

A Mission to Increase Equity and Inclusion in STEM Education



Introduction

In creating the Twig Science program, which adapts 3-D learning standards as immersive story-based investigations, we considered not just the type of STEM instruction that is needed in the 21st century but also who it should be for. We were very much aware that, unfortunately, it is still the case that not every learner can access high-quality STEM opportunities.

Multiple factors come together to produce learning environments that subtly and not so subtly differentiate between students. Not all of these factors are deliberate or even conscious on the part of learning authorities.

One of these factors is simply implicit bias, in which unconscious assumptions or stereotypes affect attitudes towards STEM participation. Traditionally, for example, science has been seen as a male subject. Archetypal depictions of scientists are usually male, and STEM professions to this day remain male-dominated. This both discourages girls from participating in science and, unconsciously or not, leads to teachers, parents, and peers being less likely to encourage girls to participate. Unconscious biases similarly extend to racial/ethnic minorities, people with disabilities, and LGBTQ+ individuals. The effect is the same: as people in these categories are assumed to fit less into the world of STEM, they are less likely to become part of that world, and the cycle continues.

**“You can’t be what
you can’t see”**

—Sally Ride, first woman in space

Socioeconomic disparity in resources and opportunities also affects STEM participation in every setting in America, with the result that Blacks/African Americans, Hispanics/Latinxs, American Indians/Alaska Natives, people with disabilities, and women/LGBTQ+ people of all racial/ethnic backgrounds are underrepresented in STEM fields when compared with their overall participation in the labor market.

Why Are Equity And Inclusion So Important?

Reduced participation by minorities and women in STEM fields represents a failure on the part of our society to enable large sectors of its population to achieve their full potential. In this way, we are letting down individuals who may otherwise have enjoyed success in STEM careers.

The Success of the Nation

This waste of talent is not only an issue for those who are unfairly excluded from STEM fields. At the same time, we are unnecessarily limiting the positive effects that STEM activity could have on the success of the nation by excluding large parts of its population.

Research suggests that numerous additional technological innovation, successful business, educational development, and many other benefits could be brought about if excluded groups were given more exposure to STEM roles.¹

Other research indicates that diverse organizations are more successful organizations. Diversity in terms of gender, race and ethnicity, socioeconomic status, ability, etc. is a great indicator of successful organizational performance in a number of ways including:²

- Talent retention and reduced employee turnover
- Innovation
- Improved reputations
- Financial performance

A Strong STEM Foundation

So there are economic grounds for being concerned about participation in STEM, as well as our desire to foster a more just and inclusive culture that values the contribution of all individuals. The United States has a strong STEM foundation, but the benefits of this will only be fully realized when there is true equitable access to STEM education allowing for participation by groups currently underrepresented in STEM fields and employment. All American children deserve the opportunity to try STEM subjects for themselves, mastering STEM skills and methods through programs that encourage them to believe that people just like them are as able as any others to go on to success in college and careers.

“The greatest challenge I faced in becoming a neurosurgeon was believing it was possible”

—Alexa Canady, Medical Doctor

1. <https://www.nber.org/papers/w24062>

2. <https://www.catalyst.org/research/why-diversity-and-inclusion-matter/>

Exclusion Begins At Elementary School

Research shows that children decide how they feel about science by the age of 7.¹ If we've lost them at this stage, we may have lost them for good. That's why STEM instruction in early education is essential. The way teachers approach science at elementary level has an impact on students through their entire school journeys, and beyond, and poor science classes in elementary or middle school discourages many from entering STEM fields.

Research Findings

Frequently, women and ethnic minorities report experiencing poor science instruction at an early stage of their education. Related to this, many report that science is not a focus of the instruction they received at this stage. For example:

- 77% of surveyed female and minority scientists agreed that women and minorities were underrepresented in the STEM workforce because “they were not identified, encouraged or nurtured to pursue STEM studies early on.”²
- In the same survey, 75% of respondents identified a lack of high-quality science classes in lower-income school as the top reason why women and minorities are underrepresented in STEM fields.
- Middle school students from low-income families are less likely to have science teachers with experience of teaching science.³
- In one survey, 95% of new elementary school teachers said they taught English every day, 93% said they taught math, while only 35% said they taught science every day.⁴
- The same study discovered that a majority of new teachers didn't feel science literate. 71% described themselves as “somewhat, a little or not at all” science literate.
- 54% of teachers in California said they lacked the material resources and instructional support to provide exemplary science instruction.⁵

“The United States cannot afford to lose more than half its talent and the fresh perspective that women and minorities can bring”

—Aprille Ericsson-Jackson, Aerospace Engineer

1. <https://www.stevespanglerscience.com/2014/10/08/early-childhood-science-education-is-important/>

2. http://www.igert.org/system/content_item_assets/files/579/Bayer_Facts_of_Science_Education_Executive_Summary.pdf

3. <http://www.nsf.gov/statistics/seind10/c1/c1h.htm>

4. https://knowledgecenter.csg.org/kc/system/files/FF_Women_STEM.pdf

5. <https://www.nap.edu/read/13165/chapter/16#281>

Fostering Diversity

At Imagine Learning, we have a mission to secure access, equity, and inclusion for all students when we develop STEM experiences. We have worked hard to ensure that all students, regardless of background or status, are able to experience the magic of Twig Science—learning and progressing alongside their peers.

Some of the steps we have taken to ensure that equity and access is at the foundation of the Twig Science program include those on these two pages.

Of course, we recognize that there is always more that can and should be done to ensure that every child reaches their full potential, and we are constantly looking for ways that we can help to make the STEM world more inclusive. Further ideas for how we can use the Twig Science program to increase access and equity program for historically underrepresented communities will be presented in a follow-up white paper.

“People don’t choose careers they’ve never heard of”

—Helen Quinn, Chair of the National Research Council committee that developed the NGSS

WE MAKE THE CONTENT REFLECTIVE OF ALL STUDENTS.

Students get excited about science careers when they understand that scientists are regular people just like them. Throughout the imagery used in Twig Science, we’ve made sure to include representation of different genders, races, and disabilities. We’ve included historical and contemporary examples of a wide range of STEM professionals from all backgrounds to inspire students, including interviews with real-world scientists who talk in a relatable way about what they do, how they got started, and the tools they use.

THAT ARE MULTIMODAL, FLEXIBLE, AND RESPONSIVE TO THE NEEDS OF STUDENT NEEDS.

We recognize that there is inequality in access to the technologies and environments needed to receive much of the instruction that is currently available remotely. Our distance learning offering is designed to make allowances for, and reduce the importance of, this inequality. Twig Distance Learning includes all of the other measures available in the wider program to secure access and equity.

WE ENSURE THAT ALL STUDENTS HAVE THE SOCIAL AND EMOTIONAL SKILLS TO BE ABLE TO PARTICIPATE AND COLLABORATE WITH THEIR PEERS.

Through team-based investigations in Twig Science, students develop working practices that increase both their self-worth and the value they ascribe to others. They learn to be better communicators and to better respect the diverse range of skills, abilities, and ideas of others. They understand why everybody's role is important, no matter who they are. These are essential aspects not only of classroom collaboration, but also of being part of society.

WE INCLUDE TEACHER SUPPORT.

At elementary level, not every teacher teaching science has a science background, and teachers in lower-income districts are still less likely to have a science background. To help these teachers, the Twig Science program includes multiple forms of support to enable teachers to deliver science instruction with confidence, from bite-sized science content background information to onboarding sessions and teacher training workshops. Supporting teachers in this way helps to close the science literacy gap for their students.

WE PROVIDE POINT-OF-USE SCAFFOLDS THAT MAKE IT EASY FOR TEACHERS TO SUPPORT A DIVERSE STUDENT POPULATION.

These scaffolds provide guidance and differentiation strategies to adapt the curriculum, including instructional materials to address the needs of students who are below grade level. Instructional strategies are scaffolded and varied for student learning needs.

WE HELP ENGLISH LEARNERS SUCCEED REGARDLESS OF THEIR LEVEL OF PROFICIENCY.

English learner supports provide strategies for teachers to support students of all proficiency levels, with specific guidance on how to tailor lessons to accommodate them.

WE MAKE SURE TO INCLUDE PARENTS IN THEIR CHILDREN'S STEM JOURNEYS.

All Twig Science modules include Family Outreach Letters (FOL)—digital assets that teachers can print and hand out to students, or email to students' families. FOLs summarize the learning content and provide suggestions for connecting students' learning to experiences outside the classroom, helping to embed the sense that science is a subject that can be a relevant part of the lives of all students.

WE OFFER A COMPREHENSIVE SPANISH VERSION OF OUR PROGRAM.

To support dual immersion or bilingual programs, the Twig Science program is also available in Spanish. Teachers can teach with confidence using the same printed materials—and support English Learners with leveled readers, available in English with Spanish cognates or fully translated into Spanish. In total, 600+ Twig Science videos and 750+ Twig Science Tools phenomena videos are available with Spanish narration, captions, and graphics.

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