Bridging the Encouragement Gap in Computing

There is consensus among researchers that encouragement matters and plays a critical role in engaging more young women and girls in computing. Here are some key highlights from published research studies, and follow-up tips on practicing encouragement.

Gender Stereotypes Start Early & Discourage Young Girls from Dreaming Big.

When it comes to career aspirations, young girls and boys dream big equally, with many preschoolers hoping to one day become doctors, vets, and scientists[1]. However, by the time they reach elementary school, girls receive and internalize negative messages about their intelligence, ability, and career potential.

A prominent study shows that by the time young girls reach the age of 6, they are less likely to believe that they are as smart as boys[2].

Six-year-old girls are not as interested in activities that they perceive to be for **"REALLY SMART" KIDS.**

The same study also reports that girls don't have enough confidence in their science and math abilities, but **GIRLS DO BELIEVE THAT THEY ARE CREATIVE AND NICE.**

A group of psychologists examined how children's gendered stereotypes about scientists changed over a fifty-year period (1960s–2010s)[3]. The researchers reviewed dozens of studies in which children were asked to draw a picture of a scientist. They found:

Younger children (ages 5-6) drew equal percentages of male and female scientists.

Drawings of female scientists increased significantly in later decades.

The majority of children (both boys and girls) drew pictures of scientists as male.

Older children (both boys and girls) drew more male scientists than female scientists.

Bridge the Gap

### BRIDGE THE GAP WITH ENCOURAGING MESSAGES TO GIRLS AND BOYS EARLY, OFTEN, AND EQUALLY.

1 The cultural messages that children receive and internalize about girls' intelligence compared to boys can certainly impact their beliefs about being successful in computer science.

2 Boys and girls alike need to hear that all girls are just as smart, talented, and capable of being scientists as boys.

Girls Don't Know Enough About Careers in Computing.

Researchers who have talked to girls about their career interests learned that girls don't know enough about the range of career choices in STEM and computer science that are available now and will be in the future[4]. This can be detrimental, as studies show that some girls lose interest in STEM and computer science over time, particularly in fields that require coding and programming.
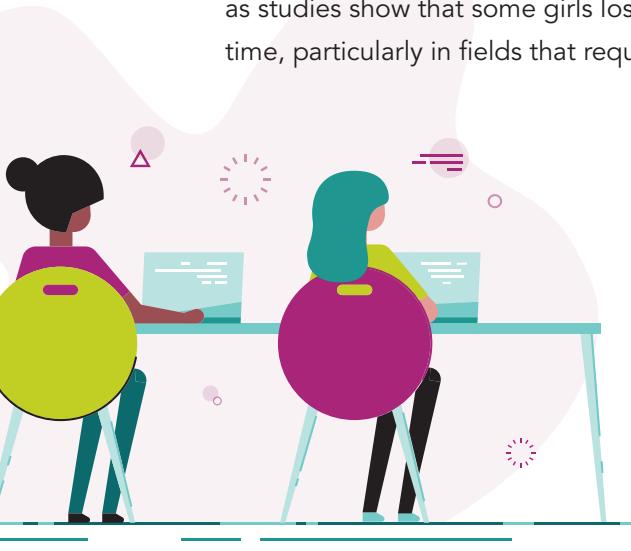
A Google report on role encouragement and exposure[5] showed that young women's perceptions about computer science significantly impacted their desire to pursue a computer science degree.

Young women who were **FAMILIAR** with computer science offered *positive* word associations (CS is **FUN**, **INTERESTING**, or **EXCITING**, for example) with the profession.

Young women who were **UNFAMILIAR** with computer science offered *negative* associations with related careers (CS is **BORING**, **HARD**, or **DIFFICULT**).

The Girl Scouts Research Institute[6] conducted a study on girls' perceptions of STEM.

IT FOUND:

60 percent of girls **INTERESTED IN STEM** admit to not knowing their possible career choices.

79 percent of girls **UNINTERESTED IN STEM** aren't knowledgeable of career choices.

Bridge the Gap

BRIDGE THE GAP BY SHOWING GIRLS HOW CREATIVITY, INNOVATION, AND PROBLEM SOLVING ARE LINKED TO JOBS AND CAREERS IN COMPUTING.

1 Learn and tell! Parents and educators can learn more about the diversity of career options in computing, and share that information with girls.

2 Connect with local and national organizations that offer STEM programming for children so that they can gain early career exposure.

KNOWLEDGE IS POWER!

Parents & Teachers Can Influence CS Learning.

Prior experience or knowledge isn't required to boost a girl's interest in computer science, and the research supports this idea. Families do not need to be CS experts to be actively engaged in girls' learning. As cliché as it sounds, even the smallest "you can do it" goes a long way in motivating young women and girls to learn computer science.

The Girl Scouts Research Institute[7] conducted a study on girls' perceptions of STEM.

IT FOUND:

PARENTAL ENCOURAGEMENT plays a key role in supporting girls with prior knowledge/ exposure to STEM.

76 percent of STEM girls in the study indicated that their parents' support and encouragement **PUSHED THEM TO THINK ABOUT THEIR CAREER GOALS**, compared to 67 percent of non-STEM girls.

Researchers at Microsoft[8] found that middle school girls in grades 5–8 who are encouraged by their teachers, mothers, or fathers individually are roughly **1.5 TIMES MORE LIKELY** to take computing and technology classes in high school compared to girls who have not been encouraged to do so.

Girls who have the combined support of parents and teachers are **3 TIMES MORE LIKELY** to study computer science than girls who don't have that support!

Bridge the Gap

BRIDGE THE GAP BY ENCOURAGING YOUNG WOMEN AND GIRLS FROM A "GROWTH MINDSET," SUPPORTING ALL ASPECTS OF THE LEARNING PROCESS, INCLUDING SUCCESS AND FAILURE.

1 For educators, seek out ways for students to learn about computer science both inside and outside the classroom (coding clubs, workshops, etc.). Look into building a collaborative partnership with local and national organizations (such as Girl Scouts or Girls Who Code) if your school or district isn't already working with STEM and CS-based groups.

Girls of Color Face Additional Barriers.

Girls from underrepresented groups face additional barriers related to their participation and engagement in computing and technology. Research supports that specific strategies and interventions (such as TECHNOLOchicas, a campaign powered by NCWIT and Televisa Foundation; or SMASH Academy, a program of Kapor Center) positively impact outcomes for girls of color.
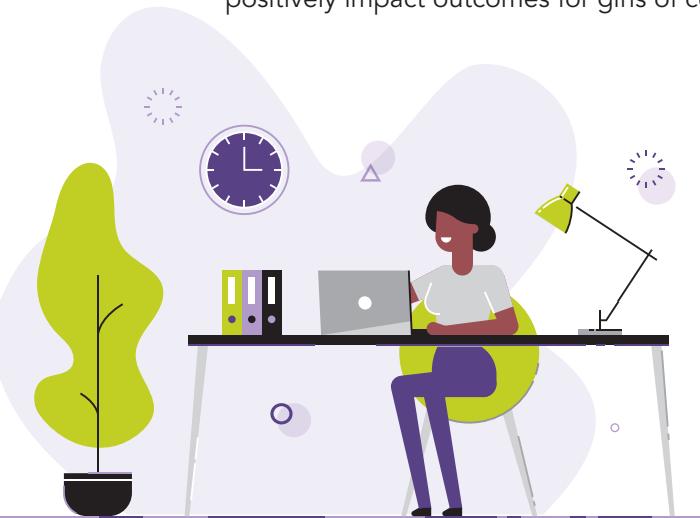
The Girl Scouts Research Institute study[9] found an encouragement gap between white girls and African-American and Hispanic girls:

Teacher **SUPPORT AND ENCOURAGEMENT WAS LOWER** for African-American and Hispanic girls compared to Caucasian girls (9 and 6 percentage points respectively).

African-American girls (38 percent) reported that their parents were **LESS LIKELY TO APPROVE OF A STEM CAREER** compared to Caucasian girls (54 percent).

Researchers who examined the experiences of female participants in a summer STEM-intensive program[10] found that although the underrepresented girls began the program with little interest in computer science, their interest grew over time.

Taking **MORE THAN ONE COMPUTER SCIENCE COURSE** fueled CS interest among girls of color.

Bridge the Gap

BRIDGE THE GAP BY BEING RESPONSIVE TO RACE, CLASS, GENDER, COLOR, ETHNICITY, AND OTHER INTERSECTIONAL ASPECTS OF SOCIAL IDENTITY THAT CREATE DIFFERENT EXPERIENCES FOR YOUNG WOMEN AND GIRLS.

1 Remember that visibility matters! Girls of color should be able to see themselves in others, and be encouraged by fellow women and girls of color.

2 Consider how girls with disabilities, from rural communities, and with other marginalized identities beyond race encounter different kinds of barriers, and actively seek ways to address them.

3 For educators: ensure that your K-12 CS curriculum is relevant, responsive, and equitable for all students.

Remember:

ENCOURAGEMENT MATTERS, and the research supports this!

Encouragement requires us to **ENGAGE A DIVERSE AUDIENCE AND BE INCLUSIVE** and strategic about reducing unconscious bias.

Visibility matters, and **GIRLS NEED TO SEE TANGIBLE AND CONCRETE EXAMPLES** of girls who look like them in the tech world.

Don't be afraid to **BECOME A CHANGE LEADER!** Change leaders are people who expand and go outside their comfort zone to build community and connection; they change the local conditions that create barriers to diversifying computing.

CHECK OUT OUR COMPANION PIECES ON ENCOURAGEMENT:

Computer Science is for Everyone Toolkit and PowerPoint Presentation
www.ncwit.org/CSEveryone_Toolkit

Enrich PK-8 Computing Education
www.ncwit.org/enriched

How Can You Engage a Diverse Range of Girls in Technology?
www.ncwit.org/compugirls

Case Studies on Encouragement
www.ncwit.org/academicencouragement

Top 10 Ways Families Can Encourage Girls' Interest in Computing
www.ncwit.org/top10families

Top 10 Ways to Engage Underrepresented Students in Computing
www.ncwit.org/top10engagestudents

Why Should Young People Consider Careers in IT?
www.ncwit.org/consideritcareers

Multiple Factors Converge to Influence Women's Persistence in Computing
www.ncwit.org/multiplefactorsarticle

SOURCES

[1] Fatherly (2017). *The Imagination Report: What Kids Want to Be When They Grow Up.*
[2] Miller, Nola, Eagly, and Uttal (2018). *The Development of Children's Gender-Science Stereotypes.*
[3] Bian, Leslie, and Cimpian (2017). *Gender Stereotypes About Intellectual Ability Emerge Early and Influence Children's Interests.*
[4] *Women Who Choose Computer Science: What Really Matters.* Google Report, 2014.
[5] *Women Who Choose Computer Science: What Really Matters.* Google Report, 2014.
[6] *Generation STEM: What Girls Say About Science, Technology, Engineering and Math.* A Report from the Girl Scouts Research Institute, 2012.
[7] *Generation STEM: What Girls Say About Science, Technology, Engineering and Math* (2014). A Report from the Girls Scouts Research Institute.
[8] *Closing the STEM Gap: Why STEM Classes and Careers Still Lack Girls and What Can we Do About It* (2017). A Microsoft Report.
[9] *Generation STEM: What Girls Say About Science, Technology, Engineering and Math* (2014). A Report from the Girls Scouts Research Institute.
[10] Scott et al,. *Broadening Participation in Computing: Examining Experiences of Girls of Color.* Innovation and Technology in Computer Science Education 2017 Conference Proceedings.