STEM-IT-YOURSELF: INCREASING PARTICIPATION OF GIRLS AND MINORITIES IN STEM

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YOUNG REVIEWERS:

CHLOE
AGE: 14

DIA
AGE: 13

ELIZABETH
AGE: 15

KAVYA
AGE: 15

KIANA
AGE: 15

Have you ever wondered why, when browsing the internet looking for scientists, technologists, engineers, or mathematicians, most of the results show men? Or have you ever wondered if there was someone out there who might look like you doing work in science, technology, engineering, and mathematics (STEM)? Our research aimed to better understand why STEM fields are not diverse in gender or race, and to empower the next generation of STEM leaders through a project called STEM-It-Yourself (SIY). Through SIY, we introduced middle school girls to women in STEM who are representative of the girls' races. By hearing about the STEM journeys of the presenters, who were women, and Black, Indigenous, and people of Color (BIPOC), the girls participating in SIY could cultivate STEM identities, which could motivate them to stay in STEM and help diversify the STEM workforce.

INTRODUCING GIRLS OF DIVERSE BACKGROUNDS TO STEM AT AN EARLY AGE

Only a few girls and children from diverse backgrounds see themselves having careers in science, technology, engineering, and math (STEM) fields. Some children, primarily from **minority** groups, do not feel like they belong in the STEM world when they finish school. Early involvement in STEM is essential because when young children participate in STEM activities, this involvement can give them a stronger STEM career identity, more interest in science, and confidence about working in STEM [1]. The STEM-It-Yourself (SIY) program, developed by The Laboratory for Artificial Intelligence and Equity Research (LAIER), aims to help change how Black, Indigenous, and people of color (BIPOC) girls see themselves and behave in STEM. Specifically, SIY seeks to help these girls become more self-assured so that they can picture themselves with a job in STEM.

WHAT IS A STEM IDENTITY?

A **STEM identity** is when a person can feel a sense of attachment or belonging to a STEM environment. To help children develop a STEM identity, educators and researchers should focus on early STEM education in children's day-to-day lives. Research shows that the early stages of a child's life are when identity development happens, helping kids learn how to live in the present and develop potential future STEM identities [2]. The SIY initiative provided mentors to encourage, inspire, and guide these young women. It was an excellent way for young kids to explore their interests and cultivate their STEM identities.

According to the Pew Research Center, only 14% of women workers are in physical science and engineering, only 20% are health-related workers, and 15% are computer science BIPOC workers [3]. In the USA, women and people of color are often missing from STEM jobs—less than one-quarter of STEM employees are women, as you can see! More women and people of color in STEM could boost creativity and innovation [4]. Financial barriers and the lack of role models can make it challenging for girls of color to see themselves in STEM careers. However, having mentors who look like them can make a big difference in helping girls believe they can succeed. The more they learn about STEM fields, the more likely they are to pursue STEM careers.

HOW CAN EXPOSURE HELP?

Less than 10% of STEM content is taught in kindergarten through second-grade classes—that is a tiny amount [2]! But guess what? We can change that by developing ways to expose young people to STEM. Early exposure might help increase the percentage of females

entering STEM fields. Research shows that grades 6–8 (ages 9–13) are when most career aspirations are developed [5]. Hands-on activities like building robots, playing coding games, or conducting science experiments can make STEM subjects more engaging. Programs and clubs like those from the Society of Women Engineers or Black Girls Code connect students with mentors and real-world projects that inspire and guide them. With these thoughts in mind, The LAIER created SIY to help link children to their actual likes and interests in a STEM field so they could find their passion and eventually increase the number of people from underrepresented groups in STEM jobs for the future (Figure 1)!

Figure 1

Percentages of BIPOC women in computer science, physical science, engineering, and health-related fields (Pew Research Center).
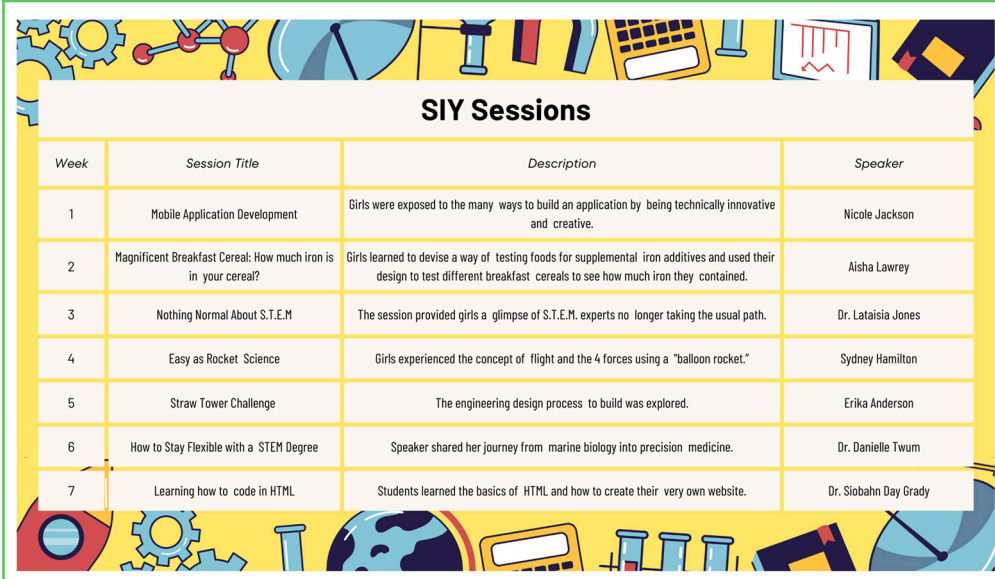

Figure 1
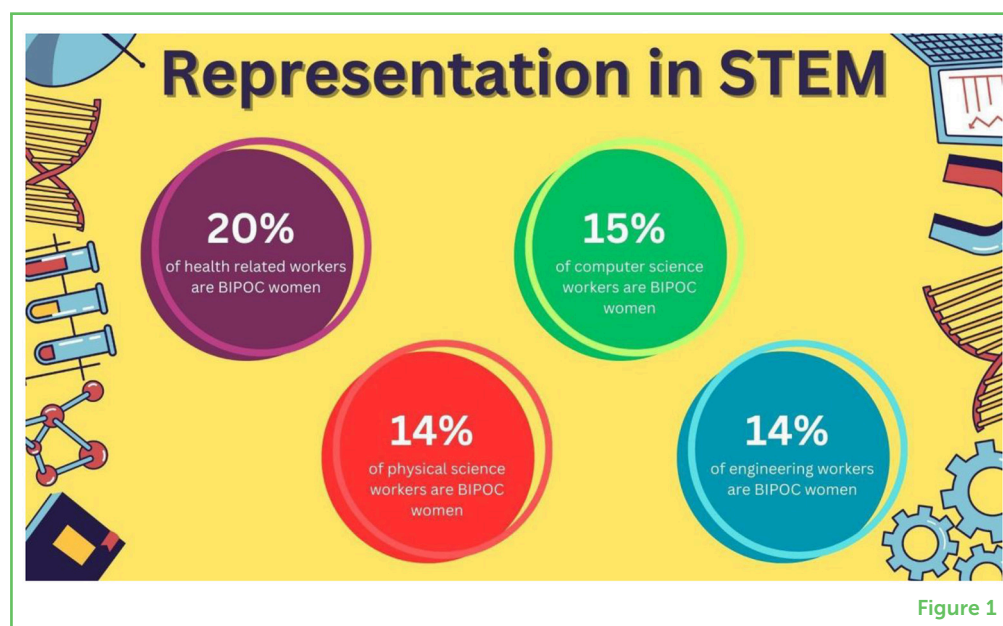
HOW THE SIY INITIATIVE WORKS

SIY was an extracurricular movement for middle school students (grades 6–8; ages 9–13) that explored adolescent girls' perceptions, attitudes, and behaviors by having them participate in STEM activities [6]. These girls may not have had a chance to form a STEM identity, see women who look like them in STEM or may not have the resources available to learn more about STEM. The SIY initiative had two main parts: sessions and activities.

SIY activities were hands-on projects geared toward creating something related to the various STEM topics, while the SIY sessions were focused on themes and provided speakers from STEM professions. Figure 2 provides a snapshot of the diverse topics and activities covered. These educational, interactive sessions exposed girls to real-life STEM activities, fostering a deeper understanding of the world around them. They were encouraged to apply the principles they learned from the speakers through the sessions by

participating in hands-on, topic-related activities. All sessions were recorded and shared online to be revisited at any time on our SIY initiative YouTube page.

SIY Sessions

Week	Session Title	Description	Speaker
1	Mobile Application Development	Girls were exposed to the many ways to build an application by being technically innovative and creative.	Nicole Jackson
2	Magnificent Breakfast Cereal: How much iron is in your cereal?	Girls learned to devise a way of testing foods for supplemental iron additives and used their design to test different breakfast cereals to see how much iron they contained.	Aisha Lawrey
3	Nothing Normal About S.T.E.M	The session provided girls a glimpse of S.T.E.M. experts no longer taking the usual path.	Dr. Lataisia Jones
4	Easy as Rocket Science	Girls experienced the concept of flight and the 4 forces using a "balloon rocket."	Sydney Hamilton
5	Straw Tower Challenge	The engineering design process to build was explored.	Erika Anderson
6	How to Stay Flexible with a STEM Degree	Speaker shared her journey from marine biology into precision medicine.	Dr. Danielle Twum
7	Learning how to code in HTML	Students learned the basics of HTML and how to create their very own website.	Dr. Siobahn Day Grady

Figure 2

SIY is not just about fun activities. We also used surveys to ensure the girls got the most out of each session. Surveys measured how much girls remembered from previous sessions and served as a "preview" for the next section. Girls also took short, interactive quizzes on Kahoot to test their knowledge and memory of the topics taught in the lesson. To close each session, the SIY team gave post-survey questions to collect information to help us modify teaching methods to ensure the young women were not overwhelmed or discouraged. While SIY helped us discover multiple ways to bridge the gap for young BIPOC learning about STEM, the work does not stop here.

IMPACT AND CONCLUSION

The SIY initiative can be used in other settings, age groups, grade levels, organizations, or universities to target BIPOC and support or grow the STEM workforce. To assess how well the program worked, we track participants' progress to see if SIY made a long-term impact and helped girls foster their STEM identities. We hope that, through reading this article, you can see the power of representation, enrichment activities, and outreach. Maybe you can think of other organizations that may need to implement STEM activities or improve their STEM programming. We plan to expand the program to reach other young women from underrepresented and underserved communities.

ORIGINAL SOURCE ARTICLE

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YOUNG REVIEWERS

CHLOE, AGE: 14
I have only recently gown to live a be more in evolved in STEM as of last year. I am in a program that helps support and encourage me to pursue STEM.

DIA, AGE: 13
I recently finished 7th grade, and am excited and looking forward to entering 8th grade soon. Some of my hobbies include meeting up with friends, reading, listening to music, swimming, painting, and occasionally shooting hoops in my driveway. My favorite subjects/extra classes at school are P.E and Math. As I am 13 years old, I have not fully discovered what I want my future career path to look like, but I am considering a future as a corporate lawyer or as a software engineer.

ELIZABETH, AGE: 15
I am Elizabeth and I will be a sophomore in high school. I love learning about chemistry and physics, especially topics like quantum mechanics and electrochemistry. Recently, I have also enjoyed playing around with Arduinos and using different types of sensors. Besides exploring STEM topics, I also enjoy playing the piano, ultimate Frisbee, and doing volunteer work in local parks like Torrey Pines, Cabrillo, and Los Penasquitos Reserve.

KAVYA, AGE: 15
Hi! I am Kavya! I absolutely love science and all aspects of genetics, medicine, and environmental science! In my free time I do calligraphy and go on long runs! I also love writing poetry and all types of literature. Cuddling with my pet guinea pig and reading autobiographies are some of my go-to activities.

KIANA, AGE: 15
Hey all! My name is Kiana, and I am super excited to be a Young Reviewer! I am super passionate about supporting disabled communities, as I am deaf! Some of my hobbies include spending time with friends, family and my three big dogs, journaling, coding, and teaching American Sign Language.

AUTHORS

SIOBAHN DAY GRADY

Dr. Siobahn Day Grady is the program director and assistant professor of information science at North Carolina Central University in the School of Library and Information Sciences. She leads the Laboratory for Artificial Intelligence and Equity Research, where her research areas include authorship attribution, human-computer interaction, and machine learning. She also participates in numerous outreach activities to broaden participation in computing. *sday@nccu.edu

NATALIE TUCKER

Natalie Tucker, a security specialist on the Cyber Threat Intelligence team at The Walt Disney Company, is driven by a deep passion for her work. Her role demands constant vigilance, ensuring she is aware of and quick to report or share vital information, such as emerging threats and vulnerabilities, that may impact or affect the company. Her passion lies in collecting and compiling information and creating stories from those insights. This passion fuels her desire to share her journey and knowledge with BIPOC, hoping to inspire them to pursue their dreams in STEM.

CHRISTOPHER LAWSON

Christopher Lawson is a program training and development manager at North Carolina Central University in the School of Library and Information Sciences for the Digital Equity Leadership Program. Christopher is also pursuing his doctoral degree in human-centered computing from Clemson University. With a diverse background and a strong commitment to promoting diversity and representation, Christopher is dedicated to inspiring others and advancing the fields of computer science and information technology. Through his work, he strives to bridge the digital divide, increase digital equity, and empower underrepresented communities.