depart from STEM pathways because educators depend upon the content alone to hold their interest.

Primary Evidence

"It's definitely the communication and people skills that attract many of the under-represented groups to consider a field like [engineering]. They want to use their understanding of sociology to get a job or get through college."

—Andrew Davidson, UW-HCDE

Several girls get together and discuss the social dynamics of their group as they plan and organize a dance for their class.

—Students, Summit Public School

Secondary Evidence

STEM girls have philanthropic motivations

94% Want to **help**
people

92% Want to make a
difference in the world

—Girl Scouts

Key Insights

Isolation from female peers in STEM environments is a significant factor causing young women to depart from STEM pathways.

Primary Evidence

"The problem is because of the STEM curriculum. There is no collaborative learning experience. They are sold as linear and rigid learning methods."

–Victoria Santos, Y-WE

"Women, especially young women, are interested in collaborative problem solving, not competitive...they want to get together and work together."

–Andrew Davidson, UW-HCDE

Secondary Evidence

47%
of all girls say

that they would feel **uncomfortable** being the **only girl** in a group or class.

–Girl Scouts

Key Insights

Girls in STEM from vulnerable and marginalized populations may have little stability and support in their personal lives.

Primary Evidence

"Mentors see me down and will help out. All teachers check up on you all the time, both for academics and personal. Because you can't do well if you're having problems at home."

—Student, Summit Public School

A girl talks about breaking a bone in her leg after tripping on a rock, but waiting for her grandfather to get home before seeking help. She didn't want her grandmother to worry. She says, **"I'm trying to manage their questions."**

—Student, Summit Public School

Secondary Evidence

54%

African American & Hispanic are less likely than

70%

Caucasian girls

to go to their parent(s) for information on career choices.

38%

African American girls say that their parents are less likely to approve of a STEM career compared to

54%

Caucasian girls

—Girl Scouts

Key Insights

Female peer groups often reinforce negative attitudes and gender biases toward young women in STEM pathways through ostracization and social exclusion.

Primary Evidence

"STEM is embedded in everyday life, not something new. It's based on relationships. Social stigmas keep girls from accessing STEM fields."

–Luis Ortega, education consultant

A shy girl mentions that she likes math, but gets quiet when her peers contradict her.

–Student, Summit Public School

Secondary Evidence

**Interacting
& connecting**

with others is important to **women makers.**

–Intel MakeHers report

Design Implications

1. Show young women how STEM skills are **relevant to everyday life**.
2. Help young women to **set attainable goals** and **connect their learning to careers**.
3. Engage young women in STEM learning by **demonstrating social impacts**.
4. Facilitate emotional connection through **collaborative social interactions**.
5. Connect vulnerable and marginalized populations with **adult mentors**.
6. Empower young women in STEM pathways to **galvanize their peers**.



Design principles

Design thoughtfully:

- Keep it simple
- Make it attractive
- Make it easy to use
- Communicate clearly
- Be consistent

Consider the user's prior knowledge and experience:

- Don't waste time or effort
- Leverage existing platforms
- Leverage common design patterns

Consider the user's goals and motivations:

- Don't expect trust, earn it
- Add value, not features
- Make info easy to find
- Provide accountability
- Reinforce progress

Be inclusive:

- Make it accessible
- Make it appropriate
- Make it safe
- Build communities
- Support collaboration



Next steps

- Coordinating user studies with **DawgBytes**: *The lead for the Middle School Girls Creative Coding Camp*
- Meeting with **Digital Media Academy** for their Made By Girls summer camps
- **Onboarding** evaluation



Thank
you