



Diversity Gaps in Computer Science:

Exploring the Underrepresentation of Girls, Blacks and Hispanics

2016



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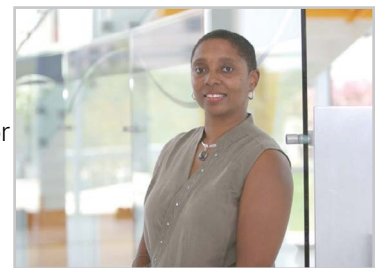
Foreword

The *Diversity Gaps in Computer Science: Exploring the Underrepresentation of Girls, Blacks, and Hispanics* report is essential given the announcement of President Obama's bold new initiative, CS for All, in January of this year (2016). The report contains the needed focus on women, Blacks, and Hispanics – three groups that are underrepresented in computer science studies and the computing workforce. The report raises awareness about the structural and social barriers for the target groups in computer science, based upon a holistic assessment – surveying students, parents, teachers, principals, and superintendents.

As I read the report, the major findings struck a personal chord with me as a Black woman in the field of computer science. When I was in high school, we did not have personal computers or cellphones. My initial interest in computer science was the result of a class that I was fortunate to have access to in high school. I attended a parochial, all-girls high school, that provided access to the main frame computer that was owned by the local hospital for billing purposes. Once a week, we were able to run our programs on this computer. I excelled in my first programming course on Fortran. As a result, my teachers recognized my success and encouraged me to major in engineering in college. In addition, my parents (my mother was a kindergarten school teacher and my father was an engineer), also strongly encouraged (close to required) that I major in an engineering field in college. Without this encouragement and critical exposure, I would not have thought about engineering or computer science and would have missed out on such an exciting and creative career.

Once in college at Purdue University, I initially majored in chemical engineering. When I took my first programming course during my freshman year, I felt confident in my abilities because of my positive experience in high school, whereas many of my peers had no programming experience. Largely because of support from teachers and family, I went on to complete my bachelors, masters, and PhD in fields related to computing, and became the head of the Department of Computer Science and Engineering at Texas A&M University, where I served two terms. It all started with a programming course in high school and the simple support from teachers and parents, which this report finds is powerfully impactful for students.

This report provides excellent recommendations for parents and educators to increase the engagement of women, Blacks, and Hispanics in computer science. It further highlights recommendations for organizations to provide content for mobile devices that encourages the target groups to consider computer science. I strongly encourage you to read the report to understand the computer science education landscape for girls, Blacks, and Hispanics.



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Executive Summary

Given the ubiquity of the computing field in society, the diversity gap in computer science (CS) education today means the field might not be generating the technological innovations that align with the needs of society's demographics. Women and certain racial and ethnic minorities are underrepresented in learning CS and obtaining CS degrees, and this cycle perpetuates in CS careers. Many — including tech companies and educational institutions — have taken steps to make CS more appealing and accessible to these groups, yet the diversity gap endures.

Google commissioned Gallup to conduct a multiyear, comprehensive research effort with the goal of better understanding computer science perceptions, access and learning opportunities among underrepresented groups in the U.S., such as female, Black and Hispanic students. This report presents the results from Year 2 of this multiyear study among seventh- to 12th-grade students, parents of seventh- to 12th-grade students, and elementary through high school teachers, principals and superintendents. It focuses on the structural and social barriers underrepresented groups face at home, in schools and in society that could influence their likelihood to enter the computer science field.¹

Key points

Underrepresented groups face **structural barriers** in access and exposure to computer science (CS) that create disparities in opportunities to learn.

- » **Black students are less likely than White students to have classes dedicated to CS at the school they attend (47% vs. 58%, respectively).** Most students who have learned CS did so in a class at school, although Black and Hispanic students are more likely than White students to have learned CS outside of the classroom in after-school clubs.
- » **Black (58%) and Hispanic (50%) students are less likely than White students (68%) to use a computer at home at least most days of the week.** This could influence their confidence in learning CS because, as this study finds, students who use computers less at home are less confident in their ability to learn CS.
- » **Teachers are more likely than parents to say a lack of exposure is a major reason why women and racial and ethnic minorities are underrepresented in CS fields.** This suggests that educators observe interest among all student types and that broadening exposure and access might help drive greater minority involvement in CS.

Underrepresented groups also face **social barriers** to learning CS, such as the continuing perception that CS is only for certain groups, namely White or Asian males.

- » **Female students are less likely than male students to be aware of CS learning opportunities on the Internet and in their community, to say they have ever learned CS, and to say they are very interested in learning CS.** Despite presumably equal access to CS learning opportunities in schools, female students are not only less aware but also less likely than male students who have learned CS

¹ Only White, Black and Hispanic student and parent data are analyzed in this report because of insufficient n sizes for other racial and ethnic groups.

to say they learned it online (31% vs. 44%) or on their own outside of a class or program (41% vs. 54%). Female students are also less interested (16% vs. 34%) and less confident they could learn CS (48% vs. 65%). The lesser awareness, exposure, interest, and confidence could be keeping female students from considering learning CS.

- » **Black students are more confident than White and Hispanic students** (68% vs. 56% and 51%, respectively) – so to the extent that Blacks are underrepresented in CS, lack of confidence would not appear to be the cause.
- » **About one in four students report “often” seeing people “doing CS” in television shows (23%) or movies (25%), and only about one in six (16%) among them report “often” seeing people like them** – this is true of even smaller proportions of female (11%) and Hispanic (13%) students. If students do not see people “doing CS” very often, especially people they can relate to, it is possible they will struggle to imagine themselves ever “doing CS.”²
- » **Male students are more likely to be told by a parent or teacher that they would be good at CS (46% vs. 27% being told by a parent; 39% vs. 26% being told by a teacher).** This is despite the fact that all parents place great value in CS learning, with a large majority of those whose children have not learned CS (86%) saying they want their child to learn some CS in the future – including 83% of parents of girls and 91% of parents of boys.
- » **Parents are more likely than educators to report that a lack of interest in learning CS is a major reason why women and racial and ethnic minorities are less likely to work in CS fields,** although less than a majority feel this way. If parents believe that an inherent lack of interest is the reason underrepresented groups are not as prevalent in CS, they may be less likely to encourage their children to learn CS. This may be especially true if their children do not show interest in CS and do not fit the computer scientist stereotype of White or Asian males “wearing glasses.”³

These complex and interrelated structural and social barriers have far-reaching implications for underrepresented groups in CS. Not only do females, Blacks and Hispanics lack some of the access and exposure to CS that their counterparts have, but the persistence of long-standing social barriers that foster narrow views of who does CS can also halt interest and advancement. For example, parents and educators tell fewer female students that they would be good at CS, which may be due to girls’ less-expressed interest in and activity with CS, or it could come from parents’ unconscious bias. While further research should be done to assess these relationships, understanding the individual effects of these barriers is a first step toward building support and offerings to encourage equitable learning of CS among all students.

A companion report, *Trends in the State of Computer Science in U.S. K-12 Schools*, focuses on changes from Year 1 on key measures in opportunities to learn CS (including awareness of and access to CS), as well as perceptions of CS, demand for CS and challenges and opportunities for CS in K-12 schools.

2, 3 According to page 3 of *Images of Computer Science: Perceptions Among Students, Parents and Educators in the U.S.*, it is much more common for students and parents to see people “doing CS” in the media who are male, White or Asian, and wearing glasses.

Introduction

The computer science (CS) industry, and STEM (Science, Technology, Engineering and Math) fields more broadly, have a well-documented lack of gender and racial diversity, with relatively few women, Blacks and Hispanics working in the industry. Despite efforts by tech companies and educational institutions to attract more underrepresented groups to STEM fields, the gap persists. Fewer underrepresented minority students earn degrees in CS in college.⁴ Additionally, women are significantly less likely than men to earn a degree in CS, and this gap has grown since the mid-1980s.⁵

Compounding this problem is a lack of comprehensive data on the factors that contribute to the underrepresentation of these groups in CS. Comprehensive data on U.S. students' early exposure to CS, as well as on parents' and educators' perceptions of CS, can shed light on why certain groups choose (or do not choose) to pursue CS through high school, in college and as a career.

To understand the motivating factors for women, Google's 2014 report *Women Who Choose Computer Science – What Really Matters*⁶ identified four leading factors that influence a woman's decision to pursue a CS degree: social encouragement to study CS, self-perception (having an interest in areas applicable to CS, such as problem-solving and tinkering), academic exposure to CS and career perception (including understanding broader professional applications for CS).

Expanding on the scope of *Women Who Choose Computer Science – What Really Matters*, Google commissioned Gallup to conduct a multiyear, comprehensive research effort to better understand these factors among students, parents and K-12 educators in the U.S. The findings from the first year of this study can be found in two separate reports. *Searching for Computer Science: Access and Barriers in U.S. K-12 Education* examines student exposure to computer technology, demand for CS in schools, opportunities for students to learn CS and barriers to offering CS in schools. The second report, *Images of Computer Science: Perceptions Among Students, Parents and Educators in the U.S.*, explores the confusion between CS activities and general computer literacy, perceptions of

CS careers, the stereotypes of who engages in CS and the demographic profiles of students who have learned CS.

This special report on diversity is part of the second year of this multiyear study and focuses on access to and participation in CS learning opportunities among girls and underrepresented racial and ethnic minorities, namely Blacks and Hispanics, in seventh to 12th grade in the U.S. The companion report from this second year, *Trends in the State of Computer Science in U.S. K-12 Schools*, covers overall differences from the first year, including changes in CS offerings, perceptions, and barriers while this report dives into the pertinent diversity gaps in CS. Understanding the access challenges certain underrepresented groups face and the avenues these groups take to learn CS when they are available helps reveal important facts about the CS pipeline. Throughout this report, the term "underrepresented groups" is used to describe females, Blacks and Hispanics, as they are underrepresented in the field of CS. Sample sizes for other potentially underrepresented minorities (such as Native Americans) were too small to report.

This report also examines social barriers that could hinder participation by underrepresented groups in CS, including exposure to CS stereotypes in the media, lack of encouragement to learn CS from adults, and parents' and educators' belief that underrepresented groups are not as interested in pursuing CS. These data reveal the various ways in which students might receive unconscious messages that either encourage or discourage their participation in CS.

For this phase of the study, Gallup interviewed nationally representative samples with responses from 1,672 seventh- to 12th-grade students, 1,677 parents of seventh- to 12th-grade students, and 1,008 first- to 12th-grade teachers via telephone in December 2015 and January 2016. In addition, Gallup surveyed nationally representative samples with responses from 9,805 K-12 principals and 2,307 school district superintendents in the U.S. online. The data for all five samples were weighted to be representative of their respective groups, and all comparisons between Year 1 and Year 2 data reflect weighted, representative data. Gallup researchers tested all differences noted (as higher or lower than other groups) between samples and demographic subgroups for statistical significance and, in many cases, used models to ensure differences noted are still significant after controlling for other factors, such as education and income. See Appendix A for more details on the sampling frames for each group and methodology. This report includes a selection of key findings from the second year of this expansive research project.

4, 5 According to National Center for Education Statistics, in 2013-2014 Blacks made up 10.7% of Bachelor's degrees in Computer and information science, while according to the 2014 U.S. Census, Blacks make up 13.5% of 20- to 24-year-olds. Race/Ethnicity data retrieved from http://nces.ed.gov/programs/digest/d15/tables/dt15_322.30.asp?current=yes and http://www.census.gov/population/projections/files/natproj/detail/d2011_20.pdf

6 Reference access at <https://goo.gl/rLX6ax>

**COMPUTER
SCIENCE
LEARNING**

Black students are less likely than White students to have access to a Computer Science class in school. Female students are less likely to be aware of Computer Science learning opportunities online and in their community. While most students who have learned Computer Science did so in a class at school, Black and Hispanic students are more likely than White students to have learned Computer Science outside of the classroom in after-school clubs or groups.

Access to CS: Black Students Are Less Likely Than White Students to Have Access to CS Classes In School

As CS becomes more integrated into a variety of career fields and facets of everyday life, it is of growing importance that all students have the opportunity to learn CS. Overall, just over half (56%) of seventh- to 12th-grade students in the U.S. say their school offers at least one dedicated CS class, and about half (51%) report that CS is taught as part of other classes at their school. More than four in 10 students (44%) say there are after-school groups or clubs where students can learn CS.

Black students are less likely than White students to say their school offers a dedicated CS class (47% vs. 58%). Black students are also less likely than Hispanic students to have a CS class in their school; however, after controlling for income and parents' education, the difference is no longer significant.⁷

In general, when students have access to CS learning in school, they are more likely to say they are very interested in learning it — suggesting that exposure to these opportunities is key to piquing students' interest in the first place. Students who report there are groups or clubs at their school where they can learn CS show greater interest in learning CS. Educators might want to think about ways to integrate CS into schools outside of dedicated CS classes to appeal to more students.

To ensure that respondents were thinking only about computer science — and not computers more generally — respondents were provided with a definition of computer science after answering initial questions about computer science activities. In addition, respondents were reminded multiple times throughout the survey that “computer science involves using programming/coding to create more advanced artifacts, such as software, apps, games, websites and electronics, and that computer science is not equivalent to general computer use.”

Awareness of CS: Female Students Are Less Aware of Computer Science Learning Opportunities On the Internet and In Their Local Community

While there are no gender differences in access to CS in schools, male students are more likely than female students to be aware of groups or clubs at their schools where CS can be learned, and are more likely to be aware of opportunities in their community and on the internet where they can learn CS. While there could be many reasons for the gender awareness gap — including student interest driving awareness — one possibility is that these opportunities are geared toward activities more likely to attract boys, such as gaming, and that the material itself might not resonate as much with some girls. Approaches to increasing the number of students — both male and female — who learn CS should consider material that signals to male and female students that they belong and can succeed.⁸

Awareness of CS opportunities is related somewhat to interest in learning it. Students who say they are aware of specific websites where they can learn CS are more likely than those who are not aware of them to say they are “very interested” in learning CS (30% vs. 16%). About two-thirds

7 All differences discussed are significant at the 0.05 level, and significance holds when controlling for parents' education and annual household income, unless otherwise noted.

8 See Master, A., Cheryan, S., and Meltzoff, A. N. (2015). Computing whether she belongs: Stereotypes undermine girls' interest and sense of belonging in computer science [Electronic version]. *Journal of Educational Psychology*, 108(3), 424-437. Retrieved from http://life-slc.org/docs/MasterCheryanMeltzoff_2015_JEP.pdf

of students overall are aware of specific websites, and just over half are aware of opportunities in their community to learn CS outside of their school.

Among parents, a majority are aware of specific websites where their child could learn CS on the internet. Black parents are more likely than White parents to know of these websites, with nearly two-thirds of Black parents reporting they know of specific websites to learn CS, compared with half of White parents. Awareness of CS learning opportunities in the community outside of school is even lower among parents than among students, with just 43% saying they are aware of outside opportunities.

Awareness of computer science learning opportunities online and in the community is important, especially among those who lack the opportunity to learn computer science at school. Awareness of community-based CS learning opportunities among parents is an important step in supporting and encouraging CS learning among children (see Appendix B, Figure B4).

Learning CS: Overall, Male Students Are More Likely Than Female Students to Have Learned CS and Are More Likely to Have Learned It On Their Own, While Black And Hispanic Students Are More Likely Than White Students to Have Learned Outside of the Classroom In After-School Clubs or Groups

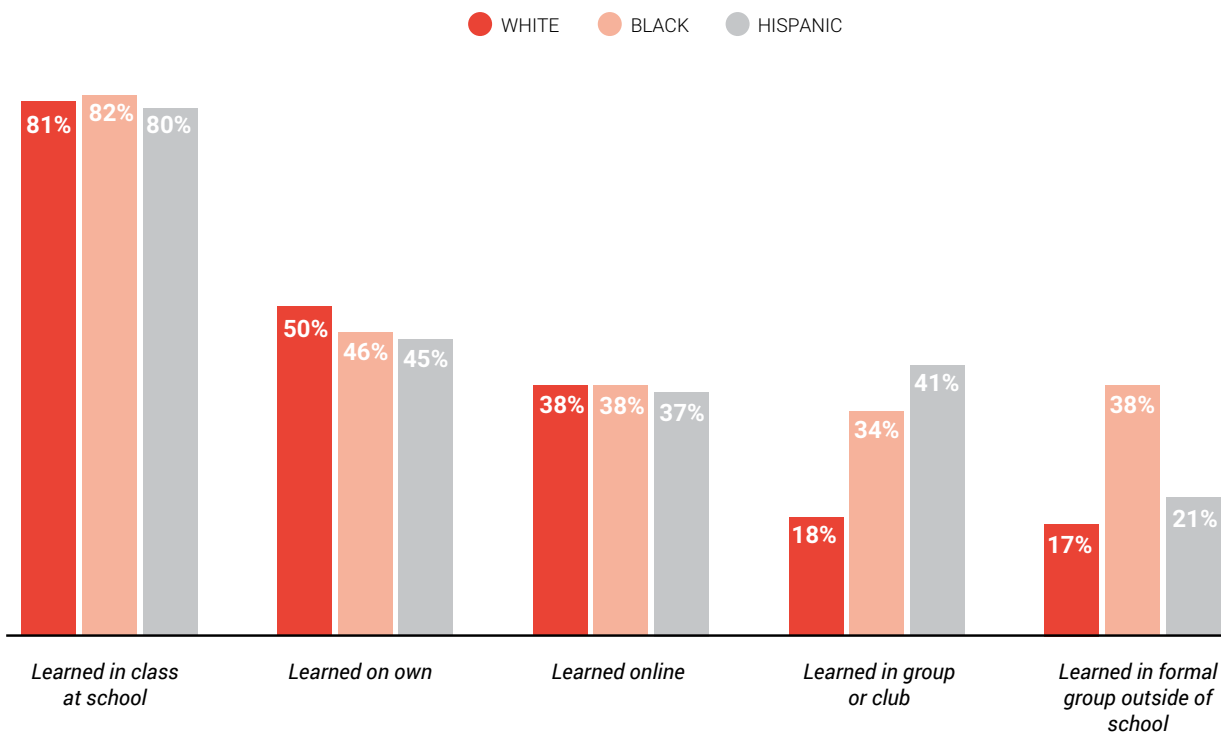
With a majority of students saying their school offers at least one dedicated CS class, it is not surprising that over half the students (55%) in grades seven through 12 say they have learned some CS. Most of these students (80%) learned CS in a class at school, with almost half of this group (47%) saying they learned in a dedicated CS class. Nearly two-thirds of students who learned CS are self-learners, with 48% saying they learned on their own outside of class, 39% reporting they learned online, and one-quarter or less saying they learned in a group or club at school (26%) or in a formal group outside of school (22%).

Figure 1.

HAVE YOU EVER LEARNED COMPUTER SCIENCE IN ANY OF THE FOLLOWING WAYS? (% YES)

Asked only of those who learned computer science (White n=584, Black n=140, Hispanic n=173)

%STUDENTS



CS groups and clubs at school outside of official classes could also engage more Black and Hispanic students. Both Black and Hispanic students (34% and 41%, respectively) are more likely than White students (18%) to say they learned CS in a group or club at school. Black students (38%) are also more likely than White (17%) or Hispanic (21%) students to say they learned CS in a formal group outside of school. Since Black students are less likely than White students to have classes at their school where only CS is taught, many Black students might seek alternative opportunities for learning CS outside of class. However, the vast majority of CS learning still takes place in a class at school across all racial groups, demonstrating that when schools offer CS classes, it is increasingly important to ensure that all racial and ethnic groups equally participate and benefit.

Male students (59%) are more likely than female students (50%) to say they have ever learned CS, and they are more likely to pursue opportunities to learn CS outside of the classroom. This difference is striking because male and female students have the same level of access to CS learning opportunities in their schools and communities. While male and female students who have learned CS are equally likely to say they learned CS in class, in a club at school or in a formal group outside of school, male students are more likely than female students to say they learned CS online (44% vs. 31%) or on their own outside of class (54% vs. 41%). In fact, over half of the male students who say they have ever learned CS say they learned some on their own. This aligns with the finding that males are more aware of outside opportunities to learn CS.

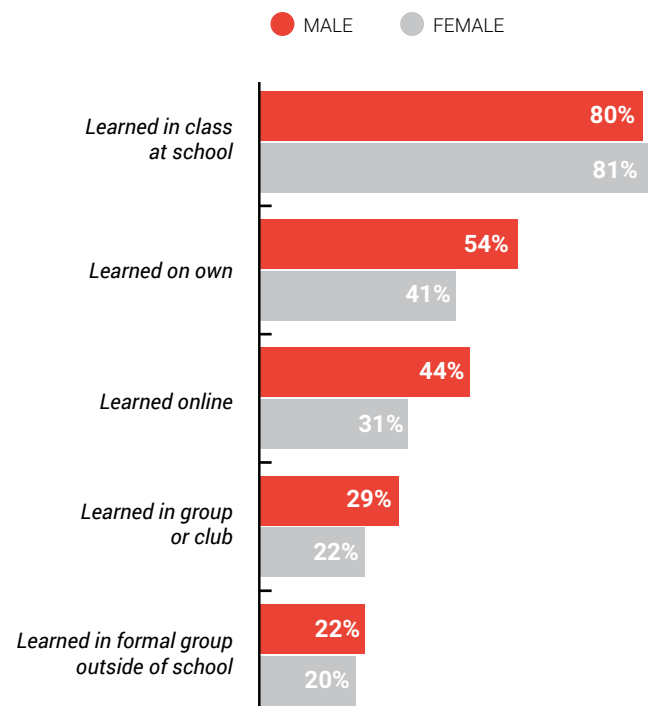
Figure 2.

HAVE YOU EVER LEARNED COMPUTER SCIENCE IN ANY OF THE FOLLOWING WAYS? (% YES)

Asked only of those who learned computer science

(Male n=548, Female n=403)

%STUDENTS



EXPOSURE TO TECHNOLOGY

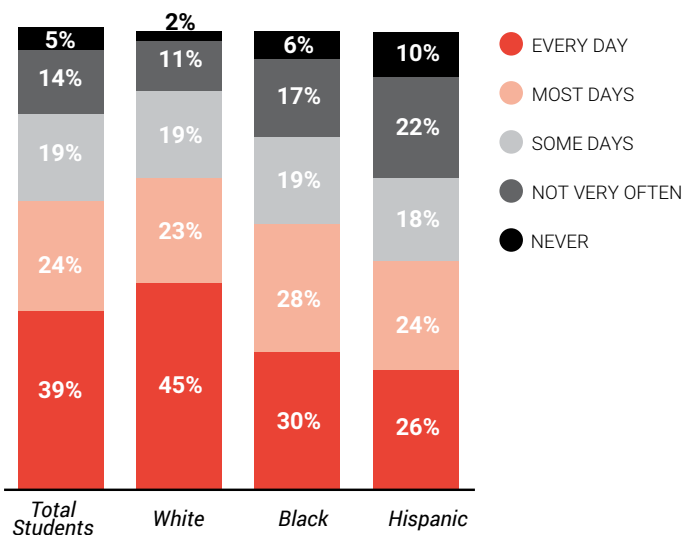
Black and Hispanic students are less likely than White students to use a computer at home every day, and Hispanic students are less likely than White students to say they use a computer at school every school day. More than six in 10 students know an adult who works with computers and technology, although fewer Hispanic students know such an adult.

Home Computer Access Is Higher Among White Students, With Large Majorities of All Students Reporting Daily Cellphone Usage

Disparities in exposure to technology in the home and school may also influence the likelihood that students in underrepresented groups will learn and do computer science in the future. Overall, almost four in 10 students (39%) use a computer at home every day, and among those who do, more than three-quarters (77%) use a computer at home for two hours or more daily. White students are more likely than Black and Hispanic students to use a computer at least most days of the week at home. In fact, two-thirds of White students (68%) use a computer at home at least most days a week, while just half of Hispanic students (50%) use a computer that often. Almost six in 10 Black students (58%) use

Figure 3.

IN A TYPICAL WEEK, HOW OFTEN DO YOU USE A COMPUTER AT HOME?



Total n=1672, White n=1033, Black n=228, Hispanic n=310

computers at home at least most days of the week. Just one in 20 students (5%) say they never use a computer at home.

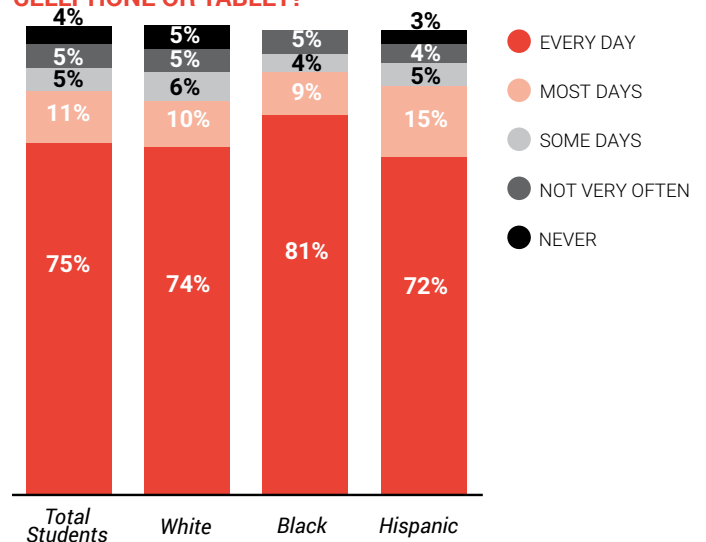
At-school computer use is similar to at-home use, with almost four in 10 seventh- to 12th-grade students (38%) saying they use a computer at school every school day — although Hispanic students are less likely than White students to say this (31% vs. 42%, respectively). An additional one-quarter of students say they use a computer most days at school. Hispanic students are more likely than White or Black students to say they use a computer only some days or never (45% vs. 33% and 34%, respectively).

Home and school computer use do not differ significantly by gender, although a greater proportion of female students (42%) than male students (36%) report using a computer at home every day.

Cellphone and tablet usage is very high among all students, with three-quarters (75%) saying they use a cellphone or tablet every day. Among students who use a cellphone or tablet every day, 83% use it for at least two hours, including 35% who use it for more than five hours on a typical day. Black students are more likely than Hispanic students to use a cellphone or tablet every day (81% vs. 72%), and over half of Black students who report daily cellphone or tablet usage (52%) say they use their cellphone or tablet for more than five hours on a typical day. The duration of cellphone and tablet usage is just as high among Hispanic students who use their devices every day, with 47% saying they use their device more than five hours on a typical day; just 27% of White students who use a cellphone or tablet daily say the same.

Figure 4.

IN A TYPICAL WEEK, HOW OFTEN DO YOU USE A CELLPHONE OR TABLET?



Total n=1672, White n=1033, Black n=228, Hispanic n=310

While there are no differences between male students and female students when it comes to computer usage, female students are more likely than male students to use a cellphone or tablet every day. In fact, 84% of seventh- to 12th-grade female students in the U.S. say they use a cellphone or tablet every day, compared with only 68% of male students. Daily users among both genders are active, with about one-third saying they use their device more than five hours in a typical day. With large majorities of students from underrepresented groups using a cellphone or tablet every day and using them for several hours each day, opportunities to learn CS through mobile technology or that explicitly connect CS to the devices they use (for example, programs that show students how to make their own mobile app) could help build interest in CS among these students.

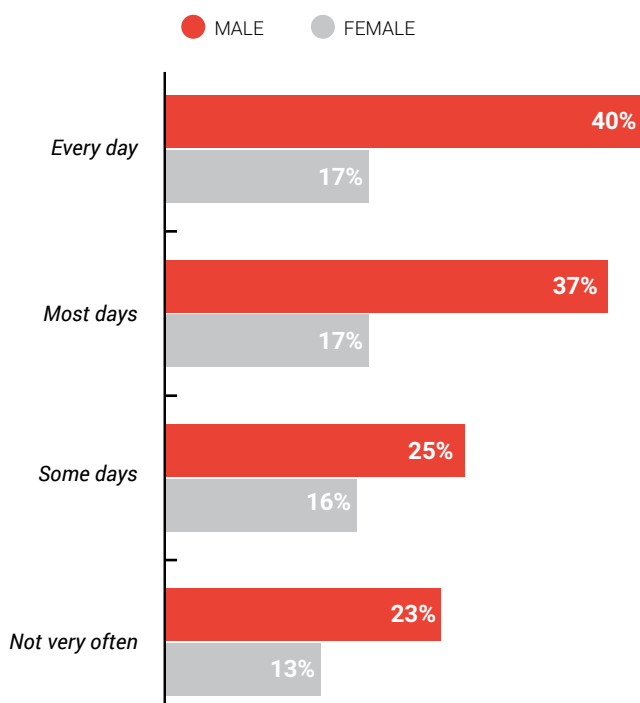
Frequent computer usage is also related to interest in CS. Male students who use a computer every day at home are more likely to say they are “very interested” in learning CS (40%), compared with male students who use a computer at home just some days a week (25%). This difference does

not exist for female students, among whom about one in seven (between 13% and 17%) say they are “very interested” in learning CS regardless of how frequently they use a computer at home. This may be attributable to male and female students using computers at home for different purposes. For example, male students might be more likely to use computers to play video games, where they are exposed to CS ideas via creation; on the other hand, female students may use computers more for social media, which could be more passive consumption. Introducing CS elements into a broader range of online activities might be key to attracting more students to the field — particularly female students, who may be less likely to engage in activities such as computer gaming.

In addition, students’ exposure to adults who work with computers and technology can influence their attitudes toward CS. Male and female students are equally likely to say there is an adult in their life who works with computers or technology (63% for each). However, Hispanic students (49%) are less likely than White (68%) or Black students (65%) to say an adult in their life works with computers or technology.

Figure 5.

STUDENTS “VERY INTERESTED” IN LEARNING COMPUTER SCIENCE, BY NUMBER OF DAYS THEY USE A COMPUTER AT HOME



**INTEREST AND
CONFIDENCE
IN LEARNING
COMPUTER SCIENCE**

Male students are more interested and more confident in learning computer science. Black students are more confident than White and Hispanic students in their ability to learn Computer Science. Female students and Hispanic students rate themselves lower in skills related to Computer Science. Black and Hispanic parents are more likely than White parents to believe their child will learn Computer Science in the future.

Male Students Are More Confident Than Females, and Black Students Are More Confident Than White and Hispanic Students, That They Could Learn CS If They Wanted To

Among seventh- to 12th-grade students in the U.S., one-quarter are “very interested” and slightly fewer than six in 10 are “somewhat interested” in learning CS in the future.

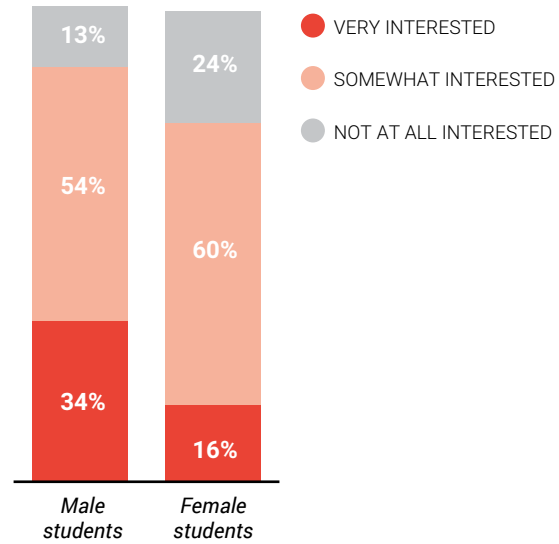
However, there is a sizable difference between male and female students’ responses to this question, with twice as many male students (34%) as female students (16%) saying they are “very interested” in learning CS in the future, and nearly twice as many female students (24%) as male students (13%) saying they are “not at all interested.” While many factors may influence interest in CS, this current gap in interest among students could foreshadow a lack of women entering CS fields later in life.

Along with student interest, confidence in their ability to learn CS may influence who pursues it. While 57% of students overall are “very confident” they could learn CS, this decreases to 48% among female students, compared with nearly two-thirds of male students (65%). Female students are also less likely than male students to think they will have a job someday for which they will need to know CS; 22% of female students say they are “very likely” to have such a job, compared with 35% of male students (see Appendix B, Figure B15).

Figure 6.

HOW INTERESTED ARE YOU IN LEARNING COMPUTER SCIENCE IN THE FUTURE?

%STUDENTS

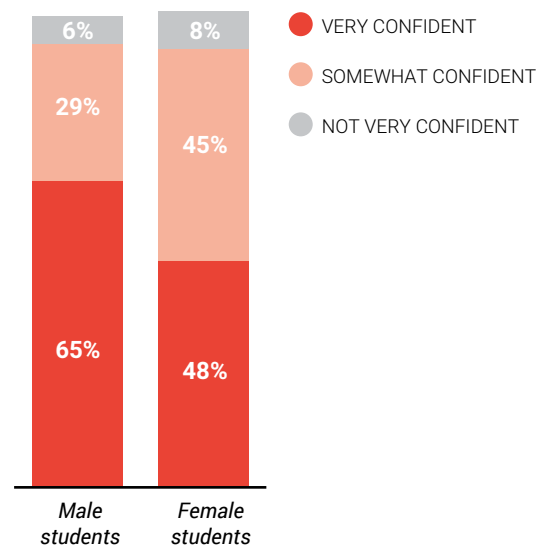


Male students n=901, Female students n=771

Figure 7.

HOW CONFIDENT ARE YOU THAT YOU COULD LEARN COMPUTER SCIENCE IF YOU WANTED TO?

%STUDENTS

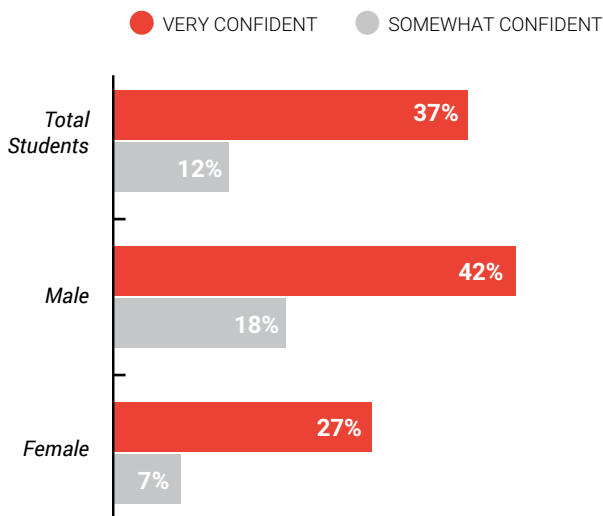


Male students n=901, Female students n=771

Unsurprisingly, interest in learning CS is moderately correlated with confidence that one could learn it.⁹ Students who are very confident they could learn CS are three times more likely to be “very interested” in learning (37%) than are students who are somewhat confident they could learn (12%). This relationship is even greater among male students, with more than four in 10 (42%) who are “very confident” saying they are also “very interested” in learning. Just over one-fourth (27%) of female students who are “very confident” say the same.

Figure 8.

STUDENTS WHO ARE “VERY INTERESTED” IN LEARNING COMPUTER SCIENCE, BY CONFIDENCE IN LEARNING COMPUTER SCIENCE



Very confident n=971, Somewhat confident n=608

Additionally, among students who have already learned some CS, male students are more likely than female students to say they are “very confident” they could learn CS (72% vs. 59%). This could indicate that the first step toward getting more girls interested in CS is to boost their confidence that they could learn it and to help them stay confident in their CS skills once they have learned some. Of course, many factors outside of confidence may be contributing to girls’ interest or lack of interest in CS, including seeing people like themselves “doing CS” or computer usage.

Black and Hispanic Students Show Higher Interest In Learning CS, and Black and Hispanic Parents Are More Likely to Believe Their Child Will and Would Like to Learn Computer Science

Similar to findings from Year 1, students who say they are very skilled in math and science are more interested in learning CS and are more confident they could learn it. However, female students are less likely than male students to say they are “very skilled” in math or science, with nearly half of male students (48%) saying this for each, compared with fewer than four in 10 female students (37% for math and 33% for science).

In addition, while parents give similar assessments of their child’s ability in math and science regardless of the child’s gender, parents assessing a female child are more likely than parents assessing a male child to say their child is “very skilled” in English (70% vs. 49%), music (46% vs. 34%) and working with other people (69% vs. 59%). If parents feel their child is “very skilled” in an area, they may encourage their child to take classes that rely on those skills, suggesting parents could end up unconsciously pushing their daughters away from CS and toward other classes, such as English and music.

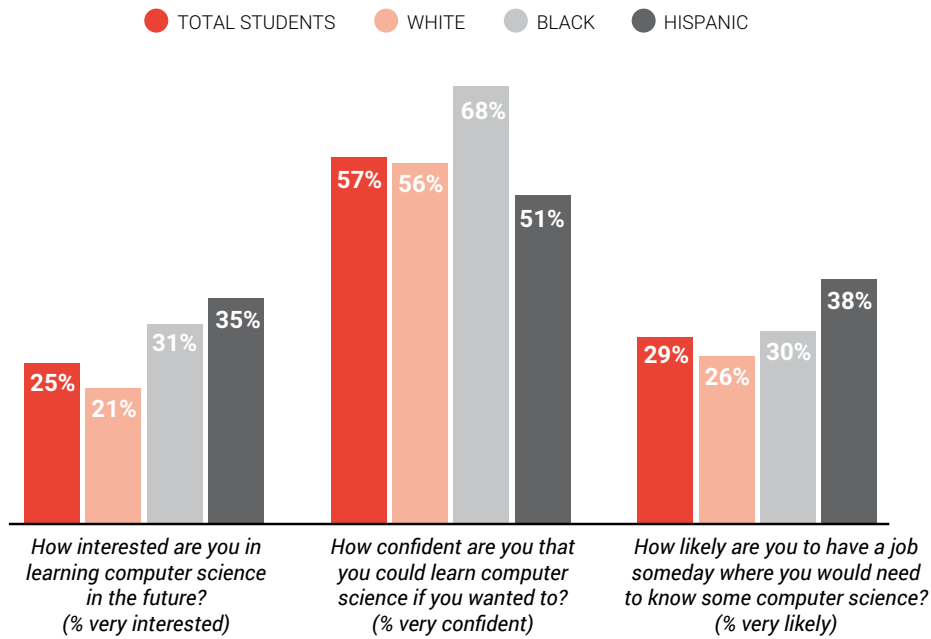
Black and Hispanic students also express more interest in CS than White students. About a third of Black and Hispanic students say they are “very interested” in learning CS in the future, compared with about one-fifth of White students. Black students are also more likely than White or Hispanic students to say they are very confident they could learn CS; about two-thirds of Black students (68%) say they are very confident, compared with 56% of White students and 51% of Hispanic students. In addition, Hispanic students are more likely than White students to say it is “very likely” they will have a job someday where they will need to know CS (38% vs. 26%, respectively).

While just over half of the seventh- to 12th-grade students in the U.S. say they have learned some CS, close to nine in 10 parents of seventh- to 12th-graders who have not learned CS want their child to learn it in the future, including 92% of Black and Hispanic parents. Furthermore, among parents whose child has already learned some CS, there is near-universal agreement (95%) that they want their child to learn more CS, showing that parents whose children have had some introduction to CS see the value in learning more advanced aspects of it.

⁹ There was a positive correlation between the two variables, $r = 0.397$, $n = 1671$, $p < 0.001$

Figure 9.

INTEREST, CONFIDENCE AND LIKELIHOOD TO WORK IN COMPUTER SCIENCE BY RACE



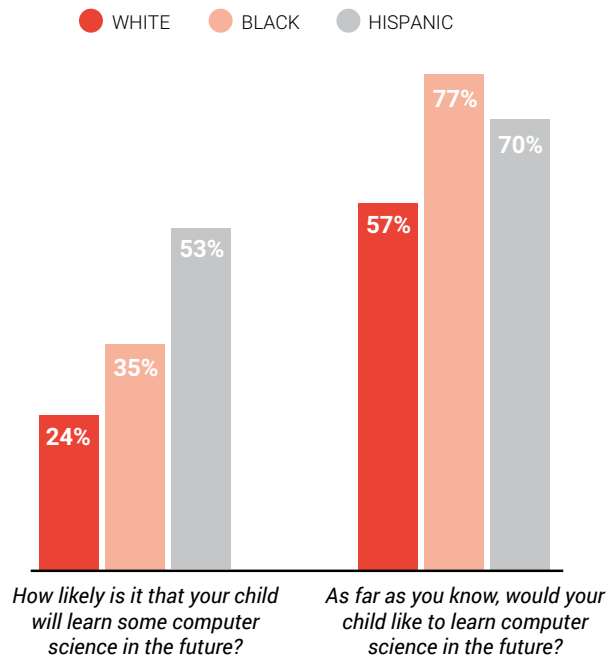
Total n=1672, White n=1033, Black n=228, Hispanic n=310

Among parents of a child who has never learned CS, White parents are less likely than either Black or Hispanic parents to say their child is “very likely” to learn CS in the future. In fact, over twice as many Hispanic parents (53%) as White parents (24%) report their child is very likely to learn some CS, while 35% of Black parents say the same. Additionally, 77% of Black parents and 70% of Hispanic parents of a child who has never learned CS claim that their child wants to learn CS in the future, compared with just 57% of White parents.

However, Blacks and Hispanics continue to be underrepresented in CS fields.¹⁰ This indicates the factors that contribute to the underrepresentation of racial and ethnic minorities in CS fields go beyond student interest and confidence in learning CS.

Figure 10.

PARENTS' PERCEPTIONS OF CHILD FUTURE CS LEARNING



Asked only of those whose child has NOT learned CS

10 U.S. Census. (2013, September). Disparities in STEM employment by sex, race, and Hispanic origin. Retrieved from <http://www.census.gov/prod/2013pubs/acs-24.pdf>

VIEWS OF PEOPLE IN COMPUTER SCIENCE

While student reports of “often” seeing people “doing CS” in the media are relatively low, female students are even less likely than male students to report seeing people like themselves “doing CS” in the media. Male students are also more likely to be encouraged by teachers or parents to learn Computer Science.

Black Students are More Likely than White or Hispanic Students, and Boys Are More Likely Than Girls, to Recall Often Seeing People Like Themselves “Doing CS” In the Media, With Students Who Report Often Seeing People Like Themselves “Doing CS” In the Media Much More Likely to Say They Are “Very Interested” In Learning CS

Students may also be influenced by who they see “doing CS” in the media and who they see “doing CS” as a job. In the 2015 *Images of Computer Science* report, Google-Gallup found that “Students and parents perceive that there are few portrayals of women, Hispanic or Black computer scientists on TV or in movies. These groups are much more likely to see White or Asian men engaged in computer science. They also often see computer scientists portrayed wearing glasses.”¹¹ For this study, students were asked additional questions about exposure to CS in TV, movies and online. Overall, at least four in five students say they see people “doing CS” “often” or “sometimes” in movies, television shows and online. Fewer than one in five say they “never” see people “doing CS” in the media. Of the students who do see people “doing CS” in the media, just 16% say they often see people like themselves “doing CS” in the media, while nearly one in four (24%) never do. Male students are much more likely than female students to see people “doing CS” online and, among students who see people “doing CS” in the media, male students are also more likely than female students to say they often see people like themselves “doing CS” in the media. About one-

¹¹ According to page 3 of *Images of Computer Science: Perceptions Among Students, Parents and Educators in the U.S.*, it is much more common for students and parents to see people “doing CS” in the media who are male, White or Asian, and wearing glasses. See <https://goo.gl/F3SSWH>

Figure 11.

HOW OFTEN DO YOU SEE OR READ ABOUT PEOPLE DOING COMPUTER SCIENCE IN EACH OF THE FOLLOWING PLACES?

%STUDENTS

In TV shows	Often	23%
	Sometimes	57%
	Never	19%
In movies	Often	25%
	Sometimes	60%
	Never	14%
Online through social media, articles or videos	Often	33%
	Sometimes	49%
	Never	15%
IF OFTEN OR SOMETIMES SEE PEOPLE “DOING CS” IN TV, MOVIES, OR ONLINE:		
Thinking about all of the people you see or read about doing computer science in TV shows, in movies or online, how often do you see people like you doing computer science?	Often	16%
	Sometimes	59%
	Never	24%

fifth of male students (21%) say they often see people like them “doing CS” in the media, while just one in 10 female students (11%) say this (see Appendix B, Figures B22 and B23). Because female students report seeing fewer people in general and fewer people like themselves “doing CS” in the media, they might be less likely to picture themselves ever “doing CS.”¹²

Even female students who do report often seeing people like themselves doing computer science in the media are still half as likely as male students who say the same to report that they are “very interested” in learning CS (31% vs. 58%, respectively).

¹² For more information, see: Gender Differences in Factors Influencing Pursuit of Computer Science and Related Fields at <http://static.googleusercontent.com/media/research.google.com/en//pubs/archive/43820.pdf>

Figure 12.

**HOW OFTEN DO YOU SEE OR READ ABOUT PEOPLE DOING COMPUTER SCIENCE IN EACH OF THE FOLLOWING PLACES?
HOW ABOUT _____?**

%STUDENTS

		Gender		Race/Ethnicity		
		Male (n=901)	Female (n=771)	White (n=1033)	Black (n=228)	Hispanic (n=310)
In TV shows	Often	25%	21%	20%	34%	23%
	Sometimes	55%	61%	62%	44%	54%
	Never	20%	19%	18%	22%	22%
In movies	Often	28%	23%	24%	36%	23%
	Sometimes	59%	61%	62%	47%	60%
	Never	13%	16%	13%	16%	17%
Online through social media, articles or videos	Often	39%	26%	34%	32%	36%
	Sometimes	43%	55%	47%	51%	50%
	Never	17%	18%	19%	17%	14%
IF OFTEN OR SOMETIMES SEE PEOPLE "DOING CS" IN TV, MOVIES, OR ONLINE:		n=870	n=744	n=998	n=217	n=299
Thinking about all of the people you see or read about doing computer science in TV shows, in movies or online, how often do you see people like you doing computer science?	Often	21%	11%	16%	26%	13%
	Sometimes	61%	57%	59%	54%	65%
	Never	18%	31%	25%	20%	22%

Black students are more likely than both White and Hispanic students to say they often see people “doing CS” in TV shows and movies. However, there are no racial differences among students seeing people “doing CS” online. Of students who say they see people “doing CS” in the media, Black students are also more likely to say they

often see people like themselves “doing CS” in the media; one-quarter (26%) of Black students say this, compared with only 16% of White students and 13% of Hispanic students.¹³

¹³ It should be noted that data on specific shows, movies or online media were not collected, so differences between racial and ethnic groups may be attributable to differences in what media are consumed.

Students who say they “often” see people like themselves “doing CS” are more likely than students who don’t to say they are “very interested” in learning CS. Nearly half of students (49%) who often see people like them “doing CS” in the media say they are very interested in learning CS, compared with 26% of students who “sometimes” see people like them and just 10% of students who “never” see people like them. Having greater exposure to a wide range of people, including underrepresented CS groups, “doing CS” in the media could encourage interest in CS – particularly if the people “doing CS” are seen to be “like me” for the underrepresented groups. While students who are already interested in CS might watch the types of media (movies, shows and programs) that involve CS, making relatable CS activities more prevalent in the media can only serve to increase overall exposure to and interest

Male Students Are More Likely to Be Told By Parents and Teachers That They Would Be Good at Computer Science

Stereotypes may influence implicit beliefs about who can do computer science and might introduce unconscious bias in educators and parents, who may disproportionately and unconsciously encourage students who fit the computer scientist stereotype to pursue CS.¹⁴ For example, male students are more likely than female students to have been told by a teacher (39% vs. 26%) or a parent (46% vs. 27%) that they would be good at CS. Teachers and parents may inadvertently reinforce stereotypes by telling more male students they think they would be good at CS, thus furthering the underrepresentation of females in CS.

Figure 13.

HOW OFTEN DO YOU SEE OR READ ABOUT PEOPLE DOING COMPUTER SCIENCE IN EACH OF THE FOLLOWING PLACES? HOW ABOUT IN THE MEDIA (ONLINE, TV, MOVIES)?

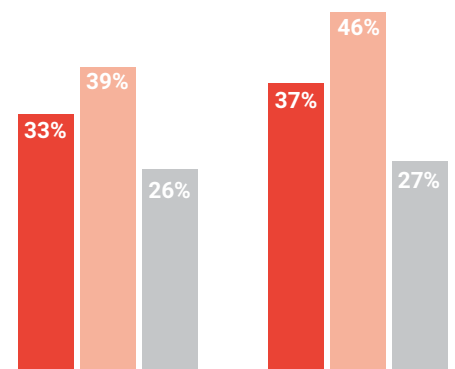
%STUDENTS

		Often (n=272)	Sometimes (n=947)	Never (n=393)
How interested are you in learning CS in the future?	Very interested	25%	55%	21%
	Somewhat interested	28%	59%	23%
	Not at all interested	39%	43%	26%

Figure 14.

ENCOURAGEMENT TO LEARN COMPUTER SCIENCE

● TOTAL ● MALE ● FEMALE



Has a teacher ever told you that you would be good at computer science? (% Yes) Has a parent ever told you that you would be good at computer science? (% Yes)

While female students’ patterns of lower interest in and confidence to learn CS and lower likelihood to be encouraged align with underrepresentation in CS, Black and Hispanic students’ relationship with CS is less direct. Blacks and Hispanics are underrepresented in CS jobs and courses,¹⁵ yet Black and Hispanic students are just as likely to report that someone has told them they would be good at CS as White students, and Black students are more likely to see people (both generally and who are like them) “doing CS” in the media.

14 Burgess, S., & Greaves, E. (2013). Test scores, subjective assessment, and stereotyping of ethnic minorities. *Journal of Labor Economics*, 31(3), 535-576.

And

Jussim, L., & Harber, K. D. (2005). Teacher expectations and self-fulfilling prophecies: Knowns and unknowns, resolved and unresolved controversies. *Personality and Social Psychology Review*, 9(2), 131-155.

15 Blacks and Hispanics are less likely to take AP CS courses. See <http://home.cc.gatech.edu/ice-gt/594>

in CS.

**PERCEIVED REASONS FOR
UNDERREPRESENTATION
OF CERTAIN GROUPS IN
COMPUTER SCIENCE**

Parents, teachers and principals are generally most likely to say the lack of exposure to Computer Science, lack of opportunity to learn Computer Science and lack of Computer Science role models are major reasons why women and certain racial and ethnic groups are underrepresented in Computer Science careers.

A Majority of Parents and Educators Do Not Think a Lack of Interest and Motivation to Learn CS Is a Major Reason Why There Are Fewer Women and Certain Racial and Ethnic Minorities In CS Fields

Master, Cheryan and Meltzoff (2015) discovered in their experiments with high school students that stereotypes can have a powerful effect on who ends up interested in pursuing CS.¹⁶ However, many stereotypes people hold are implicit or unconscious, often making them difficult to identify. In Year 2 of the Google-Gallup research study, parents, teachers and principals were asked about several factors that may contribute to the underrepresentation of females, Blacks and Hispanics in the CS industry. For each of the reasons given, respondents indicated whether they felt it was a major reason, a minor reason or not a reason why women and certain racial and ethnic minorities are less likely to work in CS fields.

The reasons offered to study participants for why some groups do not pursue CS can be divided, for purposes of analysis, into internal reasons and external reasons. Internal reasons are personal and perceived as difficult to change; a lack of interest or motivation to learn CS is an internal reason. External reasons can change based on circumstances. The external reasons given to respondents to assess included a lack of role models in CS, a lack of opportunity to learn CS, a lack of exposure to CS and a lack of encouragement from others to learn CS.

These reasons are interconnected; by increasing exposure to CS, students have the opportunity to not only learn CS, but do so through role models who encourage students to learn. Working toward improving the external reasons could help more students become interested in and motivated to learn CS. However, understanding the perceptions parents, teachers and principals have about the underrepresentation of certain groups in CS could provide insights into their own underlying and possibly unconscious attitudes, which may — directly or indirectly — influence the students in their lives.

Perceptions of Reasons for Underrepresentation of Women in Computer Science

When asked about reasons for the underrepresentation of women in computer science, parents did not greatly favor one reason over any other. In fact, less than a majority of parents identified any of the reasons provided in the survey as a “major reason” why women are less likely to work in CS, suggesting that parents view this issue as complex and multifaceted. About four in 10 parents identified each of the offered reasons as a “major reason” why there are fewer women in CS.

Despite the fairly homogeneous responses from parents overall, there are pronounced gender differences among parents. Mothers are more likely than fathers to name a lack of opportunity to learn CS (43% vs. 31%), a lack of exposure to CS (47% vs. 35%) and a lack of role models in CS (48% vs. 40%) as “major reasons” why more women do not work in CS. Mothers might be projecting their own experiences in these areas or they could be reflecting on the experiences of other women or girls they know, which could account for the gender differences noted here.

¹⁶ See Master, A., Cheryan, S., and Meltzoff, A. N. (2015). Computing whether she belongs: Stereotypes undermine girls' interest and sense of belonging in computer science [Electronic version]. *Journal of Educational Psychology*, 108(3), 424-437. Retrieved from http://life-slc.org/docs/MasterCheryanMeltzoff_2015_JEP.pdf

Figure 15.

WOMEN ARE LESS LIKELY THAN MEN TO WORK IN THE COMPUTER SCIENCE FIELD. PLEASE TELL ME WHETHER YOU THINK EACH OF THE FOLLOWING IS A MAJOR REASON, A MINOR REASON OR NOT A REASON WHY THIS IS. HOW ABOUT ... ? (% MAJOR REASON)

		Total Parents (n=1,677)	Male (n=861)	Female (n=816)
Internal Factor	Lack of interest or motivation to learn computer science	42%	43%	41%
External Factors	Lack of role models in computer science	44%	40%	48%
	Lack of exposure to computer science	41%	35%	47%
	Lack of encouragement from others to learn computer science	40%	37%	42%
	Lack of opportunity to learn computer science	38%	31%	43%

While parents’ responses as a whole were similar across the potential reasons given for why fewer women pursue CS careers, teachers and principals were more likely to identify certain reasons as “major reasons.” Both principals and teachers were least likely to cite lack of interest or motivation to learn CS as a major reason (just 23% and 32%, respectively). Teachers were most likely to say a lack of role models in CS (55%) or lack of exposure to CS (51%) is a major reason why fewer women work in CS. Principals were most likely to say lack of exposure (45%) is a major reason for fewer women in CS. Parents were generally more likely than teachers and principals to attribute fewer women working in CS to a lack of interest. While female and male students presumably have equal exposure to and opportunity to learn CS in schools because

of generally even gender distributions across schools, a greater focus on encouraging girls to use existing CS offerings at school could potentially improve interest and participation in CS learning.

There are important gender differences among teachers in views about the reasons for the gender gap in the CS field. Similar to parent gender differences, female teachers are more likely than male teachers to say a lack of opportunity to learn CS (42% vs. 34%), a lack of exposure to CS (54% vs. 43%) and a lack of role models in CS (58% vs. 48%) are major reasons why more women do not work in CS fields (see Appendix B, Figure B28).

Figure 16.

WOMEN ARE LESS LIKELY THAN MEN TO WORK IN THE COMPUTER SCIENCE FIELD. PLEASE TELL ME WHETHER YOU THINK EACH OF THE FOLLOWING IS A MAJOR REASON, A MINOR REASON OR NOT A REASON WHY THIS IS. HOW ABOUT ... ? (% MAJOR REASON)

		Parent (n=1,677)	Teacher (n=1,008)	Principal (n=9,279 to 9,300)
Internal Factor	Lack of interest or motivation to learn computer science	42%	32%	23%
External Factors	Lack of role models in computer science	44%	55%	34%
	Lack of exposure to computer science	41%	51%	45%
	Lack of encouragement from others to learn computer science	40%	43%	32%
	Lack of opportunity to learn computer science	38%	40%	40%

Perceptions of Reasons for Underrepresentation of Certain Racial and Ethnic Minorities in Computer Science

Parents, teachers and principals were also asked their opinions on why certain racial and ethnic groups, such as Blacks and Hispanics, are less likely to work in the CS field. More than half of parents say each of the external reasons (a lack of opportunity to learn CS, a lack of exposure to CS, a lack of encouragement from others to learn CS and a lack of role models in CS) is a “major reason” why certain racial and ethnic minorities are less likely to work in CS. A lack of interest or motivation to learn CS (43%) was the only reason that was given by less than half of parents as a “major reason.”

There are important racial differences in perceptions of why fewer racial minorities work in CS. White parents are generally less likely than Black and Hispanic parents to see all of the factors as major (see Appendix B, Figure B30.) The one area White parents are not statistically less likely than Black parents to see as a major reason is a lack of internal interest or motivation; however, White parents are still less likely than Hispanic parents to see this as a major reason why fewer racial and ethnic minorities work in CS.

Parents, teachers and principals are influential adults in the lives of students. Their perspectives on why certain groups are underrepresented in CS may affect their own attitudes about who can do CS and, in turn, influence the attitudes of the students they know. If these adults believe that certain students are not interested, then they may be less likely to encourage or even expect those students to learn CS. In general, parents and educators are more likely to say external reasons — such as a lack of exposure to CS, a lack of opportunity to learn CS and a lack of CS role models — are major reasons why women and certain racial and ethnic groups are underrepresented in CS careers.

These reasons can be addressed by continued efforts to increase CS learning opportunities for these groups — both inside and outside of school. Ensuring female, Black and Hispanic students are exposed to relatable CS role models is also key to encouraging more students from these groups to not only learn CS, but pursue careers in it.¹⁷

¹⁷ See Master, A., Cheryan, S., and Meltzoff, A. N. (2015). Computing whether she belongs: Stereotypes undermine girls’ interest and sense of belonging in computer science [Electronic version]. *Journal of Educational Psychology*, 108(3), 424-437. Retrieved from http://life-slc.org/docs/MasterCheryanMeltzoff_2015_JEP.pdf

Figure 17.

CERTAIN RACIAL AND ETHNIC GROUPS, LIKE AFRICAN-AMERICANS AND LATINOS, ARE LESS LIKELY TO WORK IN THE COMPUTER SCIENCE FIELD. PLEASE TELL ME WHETHER YOU THINK EACH OF THE FOLLOWING IS A MAJOR REASON, A MINOR REASON OR NOT A REASON WHY THIS IS. HOW ABOUT ... ? (% MAJOR REASON)

		Parent (n=1,677)	Teacher (n=1,008)	Principal (n=9,279 to 9,300)
Internal Factor	Lack of interest or motivation to learn computer science	43%	32%	20%
External Factors	Lack of role models in computer science	57%	62%	36%
	Lack of exposure to computer science	56%	64%	48%
	Lack of encouragement from others to learn computer science	55%	55%	34%
	Lack of opportunity to learn computer science	54%	60%	44%

Conclusion

Parents highly value a computer science education, with near-universal agreement that they would like their child to learn CS. In fact, parents whose children have already learned some CS are more likely to say they want their child to continue to learn more (95%) than are those whose children have not learned any CS (86%). It is possible these parents gained a greater appreciation for the need for CS education once they saw what their child was learning in a CS class, or they valued the interest their child showed in it.

However, many students, especially female students and Black and Hispanic students, do not receive CS learning opportunities at the same rate as their peer groups. There are many interwoven reasons that might contribute to this, including a lack of awareness of or access to CS learning opportunities, less frequent use of computers at home and in school, not often seeing relatable computer scientists in the media, and a lack of encouragement to learn CS from adults.

Male students are more likely than female students to be interested in CS, perhaps because they are more likely to receive encouragement from parents and teachers to pursue CS and are more likely to see people like themselves “doing CS” in the media. Black and Hispanic students are more interested in CS than are White students, but Hispanic students are less likely to have an adult in their lives who works with computers and technology and are, therefore, potentially less likely to have direct CS role models. Both Black and Hispanic students are also less likely to have a computer at home they use every day, suggesting their exposure to online learning opportunities may be more limited.

One challenge for increasing the number of women and certain racial and ethnic minorities in CS fields could be the influence of parents and educators. While they note it as one of the less influential factors, one-third or more of parents and teachers say that a lack of interest or motivation is a major reason why fewer women and racial and ethnic minorities work in CS. If the reason for underrepresentation is seen as internal, some parents and educators might assume it is not necessarily a social justice issue and conclude that they are not accountable for these groups’ chosen interests and pursuits – and so the problem will persist.

It is important that all students have the opportunity to learn CS skills during their K-12 education, as these skills become increasingly important in many areas of life. It is especially important that efforts by schools, educators and outside CS learning opportunities continue to attract female students and racial and ethnic minorities, who have thus far been largely underrepresented in computing fields. This report, along with the findings from Year 1 of this study¹⁸, provides vital information about how seventh- to 12th-grade students, their parents and their educators perceive CS and what barriers keep students from learning and, ultimately, pursuing careers in CS.

¹⁸ Images of Computer Science: Perceptions Among Students, Parents and Educators in the U.S. and Searching for Computer Science: Access and Barriers in U.S. K-12 Education <https://goo.gl/F3SSWH>

About Google

Google's core mission is to organize the world's information and make it universally accessible and useful. Google creates products to increase access to opportunity, break down barriers and empower people through technology. To help reach these goals, Google works to inspire young people around the world not just to use technology but to create it. There is a need for more students to pursue an education in computer science, particularly girls and minorities, who have historically been underrepresented in the field. More information on Google's computer science education efforts is available at [g.co/csedu](https://www.google.com/csedu).

About Gallup

Gallup delivers analytics and advice to help leaders and organizations solve their most pressing problems. Combining more than 80 years of experience with its global reach, Gallup knows more about the attitudes and behaviors of employees, customers, students and citizens than any other organization in the world. Gallup works with leaders and organizations to achieve breakthroughs in customer engagement, employee engagement, organizational culture and identity, leadership development, talent-based assessments, entrepreneurship and well-being. Gallup's 2,000 professionals include noted scientists, renowned subject-matter experts and bestselling authors who work in a range of industries, including banking, finance, healthcare, consumer goods, automotive, real estate, hospitality, education, government and business-to-business. For more information, visit www.gallup.com or education.gallup.com.

Appendix A: Methods

Results for the *Diversity Gaps in Computer Science: Exploring the Underrepresentation of Girls, Blacks and Hispanics in Computer Science* report are based on surveys conducted with students, parents, teachers, principals and superintendents in the U.S.

Telephone interviews were conducted for students, parents and teachers currently living in all 50 states and the District of Columbia based on samples drawn using the nationally representative Gallup Daily tracking recontact sample. Each night, Gallup completes 1,000 nationally representative interviews of adults age 18 and older living in all 50 states and the District of Columbia. Daily tracking interviews are conducted with respondents on landlines and cellphones, with interviews conducted in Spanish for respondents who are primarily Spanish speaking. At the end of each interview, respondents are asked if they would be willing to be recontacted to participate in a future Gallup survey. Approximately 80% of respondents agree to be recontacted for a future survey.

Eligible Gallup Daily tracking survey respondents who previously agreed to future contact were contacted to participate in this study. Individuals who previously answered that they are teachers were assigned to the teacher sample. For the student survey, a parent was first recontacted from the Gallup Daily tracking sample and permission granted before speaking to the student.

Student and parent interviews were conducted in English and Spanish. Teacher interviews were conducted in English only.

Student interviews were conducted Dec. 7, 2015-Jan. 17, 2016, with a sample of 1,672 students in grades seven to 12.

Parent interviews were conducted Dec. 7, 2015-Jan. 14, 2016, with a sample of 1,677 parents with at least one child in grades seven to 12.

Teacher interviews were conducted Dec. 3, 2015-Jan. 13, 2016, with a sample of 1,008 first- to 12th-grade teachers.

Student and parent samples are weighted to correct for unequal selection probability and nonresponse. Student data are weighted to match national demographics of age, gender, race, ethnicity and region. Parent data are weighted to match national demographics of age, gender, education, race, ethnicity and region. Demographic weighting targets are based on the most recent Current Population Survey.

Teacher samples are weighted to correct for unequal selection probability and nonresponse. The data are weighted to match national demographics of age, gender, education, race, ethnicity and region. Demographic weighting targets are based on Gallup Daily tracking information.

All reported margins of sampling error include the computed design effects for weighting.

For results based on the total sample of students, the margin of sampling error is ± 3.4 percentage points at the 95% confidence level. The design effect is ± 2.1 percentage points.

For results based on the total sample of parents, the margin of sampling error is ± 3.4 percentage points at the 95% confidence level. The design effect is ± 2.0 percentage points.

For results based on the total sample of teachers, the margin of sampling error is ± 3.9 percentage points at the 95% confidence level. The design effect is ± 1.6 percentage points.

Web surveys were completed by principals and superintendents contacted using a sample provided by established education sample providers. The sample sources are representative of all principals and superintendents currently in the U.S. Interviews were conducted in English only.

Please note that results for principals and superintendents in Year 1 were not weighted when Year 1 reports were written. Those data are now weighted for comparison with weighted Year 2 data.

Principal surveys were completed Jan. 5-Jan. 26, 2016, with a sample of 9,805 principals at the elementary, middle and high school levels.

Principal data are weighted to match national demographics of school ZIP code, school enrollment size, and census region.

Superintendent surveys were conducted Jan. 5-Jan. 26, 2016, with a sample of 2,307 school district superintendents.

Superintendent data are weighted to match national demographics of school urbanicity, school enrollment size, and Census region.

All reported margins of sampling error include the computed design effects for weighting.

For results based on the total sample of principals, the margin of sampling error is ± 1.0 percentage point at the 95% confidence level.

For results based on the total sample of superintendents, the margin of sampling error is ± 2.7 percentage points at the 95% confidence level.

In addition to sampling error, question wording and practical difficulties in conducting surveys can introduce error or bias into the findings of public opinion polls. It should also be noted that differences between telephone respondents and web respondents are not perfectly comparable because of modal differences and the representativeness of the samples.

All Hispanic students are categorized as Hispanic in this report. Non-Hispanic Black students and non-Hispanic White students are categorized as Black and White, respectively.

Appendix B: Full Results

Computer Science Learning

Figure B1.

%STUDENTS

			Gender		Race/Ethnicity		
		Total (n=1,672)	Male (n=901)	Female (n=771)	White (n=1,033)	Black (n=228)	Hispanic (n=310)
Are there classes where ONLY CS is taught in your school?	Yes	56%	57%	55%	58%	47%	59%
	No	36%	36%	37%	34%	44%	35%
	Don't know	7%	7%	8%	8%	6%	6%
Is CS taught as part of OTHER classes at your school?	Yes	51%	53%	50%	53%	44%	56%
	No	43%	42%	44%	41%	50%	38%
	Don't know	6%	5%	6%	6%	5%	6%
Are there any groups or clubs that meet at your school where students learn CS?	Yes	44%	48%	39%	42%	43%	46%
	No	49%	47%	52%	51%	51%	47%
	Don't know	7%	5%	8%	7%	6%	7%
Are there opportunities in your community for students like you to learn computer science outside of your school?	Yes	55%	58%	51%	55%	59%	53%
	No	30%	28%	32%	30%	29%	31%
	Don't know	15%	14%	17%	15%	12%	16%

Figure B2.

YOU ARE AWARE OF SPECIFIC WEBSITES WHERE YOU COULD LEARN COMPUTER SCIENCE ON THE INTERNET, BY HOW INTERESTED ARE YOU IN LEARNING CS IN THE FUTURE

%STUDENTS

	Very interested (n=425)	Somewhat interested (n=943)	Not at all interested (n=302)
Agree	30%	56%	14%
Disagree	16%	58%	25%
Don't know	19%	51%	29%

Figure B3.

YOU ARE AWARE OF SPECIFIC WEBSITES WHERE YOU COULD LEARN COMPUTER SCIENCE ON THE INTERNET

%STUDENTS

	Total (n=1,672)
Agree	66%
Disagree	30%

Figure B4.

%PARENTS

			Gender		Race/Ethnicity		
		Total (n=1,677)	Male (n=861)	Female (n=816)	White (n=1,145)	Black (n=197)	Hispanic (n=264)
You are aware of specific websites where your child could learn computer science on the internet	Agree	54%	55%	53%	50%	65%	57%
	Disagree	41%	39%	42%	44%	29%	36%
	Don't know	5%	5%	5%	5%	6%	4%
As far as you know, are there opportunities in your community for your child to learn computer science outside of his/her school?	Yes	43%	45%	42%	45%	43%	35%
	No	42%	42%	43%	40%	46%	46%
	Don't know	15%	13%	16%	15%	11%	18%

Figure B5.

HAVE YOU EVER LEARNED ANY CS, SUCH AS USING PROGRAMMING TO CREATE SOFTWARE, APPS, GAMES, WEBSITES OR ELECTRONICS?

%STUDENTS

		Gender		Race/Ethnicity		
	Total (n=1,672)	Male (n=901)	Female (n=771)	White (n=1,033)	Black (n=228)	Hispanic (n=310)
Yes	55%	59%	50%	53%	62%	54%
No	45%	41%	50%	47%	38%	46%

Figure B6.

HAVE YOU EVER LEARNED COMPUTER SCIENCE IN ANY OF THE FOLLOWING WAYS? (ASKED ONLY OF STUDENTS WHO HAVE LEARNED CS)

%STUDENTS

		Total (n=951)	Gender		Race/Ethnicity		
			Male (n=548)	Female (n=403)	White (n=584)	Black (n=140)	Hispanic (n=173)
In a class at school	Yes	80%	80%	81%	81%	82%	80%
	No	19%	20%	18%	19%	18%	17%
In a group or club at school	Yes	26%	29%	22%	18%	34%	41%
	No	74%	71%	78%	82%	66%	59%
In a formal group or program outside of school, such as a camp or summer program	Yes	22%	22%	20%	17%	38%	21%
	No	78%	77%	80%	83%	62%	79%
Online through a class, program, or online community	Yes	39%	44%	31%	38%	38%	37%
	No	61%	56%	69%	62%	62%	63%
On your own outside of a class or program	Yes	48%	54%	41%	50%	46%	45%
	No	52%	46%	59%	50%	53%	55%

Figure B7.

WAS CLASS A CS CLASS OR SOME OTHER KIND OF CLASS?

%STUDENTS

		Total (n=735)
<i>(Asked only of students who learned CS in a class at school)</i>	Computer science class	47%
	Some other kind of class	50%

Exposure to Technology

Figure B8.

IN A TYPICAL WEEK, HOW OFTEN DO YOU USE A COMPUTER AT HOME?

%STUDENTS

	Total (n=1,672)	Gender		Race/Ethnicity		
		Male (n=901)	Female (n=771)	White (n=1,033)	Black (n=228)	Hispanic (n=310)
Every day	39%	36%	42%	45%	30%	26%
Most days	24%	25%	23%	23%	28%	24%
Some days	19%	20%	17%	19%	19%	18%
Not very often	14%	13%	15%	11%	17%	22%
Never	5%	5%	4%	2%	6%	10%

Figure B9.

IN A TYPICAL DAY, HOW MANY HOURS DO YOU USE A COMPUTER AT HOME?

%STUDENTS

		Total (n=695)
<i>(Asked only of students who use a computer with Internet at home every day)</i>	Less than 2 hours	23%
	2-5 hours	60%
	More than 5 hours	17%

Figure B10.

HOW OFTEN DO YOU USE A COMPUTER AT YOUR SCHOOL?

%STUDENTS

	Total (n=1,672)	Race/Ethnicity		
		White (n=1,033)	Black (n=228)	Hispanic (n=310)
Every day	38%	42%	34%	31%
Most days	26%	25%	32%	24%
Some days	33%	30%	32%	42%
Not very often	3%	3%	2%	3%
Never	5%	2%	6%	10%

Figure B11.

IN A TYPICAL WEEK, HOW OFTEN DO YOU USE A CELLPHONE OR TABLET?

%STUDENTS

	Total (n=1,672)	Gender		Race/Ethnicity		
		Male (n=901)	Female (n=771)	White (n=1,033)	Black (n=228)	Hispanic (n=310)
Every day	75%	68%	84%	74%	81%	72%
Most days	11%	14%	8%	10%	9%	15%
Some days	5%	6%	3%	6%	4%	5%
Not very often	5%	5%	4%	5%	5%	4%
Never	4%	6%	1%	5%	0%	3%

Figure B12.

IN A TYPICAL DAY, HOW MANY HOURS DO YOU USE A CELLPHONE OR TABLET? (ASKED ONLY OF STUDENTS WHO USE A CELLPHONE OR TABLET EVERY DAY)

%STUDENTS

		Gender		Race/Ethnicity		
	Total (n=1,236)	Male (n=628)	Female (n=635)	White (n=772)	Black (n=188)	Hispanic (n=231)
Less than 2 hours	16%	19%	14%	21%	4%	14%
2-5 hours	48%	49%	47%	51%	43%	39%
More than 5 hours	35%	32%	38%	27%	52%	47%

Figure B13.

HOW INTERESTED ARE YOU IN LEARNING CS IN THE FUTURE? BY IN A TYPICAL WEEK, HOW OFTEN DO YOU USE A COMPUTER AT HOME?

%PARENTS

		Every day (n=695)	Most days (n=421)	Some days (n=273)	Not very often (n=219)	Never (n=63)
Male	Very interested	40%	37%	25%	23%	33%
	Somewhat interested	49%	53%	62%	63%	33%
	Not at all interested	12%	10%	13%	14%	33%
Female	Very interested	17%	17%	16%	13%	11%
	Somewhat interested	62%	63%	55%	57%	46%
	Not at all interested	21%	20%	30%	30%	43%
Total	Very interested	29%	28%	21%	18%	25%
	Somewhat interested	55%	57%	59%	60%	38%
	Not at all interested	16%	14%	20%	22%	37%

Figure B14.

IS THERE AN ADULT IN YOUR LIFE WHO WORKS WITH COMPUTERS OR OTHER TYPES OF TECHNOLOGY?

%STUDENTS

		Gender		Race/Ethnicity		
	Total (n=1,672)	Male (n=901)	Female (n=771)	White (n=1,033)	Black (n=228)	Hispanic (n=310)
Yes	63%	63%	63%	68%	65%	49%
No	35%	35%	36%	31%	32%	49%
Maybe	1%	1%	1%	1%	1%	1%

Interest and Confidence in Learning Computer Science

Figure B15.

%STUDENTS

		Gender		Race/Ethnicity			
		Total (n=1,672)	Male (n=901)	Female (n=771)	White (n=1,033)	Black (n=228)	
How interested are you in learning CS in the future?	Very interested	25%	34%	16%	21%	31%	35%
	Somewhat interested	56%	54%	60%	59%	57%	49%
	Not at all interested	18%	13%	24%	20%	12%	16%
How confident are you that you could learn CS if you wanted to?	Very confident	57%	65%	48%	56%	68%	51%
	Somewhat confident	36%	29%	45%	38%	28%	39%
	Not very confident	7%	6%	8%	6%	5%	9%
How likely are you to have a job someday where you would need to know some computer science?	Very likely	29%	35%	22%	26%	30%	38%
	Somewhat likely	56%	53%	61%	58%	58%	49%
	Not at all likely	14%	12%	17%	16%	12%	13%

Figure B16.

HOW INTERESTED ARE YOU IN LEARNING CS IN THE FUTURE? BY HOW CONFIDENT ARE YOU THAT YOU COULD LEARN CS IF YOU WANTED TO?

%STUDENTS

		Very confident (n=971)	Somewhat confident (n=608)	Not very confident (n=92)
Male	Very interested	42%	18%	10%
	Somewhat interested	53%	57%	43%
	Not at all interested	5%	25%	47%
Female	Very interested	27%	7%	0%
	Somewhat interested	62%	59%	48%
	Not at all interested	11%	34%	52%
Total	Very interested	37%	12%	5%
	Somewhat interested	56%	58%	46%
	Not at all interested	7%	30%	50%

Figure B17.

HOW CONFIDENT ARE YOU THAT YOU COULD LEARN CS IF YOU WANTED TO? BY HAVE YOU EVER LEARNED ANY CS, SUCH AS USING PROGRAMMING TO CREATE SOFTWARE, APPS, GAMES, WEBSITES, OR ELECTRONICS?

%STUDENTS

		Yes (n=951)	No (n=716)
Male	Very confident	72%	56%
	Somewhat confident	27%	33%
	Not very confident	1%	12%
Female	Very confident	59%	36%
	Somewhat confident	36%	53%
	Not very confident	5%	11%

Figure B18.

PLEASE TELL ME HOW SKILLED YOU ARE AT DOING EACH OF THE FOLLOWING. HOW ABOUT _____? WOULD YOU SAY YOU ARE VERY SKILLED, SOMEWHAT SKILLED OR NOT SKILLED AT ALL?

%STUDENTS

			Gender		Race/Ethnicity		
		Total (n=1,672)	Male (n=901)	Female (n=771)	White (n=1,033)	Black (n=228)	Hispanic (n=310)
Math	Very skilled	43%	48%	37%	44%	42%	39%
	Somewhat skilled	48%	45%	51%	49%	49%	48%
	Not skilled at all	9%	6%	12%	8%	8%	12%
Science	Very skilled	41%	48%	33%	41%	50%	36%
	Somewhat skilled	53%	46%	61%	53%	45%	59%
	Not skilled at all	5%	5%	6%	6%	4%	4%

Figure B19.

HOW SKILLED YOUR CHILD IS AT DOING EACH OF THE FOLLOWING?

%PARENTS

			Gender	
		Total (n=1,677)	Male (n=836)	Female (n=841)
Math	Very skilled	55%	54%	56%
	Somewhat skilled	40%	40%	39%
	Not skilled at all	5%	6%	4%
Science	Very skilled	52%	50%	54%
	Somewhat skilled	43%	44%	42%
	Not skilled at all	4%	5%	3%
English class, including reading, writing and spelling	Very skilled	60%	49%	70%
	Somewhat skilled	36%	45%	28%
	Not skilled at all	3%	5%	2%
Music	Very skilled	41%	34%	46%
	Somewhat skilled	40%	41%	39%
	Not skilled at all	19%	25%	13%
Working with other people	Very skilled	64%	59%	69%
	Somewhat skilled	32%	35%	29%
	Not skilled at all	4%	6%	2%

Figure B20.

%PARENTS

			Race/Ethnicity		
		Total (n=998)	White (n=694)	Black (n=120)	Hispanic (n=138)
How likely is it that your child will learn some computer science in the future? (Asked only of those whose child has NOT learned CS)	Very likely	31%	24%	35%	53%
	Somewhat likely	50%	55%	47%	33%
	Not at all likely	18%	19%	18%	12%
	Don't know	1%	1%	0%	3%
Would you like your child to learn computer science in the future? (Asked only of those whose child has NOT learned CS)	Yes	86%	84%	92%	92%
	No	11%	13%	7%	5%
	Don't know	2%	2%	1%	4%
As far as you know, would your child like to learn computer science in the future (Asked only of those whose child has NOT learned CS)	Yes	61%	57%	77%	70%
	No	29%	34%	15%	14%
	Don't know	10%	9%	8%	15%

Figure B21.

WOULD YOU LIKE YOUR CHILD TO LEARN COMPUTER SCIENCE IN THE FUTURE?

%PARENTS

		Total (n=679)
<i>(Asked only of those whose child has learned CS)</i>	Yes	95%
	No	4%

Views of Computer Science

Figure B22.

HOW OFTEN DO YOU SEE OR READ ABOUT PEOPLE DOING COMPUTER SCIENCE IN EACH OF THE FOLLOWING PLACES?

%STUDENTS

		Total	Gender		Race/Ethnicity		
		(n=1,672)	Male (n=901)	Female (n=771)	White (n=1,033)	Black (n=228)	Hispanic (n=310)
In TV shows	Often	23%	25%	21%	20%	34%	23%
	Sometimes	57%	55%	61%	62%	44%	54%
	Never	19%	20%	19%	18%	22%	22%
In movies	Often	25%	28%	23%	24%	36%	23%
	Sometimes	60%	59%	61%	62%	47%	60%
	Never	14%	13%	16%	13%	16%	17%
Online through social media, articles or videos	Often	33%	39%	26%	34%	32%	36%
	Sometimes	49%	43%	55%	47%	51%	50%
	Never	18%	17%	18%	19%	17%	14%

Figure B23.

THINKING ABOUT ALL OF THE PEOPLE YOU SEE OR READ ABOUT DOING COMPUTER SCIENCE IN TV SHOWS, IN MOVIES OR ONLINE, HOW OFTEN DO YOU SEE PEOPLE LIKE YOU DOING COMPUTER SCIENCE? (ASKED ONLY OF THOSE WHO SEE PEOPLE "DOING CS" "OFTEN" OR "SOMETIMES" ON TV, MOVIES AND/OR ONLINE)

%STUDENTS

	Total	Gender		Race/Ethnicity		
	(n=1,614)	Male (n=870)	Female (n=774)	White (n=998)	Black (n=217)	Hispanic (n=299)
Often	16%	21%	11%	16%	26%	13%
Sometimes	59%	61%	57%	59%	54%	65%
Never	24%	18%	31%	25%	20%	22%

Figure B24.

HOW INTERESTED ARE YOU IN LEARNING CS IN THE FUTURE? BY THINKING ABOUT ALL OF THE PEOPLE YOU SEE OR READ ABOUT DOING COMPUTER SCIENCE IN TV SHOWS, IN MOVIES, OR ONLINE, HOW OFTEN DO YOU SEE PEOPLE LIKE YOU DOING COMPUTER SCIENCE?

%STUDENTS

		Often (n=272)	Sometimes (n=947)	Never (n=393)
Male	Very interested	58%	31%	18%
	Somewhat interested	33%	61%	53%
	Not at all interested	10%	9%	29%
Female	Very interested	31%	19%	4%
	Somewhat interested	53%	63%	57%
	Not at all interested	16%	18%	39%
Total	Very interested	49%	26%	10%
	Somewhat interested	39%	61%	55%
	Not at all interested	12%	13%	35%

Figure B25.

%STUDENTS

			Gender		Race/Ethnicity		
		Total (n=1,672)	Male (n=901)	Female (n=771)	White (n=1,033)	Black (n=228)	Hispanic (n=310)
Has a teacher ever told you that you would be good at computer science?	Yes	33%	39%	26%	32%	40%	34%
	No	66%	60%	74%	68%	59%	66%
Has a parent ever told you that you would be good at computer science?	Yes	37%	46%	27%	35%	43%	41%
	No	63%	54%	73%	64%	57%	59%

Views of Computer Science

Figure B26.

WOMEN ARE LESS LIKELY THAN MEN TO WORK IN THE COMPUTER SCIENCE FIELD. PLEASE TELL ME WHETHER YOU THINK EACH OF THE FOLLOWING IS A MAJOR REASON, A MINOR REASON OR NOT A REASON WHY THIS IS. HOW ABOUT _____?

		Parents (n=1,677)	Teachers (n=1,008)	Principals (n=5245 to 5253)
Lack of opportunity to learn computer science	Major reason	38%	40%	40%
	Minor reason	35%	35%	30%
	Not a reason	26%	24%	21%
	Don't know	1%	0%	10%
Lack of interest or motivation to learn computer science	Major reason	42%	32%	23%
	Minor reason	35%	46%	40%
	Not a reason	22%	21%	23%
	Don't know	1%	0%	14%
Lack of exposure to computer science	Major reason	41%	51%	45%
	Minor reason	33%	32%	29%
	Not a reason	24%	17%	15%
	Don't know	1%	0%	10%
Lack of encouragement from others to learn computer science	Major reason	40%	43%	32%
	Minor reason	39%	41%	38%
	Not a reason	20%	16%	18%
	Don't know	1%	0%	12%
Lack of role models in computer science	Major reason	44%	55%	34%
	Minor reason	35%	31%	36%
	Not a reason	21%	14%	17%
	Don't know	1%	0%	13%

Figure B27.

WOMEN ARE LESS LIKELY THAN MEN TO WORK IN THE COMPUTER SCIENCE FIELD. PLEASE TELL ME WHETHER YOU THINK EACH OF THE FOLLOWING IS A MAJOR REASON, A MINOR REASON OR NOT A REASON WHY THIS IS. HOW ABOUT _____?

%PARENTS

		Gender	
		Male (n=861)	Female (n=816)
Lack of opportunity to learn computer science	Major reason	31%	43%
	Minor reason	38%	33%
	Not a reason	29%	24%
Lack of interest or motivation to learn computer science	Major reason	43%	41%
	Minor reason	34%	37%
	Not a reason	23%	21%
Lack of exposure to computer science	Major reason	35%	47%
	Minor reason	35%	31%
	Not a reason	28%	21%
Lack of encouragement from others to learn computer science	Major reason	37%	42%
	Minor reason	39%	39%
	Not a reason	23%	19%
Lack of role models in computer science	Major reason	40%	48%
	Minor reason	39%	31%
	Not a reason	20%	21%

Figure B28.

WOMEN ARE LESS LIKELY THAN MEN TO WORK IN THE COMPUTER SCIENCE FIELD. PLEASE TELL ME WHETHER YOU THINK EACH OF THE FOLLOWING IS A MAJOR REASON, A MINOR REASON OR NOT A REASON WHY THIS IS. HOW ABOUT _____?

%TEACHERS

		Gender	
		Male (n=335)	Female (n=673)
Lack of opportunity to learn computer science	Major reason	34%	42%
	Minor reason	32%	36%
	Not a reason	33%	21%
Lack of interest or motivation to learn computer science	Major reason	36%	31%
	Minor reason	42%	47%
	Not a reason	21%	21%
Lack of exposure to computer science	Major reason	43%	54%
	Minor reason	36%	30%
	Not a reason	22%	15%
Lack of encouragement from others to learn computer science	Major reason	39%	44%
	Minor reason	41%	40%
	Not a reason	20%	15%
Lack of role models in computer science	Major reason	48%	58%
	Minor reason	36%	29%
	Not a reason	16%	13%

Figure B29.

CERTAIN RACIAL AND ETHNIC GROUPS, LIKE AFRICAN-AMERICANS AND LATINOS, ARE LESS LIKELY TO WORK IN THE COMPUTER SCIENCE FIELD. PLEASE TELL ME WHETHER YOU THINK EACH OF THE FOLLOWING IS A MAJOR REASON, A MINOR REASON OR NOT A REASON WHY THIS IS. HOW ABOUT _____?

		Parents (n=1,677)	Teachers (n=1,008)	Principals (n=5245 to 5253)
Lack of opportunity to learn computer science	Major reason	54%	60%	44%
	Minor reason	28%	26%	28%
	Not a reason	17%	13%	15%
	Don't know	1%	0%	13%
Lack of interest or motivation to learn computer science	Major reason	43%	32%	20%
	Minor reason	37%	47%	39%
	Not a reason	19%	21%	24%
	Don't know	1%	0%	17%
Lack of exposure to computer science	Major reason	56%	64%	48%
	Minor reason	29%	26%	27%
	Not a reason	13%	10%	12%
	Don't know	1%	0%	13%
Lack of encouragement from others to learn computer science	Major reason	55%	55%	34%
	Minor reason	30%	35%	35%
	Not a reason	13%	10%	15%
	Don't know	1%	0%	15%
Lack of role models in computer science	Major reason	57%	62%	36%
	Minor reason	27%	28%	34%
	Not a reason	15%	10%	14%
	Don't know	1%	0%	16%

Figure B30.

CERTAIN RACIAL AND ETHNIC GROUPS, LIKE AFRICAN-AMERICANS AND LATINOS, ARE LESS LIKELY TO WORK IN THE COMPUTER SCIENCE FIELD. PLEASE TELL ME WHETHER YOU THINK EACH OF THE FOLLOWING IS A MAJOR REASON, A MINOR REASON OR NOT A REASON WHY THIS IS. HOW ABOUT _____?

%TEACHERS

		Race/Ethnicity		
		White (n=1,145)	Black (n=197)	Hispanic (n=264)
Lack of opportunity to learn computer science	Major reason	48%	61%	65%
	Minor reason	31%	29%	21%
	Not a reason	19%	10%	13%
Lack of interest or motivation to learn computer science	Major reason	38%	46%	54%
	Minor reason	40%	35%	27%
	Not a reason	20%	19%	19%
Lack of exposure to computer science	Major reason	52%	66%	63%
	Minor reason	32%	26%	22%
	Not a reason	14%	8%	14%
Lack of encouragement from others to learn computer science	Major reason	51%	62%	64%
	Minor reason	34%	26%	21%
	Not a reason	13%	12%	14%
Lack of role models in computer science	Major reason	53%	67%	65%
	Minor reason	31%	20%	18%
	Not a reason	15%	13%	15%