Think big, start early: New effort to close gender gap in science starts in preschool [1]

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Source: CBS News
Format: Article
Publication Date: 3 Feb 2017

AVAILABILITY
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EXCERPTS

In the 17 years she spent teaching science to middle and high school students in the Philadelphia area, Phaedra Brown developed an intuition for when her instruction wasn't landing.

More often than not, students could "plug stuff in," but they lacked the foundational knowledge, not to mention critical reasoning and reading skills, necessary to absorb scientific content on a deeper level, she said.

"It's too overwhelming when you're already lacking," Brown told CBS News. "It took me years to figure it out. The only way to solve this problem is to put in what hasn't been put in — earlier," she said.

So, she made a change. After a brief stint in early childhood education, Brown founded the Hope Institute of Science for Girls in the Mount Airy neighborhood of Philadelphia. It's a "brick and mortar" solution to engaging preschool girls in science, technology, engineering and math topics — commonly known as STEM — at the very beginning of their educational journeys, she said.

Now midway through its first school year, the Hope Institute is part of a growing movement to engage girls in STEM in proactive, not reactive, ways.

Women make up half of the total U.S. college-educated workforce, but only 29 percent of the science and engineering workforce, according to numbers released last year from the National Science Foundation. Other data shows they lag behind men in securing higher paying jobs at a number of major Silicon Valley companies.

Despite its imposing name, the Hope Institute of Science for Girls is small and focused, with only nine students total, ages 1 to 4. There, Brown's lessons are designed to expose toddler girls to STEM in subtle, age-appropriate ways. For instance, a recent lesson on anatomy taught students not only how to identify their heads, shoulders, knees and toes, but also their skulls, ribs, femurs, clavicles and mandibles.

"When I tell them to move their mandible, they're excited that they even know what a mandible is," she said.

The inaugural class of girls is mostly African-American. Women of color are especially underrepresented in STEM education and careers. In 2010, just 10.6 percent of bachelor's degrees, 7.9 percent of master's degrees, and 3.9 percent of doctorate degrees in science and engineering were awarded to women of color, and fewer than 1 in 10 employed engineers were women of color, according to the White House.

"We all know the history. You have one 'X' against you for being a woman. If you're a black woman, you have two 'X's against you in society," Brown said. "I'm challenging myself to constantly flood these little girls with positive people doing positive things so that when they hear this other thing — 'You can't do that' — that's crazy to them."

Early science teaching is not a priority in most preschool classrooms. By starting young, the Hope Institute might be on to something significant.

"Why should we wait until students are 5 years old and entering kindergarten to begin engaging in STEM activities?" Joshua Sneideman of the Natural Start Alliance wrote in 2013. "Students are incredibly active learners at 1, 2 and 3 years old, and we can start building their foundation in STEM as soon as they enter this world."

The stakes for early intervention are high: new research shows that, in the U.S., girls become affected by gender stereotypes about their intellectual abilities by age 6. The study, published this week the journal Science, showed that at age 5, boys and girls were equally likely to choose their own gender as "really, really smart." But girls age 6 and 7 were significantly less likely than boys to associate high intelligence with their own gender.

"It's possible that in the long run, the stereotypes will push young women away from the jobs that are perceived as requiring brilliance, like

being a scientist or an engineer," study co-author Lin Bian told Mashable.

In STEM fields, there's a growing awareness that early engagement should be the goal not just for girls, but their parents, too.

Parental expectations are one of the earliest roadblocks to girls exploring science and challenging themselves in math. Worldwide, parents are much less likely to expect their daughters to work in STEM careers than their sons, even if they show the same ability, according to a 2015 report from the Organization for Economic Cooperation and Development (OECD). That's one of the underlying reasons why girls worldwide "lack the same self-confidence as boys" in science and math even when they're performing at the same level, according to the OECD report.

That's the issue Emilie Liebhoff wanted to target when she co-founded Moms as Mentors in 2014, an organization designed around the premise that young girls should be encouraged in STEM not only in the classroom but outside of school as well.

Based in Boston, Moms as Mentors hosts workshops for moms and daughters to collaborate on hands-on projects — from designing a roller coaster for marbles, to making an indoor kite, to creating a launcher that will fling a ping-pong ball across a room. The goal is not only to energize girls to take pleasure in tinkering, building, designing and solving problems, but also to create a space where moms can imagine their daughters as future leaders in science, technology, engineering and math. Since 2014, the organization has served nearly 1,000 women and girls from kindergarten to eighth grade.

"We believe that moms are this untapped and unexplored resource to influence girls' career choices and academic ambitions," Liebhoff, the mother of three daughters herself, said.

In their programming, Moms as Mentors tries to teach moms how to avoid language that might unintentionally limit their daughters' ideas about what subjects they can and cannot pursue.

"As woman, we can put ourselves down, [saying] 'I'm not a math person, I'm no good at tech,'" said Leslie Coles, who co-founded the organization with Liebhoff and now serves as executive director. "They don't realize that talking about yourself is talking about your kid. You're sending a message that you're either good at something or you're not."

Instead, the team encourages mothers to embrace a "growth mindset" as their daughters start to explore STEM — building the engagement and resilience necessary to navigate the inevitable bumps in the road that might come from peer pressure, a less encouraging teacher, or a discouraging grade on a test.

The workshops are built around active engagement in STEM-related projects. Studies show that girls particularly benefit from more active teaching strategies. In math, specifically, girls perform better when they are required to explain how they solved a problem, apply what they've learned outside the classroom, and work independently, according to the OECD.

There are signs this approach is working: In surveys conducted by Moms as Mentors, 82 percent of mothers report an increase in their daughters' enthusiasm for STEM.

The window of time to engage girls in STEM is finite in many ways. Research shows that the majority of students who pursue STEM degrees make their decision during high school. In Coles' experience, she's seen firsthand that disengagement starts to take hold between fourth and eighth grades.

"We can arm moms before that confidence drop," she said.

And it's not just about making girls better at science and math. Numerous studies show that early exposure to STEM has a positive impact across the entire spectrum of learning.

Failing to engage girls early in these increasingly vital and growing fields is a lose-lose for everyone, Brown said.

"We could be missing out as a country," she said.

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