Google

Images of Computer Science:

Perceptions Among Students, Parents and Educators in the U.S.

GALLUP

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2015

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Executive Summary

Images of Computer Science: Perceptions Among Students, Parents and Educators in the U.S. is the second report based on Google and Gallup's multiyear, comprehensive study of perceptions about computer science and the opportunities students have to become more involved in computer science. While the first report, *Searching for Computer Science: Access and Barriers in U.S. K-12 Education*, focused on support for and access to computer science learning, this report examines perceptions about the value of computer science among key stakeholders in K-12 education and evaluates the opportunities for students to become more involved in computer science before college.

Key findings in this report:

» **Many students, parents, teachers and school administrators do not properly distinguish between computer science activities and general computer literacy.** It's important for students to understand the breadth of computer science and the value of computer science skills so they can make informed decisions about whether to learn. It's equally important for school leaders to understand what constitutes computer science as they try to engage students in developing these foundational skills. Courses that administrators consider to be computer science often lack programming/coding – a key element of computer science, as discussed in our first report, *Searching for Computer Science: Access and Barriers in U.S. K-12 Education*.

» **Observations from students and parents suggest that TV and film media portrayals, as well as personal perceptions among students, parents and educators, often reflect stereotypes about people who engage in computer science; this has the potential to limit participation among certain student groups.** Additional observations include:

- 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.
- Students, parents and teachers are more likely to say boys are more interested in learning computer science than girls, and that boys are more likely to be successful in their learning. Hispanic parents are less likely than Black and White parents to share this view. In fact, a larger percentage of Hispanic parents say girls (39%) are more likely than boys (29%) to be successful at learning computer science.

- About half of all students say they've learned some computer science, either in school or somewhere else. However, **students who are Hispanic, female or from lower-income households are less likely than their counterparts to have learned any computer science.** Male students are generally more confident in their ability to learn computer science and are more likely to think they will learn computer science or have a job involving computer science in the future. Hispanic students are generally less confident than Black and White students in their ability to learn computer science. Students who are more confident in their ability to learn computer science are also more likely to say they will learn it in the future.
- **Computer science careers are viewed favorably by many students, parents, teachers and administrators in the U.S.** Most students, parents and teachers perceive computer science work to be fun and exciting, and most students, parents and principals say people who work in computer science make things that help improve people's lives. All groups also believe computer science can be used in many different types of jobs. Two-thirds of students and 79% of parents further agree that most people who work in computer science have good-paying jobs. Although more than six in 10 in every group think that most computer science jobs pay well, Hispanic students and female students are less likely than their counterparts to believe this.
- **Parents in lower-income households and teachers at schools with a greater percentage of free- or reduced-lunch-eligible students are most likely to value formal computer science education.** Parents in lower-income households are most likely to think computer science learning opportunities are more important to a student's future success than required classes, such as math, science, history and English. Teachers in schools with a larger percentage of students eligible for free or reduced lunch are more likely than other teachers to think computer science learning opportunities are more important to a student's future success than other *elective* courses, but their schools are less likely to have computer science available. Among all teachers, three in four also say they would be interested in learning more about computer science if given the opportunity.

The widespread support for computer science learning from all stakeholder groups is encouraging. However, inequitable access to learning opportunities and ingrained stereotypes may hinder some students from participating, particularly females and underrepresented racial and ethnic minorities. Broadening computer science role models, as well as creating accessible learning opportunities that appeal to diverse youth, could help increase participation. Equally important is ensuring that all groups have a common understanding of what computer science is and how it can help students become better-informed consumers of technology.

Introduction

The lack of racial and gender diversity in the computer science field – both in the U.S. workforce and in university programs – is well-documented. Few female, Hispanic or Black students graduate college with a computer science degree[1], and subsequently, few work in the computer science field.[2] At the high school level, Advanced Placement (AP) Computer Science A participation is low overall, but drastically lower for Blacks and Hispanics. For instance, among the 49 states with at least one student taking the computer science exam, 12 had no Black students participating in 2014.[3] Of all the AP Computer Science A test takers in 2014, only 3.9% were Black and 8.8% were Hispanic, with dramatically lower pass rates for both Black (33.4%) and Hispanic (39.2%) students when compared with the overall pass rate of 70.3%.[4] At the university level, only 11.4% of computer science degrees were awarded to Blacks and 8.5% to Hispanic students in 2012.[5]

Given this lack of diversity and a growing demand[6] for people with computer science skills in many facets of life, it is important to understand what factors influence whether a student learns computer science. Many studies show that women and underrepresented racial and ethnic minorities have the ability to pursue a career in computer science, but that several factors prevent them from doing so.[7] The 2014 Google report, *Women Who Choose Computer Science — What Really Matters*, identified four leading factors that influence whether females want to pursue degrees in computer science: social encouragement to study computer science, self-perception (having an interest in areas applicable to computer science, such as problem-solving and puzzles), academic exposure to computer science and career perception (understanding broader professional applications for computer science).[8]

To further explore these factors, Google commissioned a multiyear, comprehensive research endeavor, in collaboration with Gallup, to better understand perceptions about computer science among seventh- to 12th-grade students, parents of students in seventh to 12th grade, first- to 12th-grade teachers and K-12 principals and superintendents. The study also evaluates the opportunities for students to become more involved in computer science learning before college.

Select results from the first year of this research project were recently released in the *Searching for Computer Science: Access and Barriers in U.S. K-12 Education* report. The study found a strong level of support for computer science education among all groups, but less access to computer technology and computer science learning opportunities

1 National Science Board. (2012). Science and Engineering Indicators 2012. Retrieved from http://www.nsf.gov/statistics/seind12/pdf/c02.pdf.

2 Solving the Diversity Dilemma: Changing the Face of the STEM Workforce. (2015, February 1). Retrieved from http://changetheequation.org/sites/default/files/2015 Solving the Diversity Dilemma FINAL 6.2015.pdf.

3 College Board. (2014). AP Program Participation and Performance Data 2014. Retrieved from http://research.collegeboard.org/programs/ap/data/participation/ap-2014.

4 Ibid.

5 National Center for Education Statistics. (2014). Digest of Education Statistics, Table 322.30. Retrieved from http://nces.ed.gov/programs/digest/d13/tables/dt13_322.30.asp.

6 U.S. Bureau of Labor Statistics. (2013, December). Occupational employment projections to 2022: Monthly Labor Review. Retrieved from http://www.bls.gov/opub/mlr/2013/article/occupational-employment-projections-to-2022.htm.

7 AAUW. (2015, March 26). Solving the Equation: The Variables for Women's Success in Engineering and Computing. Retrieved from http://www.aauw.org/research/solving-the-equation/.

8 Buzzetto-More, N., Ukoha, O., & Rustagi, N. (2010). Unlocking the Barriers to Women and Minorities in Computer Science and Information Systems Studies: Results from a Multi-Methodolical Study Conducted at Two Minority Serving Institutions. Journal of Information Technology Education. Retrieved from http://www.jite.informingscience.org/documents/Vol9/JITEv9p115-131Buzzetto808.pdf.

among certain groups. Most students have access to computer technology, but Hispanic students have less access to computers with Internet at home and use computers less often at school compared with White or Black students. Despite the prevalence of computer technology, many students do not have access to computer science learning opportunities at school, suggesting that the barriers extend beyond simple access to hardware. Lower-income students and Black students have less access to computer science learning opportunities in school than students from other racial and income groups.

Building on these findings, this report explores participation in and perceptions of computer science learning among males and females, across racial and ethnic groups and among income levels. Understanding demographic differences in involvement with computer science can provide insight into strategies needed to diversify this field. The underrepresentation of females and certain racial and ethnic minorities in computer science may perpetuate certain stereotypes. This report also addresses the prevalence of specific stereotypes associated with computer science, with the understanding that the image of the profession may influence the perspectives of students, parents, teachers and administrators.

For this study, nationally representative samples of 1,673 seventh- to 12th-grade students, 1,685 parents of seventh- to 12th-grade students and 1,013 teachers of first through 12th grades were interviewed via telephone in November and December 2014. In addition, samples of 9,693 K-12 principals and 1,865 school district superintendents in the U.S. were surveyed online. These groups are comprehensive but not representative of all principals and superintendents in the U.S.

Gallup researchers tested all differences noted between samples and demographic subgroups for statistical significance and, in many cases, used models to ensure differences noted were still significant after controlling for other factors. See Appendix A for more details on the methodology.

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.

KNOWLEDGE ABOUT COMPUTER SCIENCE

Many Don't Distinguish Between Computer Science and Computer Literacy

Opportunities exist to better educate students, parents, teachers and school administrators on what differentiates computer science from computer literacy. If these groups better understand what computer science is, learning opportunities can branch beyond literacy and delve deeper into computer science concepts, allowing students to acquire skills that are useful and in demand across a growing number of fields.

The Computer Science Teachers Association's *A Model Curriculum for K-12 Computer Science* report defines computer science as "the study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications and their impact on society."[9] To examine the extent to which various populations understand the difference between general computer use and computer science, respondents in this study were asked whether four specific computer-related activities were a part of computer science.

Most students, parents, teachers and school principals surveyed correctly identified "creating new software" and "programming and coding" as computer science activities. However, many also incorrectly identified "creating documents or presentations" and, to a lesser extent, "searching the Internet" as part of computer science. While computer science knowledge may support users' abilities to create documents and to use the Internet, respondents who are highly knowledgeable about computer science would most likely know that these two activities are not part of computer science and would, therefore, have answered "no" to the last two activities, as listed in Figure 1.

Grade level is a factor in awareness about computer science activities among teachers and students. Elementary school teachers are somewhat less knowledgeable than are teachers of seventh grade or higher. For example, three in four first- to sixth-grade teachers incorrectly classified "searching the Internet" as computer science, and 84% said the same about "creating documents and presentations," compared with 56% and 69% of seventh- to 12th-grade teachers, respectively (see Figure 2).

Students in ninth to 12th grade are more likely than seventh and eighth graders to understand that programming/coding and software creation are computer science, although large majorities in all grades understand this. Students in 11th and 12th grade are more likely than younger students to know that "searching the Internet" is not computer science. More than half (56%) of 11th and 12th graders say it is not, compared with 39% of ninth and 10th graders and 33% of seventh and eighth graders (see Figure 2).

9 Computer Science Teachers Association. (2003, October). A Model Curriculum for K–12 Computer Science: Final Report of the ACM K–12 Task Force Curriculum Committee. Retrieved from http://www.csta.acm.org/Curriculum/sub/CurrFiles/K-12ModelCurr2ndEd.pdf.

Figure 1.

BASED ON WHAT YOU HAVE SEEN OR HEARD, WHICH OF THE FOLLOWING ACTIVITIES DO YOU CONSIDER PART OF COMPUTER SCIENCE?

		STUDENTS	PARENTS	TEACHERS	PRINCIPALS
Programming and coding*	***Yes****	80%	89%	85%	88%
	No	17%	10%	15%	9%
Creating new software*	***Yes****	81%	87%	78%	79%
	No	17%	11%	21%	15%
Creating documents or presentations on the computer**	***Yes***	78%	64%	75%	63%
	No*	21%	35%	25%	35%
Searching the Internet**	***Yes***	57%	49%	64%	54%
	No*	42%	50%	36%	44%

***These activities are considered part of computer science. "Yes" responses shaded above are the "correct" answers.**
****These activities are generally not considered part of computer science. "No" responses shaded above are the "correct" answers.**

Figure 2.

KNOWLEDGE OF COMPUTER SCIENCE, BY GRADE LEVEL

		STUDENTS			TEACHERS	
		GRADE LEVEL				
		7TH-8TH	9TH-10TH	11TH-12TH	1ST-6TH	7TH-12TH
Programming and coding*	***Yes****	72%	83%	87%	80%	89%
	No	22%	16%	13%	20%	11%
Creating new software*	***Yes****	73%	83%	87%	72%	83%
	No	23%	17%	12%	28%	17%
Creating documents or presentations on the computer**	***Yes***	84%	78%	71%	84%	69%
	No*	15%	21%	29%	16%	31%
Searching the Internet**	***Yes***	66%	60%	44%	76%	56%
	No*	33%	39%	56%	23%	44%

***These activities are considered part of computer science. "Yes" responses shaded above are the "correct" answers.**
****These activities are generally not considered part of computer science. "No" responses shaded above are the "correct" answers.**

Similar to the student group, age may also be a factor for teachers. Those younger than age 50, who may have grown up with computers and computer science as part of their K-12 education, are slightly more likely than older teachers to correctly identify computer science activities. For example, 40% of teachers younger than age 50 know that searching the Internet is not a computer science activity, compared with 30% of older teachers (see Figure 3).

It is reasonable to assume that over time, teachers will continue to become more knowledgeable about computer science as their exposure to it increases. Nonetheless, the high percentages in all age groups who incorrectly identify computer science activities point to the need for additional training and education for everyone.

There are notable gender differences in understanding which activities constitute computer science. As shown in Figure 4, females generally are more likely to incorrectly identify "searching the Internet" and "creating documents and presentations" as computer science. However, large majorities of both males and females in all groups understand that software development and programming/coding are computer science activities.

Figure 3.

KNOWLEDGE OF COMPUTER SCIENCE, BY TEACHER AGE

% TEACHERS

		AGE	
		49 or younger	*50 or older*
Programming and coding*	***Yes****	87%	82%
	No	13%	18%
Creating new software*	***Yes****	81%	76%
	No	19%	24%
Creating documents or presentations on the computer**	***Yes***	72%	79%
	No*	28%	21%
Searching the Internet**	***Yes***	59%	70%
	No*	40%	30%

***These activities are considered part of computer science. "Yes" responses shaded above are the "correct" answers.**
****These activities are generally not considered part of computer science. "No" responses shaded above are the "correct" answers.**

In general, White students are slightly more knowledgeable than Black and Hispanic students about which activities can be considered computer science, but this is not the case on all items (see Figure 5). At least seven in 10 students from each racial and ethnic group correctly identify computer programming/coding and software development as computer science, but as many from each group also incorrectly classify document and presentation creation as computer science. In other words, there is still confusion surrounding computer science, regardless of race or ethnicity.

Explanations for racial and ethnic differences are complex and reflect a variety of influences, including family, cultural, economic and school-resource factors. For example, students with at least one parent who does not have a college degree and students from lower-income households are generally less knowledgeable about what computer science is, as measured by the four questions. These students are also less likely to say they have opportunities to learn computer science in school, which will be discussed in greater detail later in this report.

Figure 4.

KNOWLEDGE OF COMPUTER SCIENCE, BY GENDER

		STUDENTS		PARENTS		TEACHERS	
		Male	*Female*	*Male*	*Female*	*Male*	*Female*
Creating documents or presentations on the computer*	***Yes***	75%	81%	56%	72%	63%	79%
	No*	24%	18%	44%	27%	36%	21%
Searching the Internet*	***Yes***	56%	58%	44%	54%	55%	67%
	No*	44%	40%	56%	45%	45%	32%

***These activities are generally not considered part of computer science. "No" responses shaded above are the "correct" answers.**

Figure 5.

KNOWLEDGE OF COMPUTER SCIENCE, BY RACE/ETHNICITY

% STUDENTS

		RACE/ETHNICITY		
		White	*Black*	*Hispanic*
Programming and coding*	***Yes****	83%	71%	79%
	No	15%	28%	14%
Creating new software*	***Yes****	83%	73%	78%
	No	16%	24%	16%
Creating documents or presentations on the computer**	***Yes***	77%	75%	82%
	No*	22%	24%	17%
Searching the Internet**	***Yes***	53%	63%	64%
	No*	46%	37%	35%

***These activities are considered part of computer science. "Yes" responses shaded above are the "correct" answers.**
****These activities are generally not considered part of computer science. "No" responses shaded above are the "correct" answers.**

COMPUTER SCIENCE STEREOTYPES

TV, Film Often Reinforce Stereotypes About Computer Science

Students' and parents' perceptions tend to support the idea that TV and film media often present a stereotypical image of people in computer science. Such images could negatively influence the likelihood that girls and underrepresented racial minorities imagine themselves engaging in computer science.

Role models influence young people, so it's important to understand the extent to which students see people from diverse backgrounds engaging in computer science — both in the media and in their own lives. According to Google's report, *Women Who Choose Computer Science — What Really Matters*, young women who are unfamiliar with computer science and its broad applications have a particularly hard time visualizing it outside the narrow scope often presented in popular media. Recent University of Washington research[10] suggests that broadening perceptions about who engages in computer science is key to attracting more women to the field.

Although there are clear problems with diversity in the tech industry as a whole, the effect that media exposure to diverse computer science role models has on student attitudes and behaviors is unclear from the data. However, the data do provide some evidence that enduring stereotypes might hinder the inclusion of underrepresented groups.

Students and parents surveyed in this study were given a list of six types of people and asked to indicate how often they see each type performing computer science tasks in movies or on TV. Both groups were most likely to say that they see Whites and "people wearing glasses" performing computer science tasks, followed by Asians. Few in either group reported frequently seeing women, Blacks or Hispanics in a computer science role on TV or in films. Figure 6 presents differences in perceptions of computer science in TV or film within the groups of students and parents. About half of students and parents see Whites and people wearing glasses performing computer science tasks "most of the time" on TV or in film, and at least three in 10 in each group see Asians equally often. A scant few (7% of students and 4% of parents) see Hispanics or Blacks engaging in computer science in these types of media most of the time. Only 15% of students and 8% of parents say they see women performing computer science tasks most of the time on TV or in the movies, and about 35% in each group do not see women doing this in the media very often or ever.

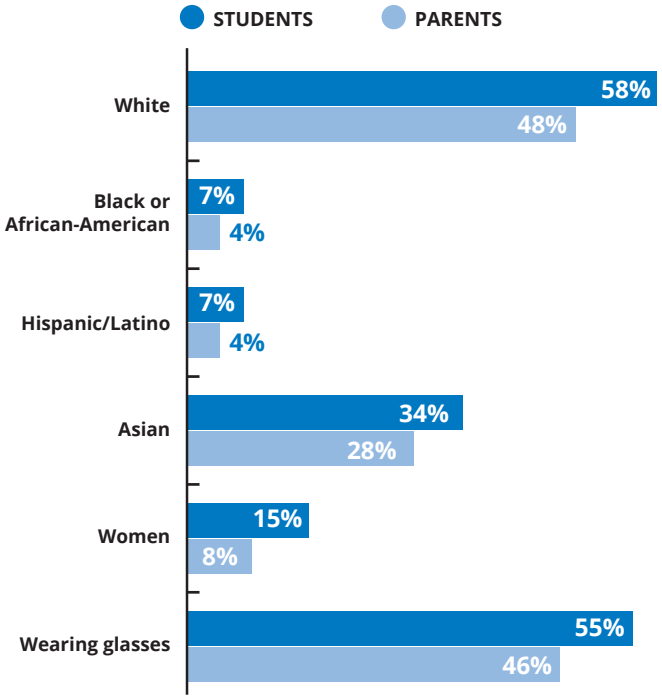
Some of these observations reflect the distribution of these groups in the population and, therefore, in the media – there are more Whites than Blacks or Hispanics. Still, the percentage of Asians in the population is lower than Blacks or Hispanics, yet students and parents are more likely to report seeing Asians engaging in computer science. This suggests that TV and film producers are more often filling those roles with individuals who fit a certain stereotype – one that is generally reflected in the field of computer science as well. More than half of the population is female, yet relatively few students and parents report seeing women in computer science roles. The large number of respondents

Figure 6.

PERCEPTIONS OF COMPUTER SCIENCE IN TV/FILM

How often do you see people who do computer science in movies or TV shows who are ...

% MOST OF THE TIME



10 Bach, D. (2015, February 11). How to interest girls in computer science and engineering? Shift the stereotypes. Retrieved from http://www.washington.edu/news/2015/02/11/how-to-interest-girls-in-computer-science-and-engineering-shift-the-stereotypes/.

who report seeing those performing computer science tasks wearing glasses suggests that computer science is associated with intelligent and scholarly roles.

Female, Black and Hispanic students could arguably be less likely to seek out computer science training and computer science as a profession if they perceive that few with their backgrounds are in the field, although this study does not necessarily provide data on the influence of these stereotypes. Previous research by Google does show that high school females who saw "students like me" engaged in computer science classes were more likely to be interested in pursuing computer science training. Additional evidence from this current study confirms that students perceive computer science as a field more occupied by males than by females.

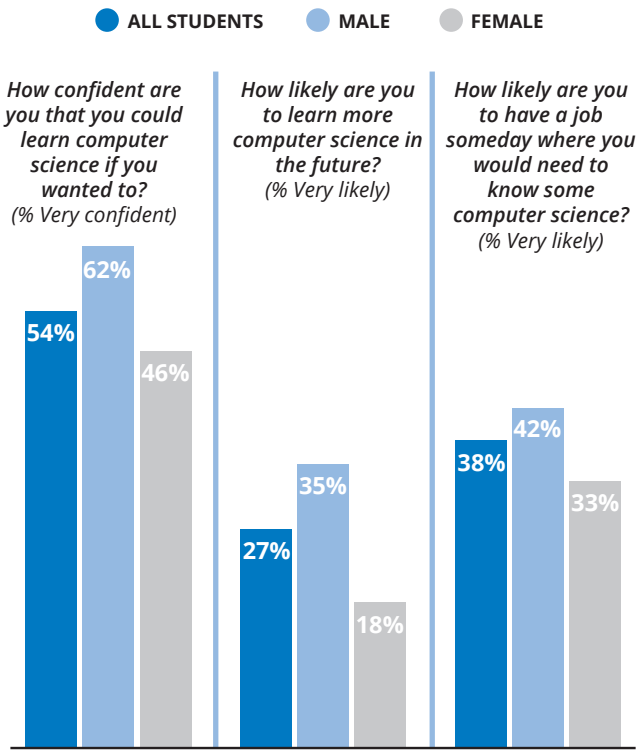
Many See Computer Science as More for Males Than Females

Male students are generally more confident than female students in their ability to learn computer science, and are more likely to think they will learn computer science or have a job involving computer science in the future. This adds to the concern that females will not pursue computer science and will miss opportunities to build related skills.

As shown in Figure 7, 62% of male students say they are "very confident" they could learn computer science if they wanted to, compared with just under half of female students (46%). Male students are also nearly twice as likely as female students to say they are "very likely" to learn computer science in the future; about one-third of males say this. Interestingly, only 18% of female students say they are "very likely" to learn computer science in the future, yet a third of female students expect to have a job someday for which they would need to know computer science. Forty-two percent of male students expect to have a job someday for which they would need to know some computer science.

Figure 7.

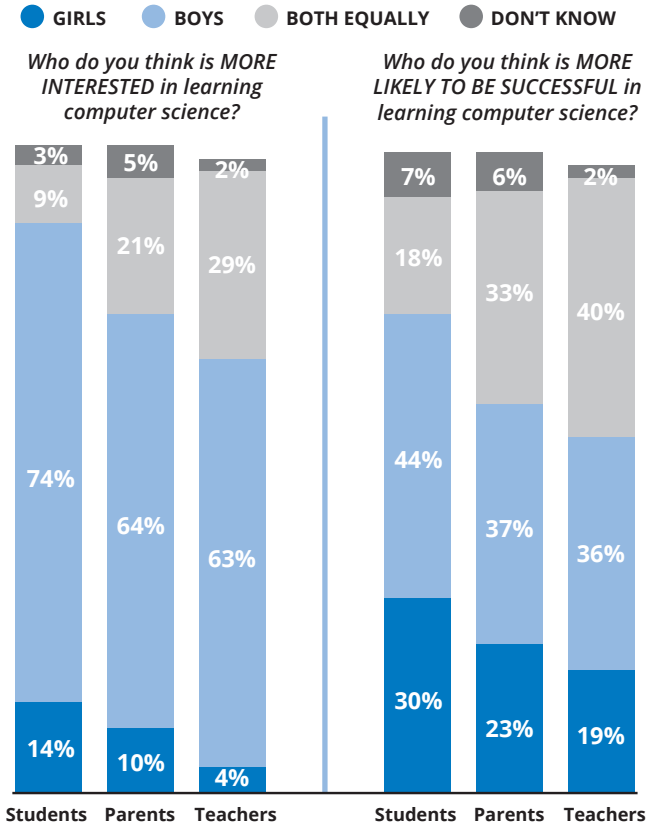
CONFIDENCE AND LIKELIHOOD TO LEARN AND WORK IN COMPUTER SCIENCE



There is also a notable inclination among students, parents and teachers to say that boys are more interested than girls in learning computer science and – to a lesser degree – that boys are more likely to be successful in learning it. More than 60% in each group say boys are more interested than girls in learning computer science, and more than a third say boys are more likely to be successful in doing so (see Figure 8).

Figure 8.

PERCEIVED GENDER DIFFERENCES IN INTEREST IN AND SUCCESS IN LEARNING COMPUTER SCIENCE



Importantly, female students might be less likely to pursue computer science if they think other girls won't be learning it with them, or if they don't feel they can successfully learn it. As shown in Figure 9, 72% of female students think boys are more interested than girls in computer science, and 45% of female students think boys are more likely than girls to be successful in learning computer science, although it is not evident from this study what contributes to this bias.

Figure 9.

PERCEIVED GENDER DIFFERENCES IN INTEREST IN AND SUCCESS IN LEARNING COMPUTER SCIENCE, BY GENDER

% STUDENTS

		GENDER	
		Male	***Female***
Who do you think is MORE INTERESTED in learning computer science?	*Boys*	75%	72%
	Girls	10%	17%
	Both equally	11%	8%
	Don't know	3%	3%
Who do you think is MORE LIKELY TO BE SUCCESSFUL in learning computer science?	*Boys*	43%	45%
	Girls	27%	34%
	Both equally	20%	15%
	Don't know	8%	6%

The majority of students and parents say boys are more interested than girls in learning computer science; however, Hispanic students and parents are less likely than White and Black students and parents to say so (see Figure 10). Hispanic parents are also more likely (39%) than White (29%) and Black (17%) parents to say girls are more likely to be successful than boys in learning computer science.

Figure 10.

PERCEIVED GENDER DIFFERENCES IN INTEREST IN AND SUCCESS IN LEARNING COMPUTER SCIENCE, BY RACE/ETHNICITY

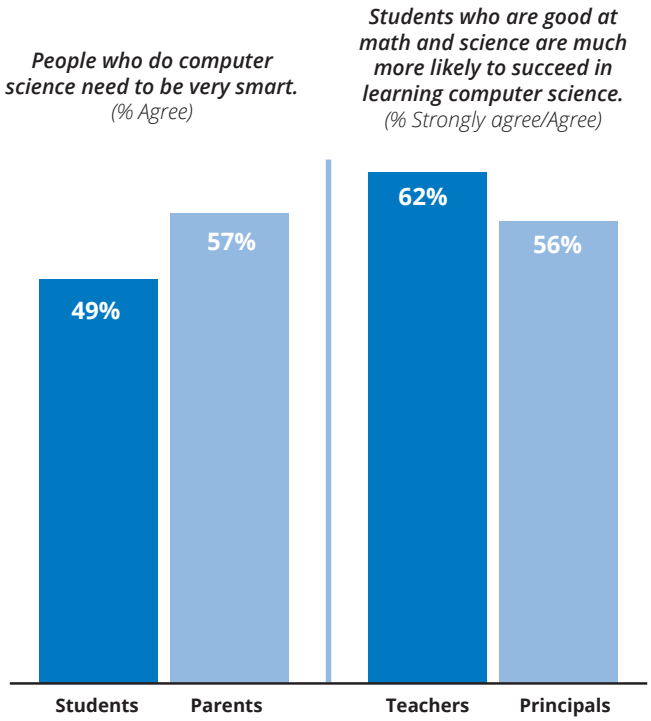
		STUDENTS			PARENTS		
		White	***Black***	***Hispanic***	***White***	***Black***	***Hispanic***
Who do you think is MORE INTERESTED in learning computer science?	*Boys*	76%	80%	60%	68%	66%	49%
	Girls	11%	13%	24%	6%	14%	20%
Who do you think is MORE LIKELY TO BE SUCCESSFUL in learning computer science?	*Boys*	44%	45%	41%	39%	39%	29%
	Girls	25%	41%	38%	17%	29%	39%

Perceptions That Only Smart People Can Do Computer Science May Prevent Some Students From Participating

About half of students and 57% of parents surveyed think people need to be very smart to learn computer science or engage in computer science activities (see Figure 11). Figure 11 also shows that more than half of teachers and principals think students who are good at math and science are more likely to be successful in learning computer science. While math and science skills are certainly fundamental in computer science, the perception that students must be academically advanced to learn it may discourage certain types of students from participating, especially if parents, teachers and school administrators reinforce this belief.

Figure 11.

PERCEPTIONS OF WHO CAN LEARN COMPUTER SCIENCE



Fewer Students See Themselves as Very Skilled in Math, Science

While many teachers and principals say students who are good at math and science have an advantage when learning computer science, less than half of the students surveyed rate themselves as "very skilled" in math or science. Students were asked to think about their own abilities in certain areas and rate themselves as either "very skilled," "somewhat skilled" or "not very skilled" in each area. Forty-two percent of students say they are "very skilled" at math and 39% say they are "very skilled" in science. About half of students say they are "somewhat skilled" in these areas. Hispanic students are less likely than White or Black students to say they are "very skilled" at science; 28% of Hispanics say this, compared with 40% of Whites and 50% of Blacks (see Figure 12).

Figure 12.

NOW, I WOULD LIKE YOU TO THINK ABOUT YOUR OWN ABILITIES IN CERTAIN AREAS. PLEASE TELL ME HOW SKILLED YOU ARE AT DOING EACH OF THE FOLLOWING.

		ALL STUDENTS	WHITE	BLACK	HISPANIC
How about math? Would you say you are very skilled, somewhat skilled or not skilled at all?	*Very skilled*	42%	42%	44%	39%
	Somewhat skilled	47%	47%	47%	46%
	Not skilled at all	11%	10%	9%	14%
How about science? Would you say you are very skilled, somewhat skilled or not skilled at all?	*Very skilled*	39%	40%	50%	28%
	Somewhat skilled	52%	53%	40%	59%
	Not skilled at all	8%	7%	10%	12%

PERCEPTIONS OF COMPUTER SCIENCE CAREERS

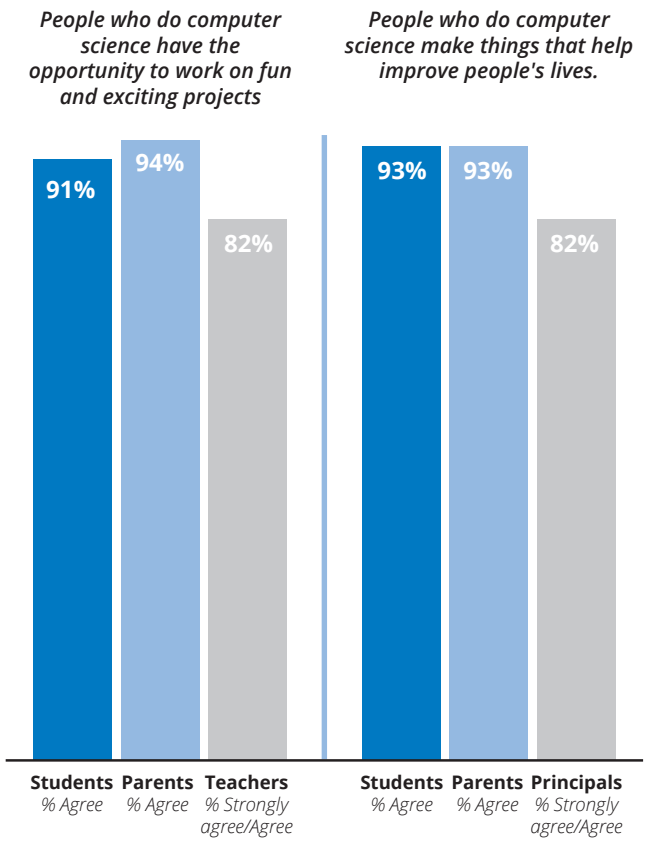
Many View Computer Science Careers Positively

Most students and parents in the U.S. have a positive image of computer science work. This bodes well for an industry hoping to attract a new generation of computer scientists.

More than 90% of students and parents, as well as 82% of teachers, agree that people who work in computer science have the opportunity to work on fun and exciting projects. Most students, parents and principals agree that people who work in computer science make things that help improve people's lives (see Figure 13).

Figure 13.

PERCEPTIONS OF COMPUTER SCIENCE WORK



Most Perceive Computer Science Leads to Good Jobs

The value of computer science skills in the job market is well-understood by most students, parents, teachers, principals and superintendents; however, certain groups are less likely to have this view. Female students and Hispanic students — two groups that are underrepresented in computer science — are somewhat less likely to say most computer scientists have good-paying jobs.

Sixty-eight percent of students and 79% of parents think that most people who work in computer science have good-paying jobs. The perceived value of computer science skills in the job market is slightly lower among Hispanic students; however, three in 10 White students and three in 10 Black students either disagree or say they "don't know" whether most people who work in computer science have good-paying jobs (see Figure 14). The results indicate that there are sizable minorities of students in each racial/ethnic group who need convincing of the value of computer science skills in the job market. Female students are also somewhat less likely than male students to think that most computer scientists have good-paying jobs.

Figure 14.

PERCEPTIONS OF COMPUTER SCIENCE JOBS BY GENDER, RACE/ETHNICITY

	ALL STUDENTS	GENDER		RACE/ETHNICITY		
		Male	*Female*	*White*	*Black*	*Hispanic*
Most people who work in computer science have good-paying jobs. *(% Agree)*	68%	72%	63%	70%	70%	60%

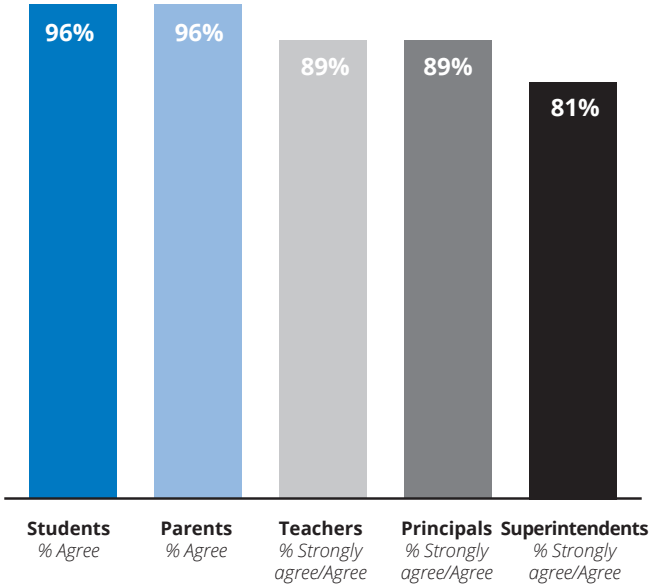
The vast majority of school and district administrators surveyed are aware of the availability of quality computer science jobs. Ninety percent of principals and 84% of superintendents think there are many good jobs available in the U.S. for people who know computer science.

Most students, parents, teachers, principals and superintendents also understand that computer science skills can be used in many different types of jobs (see Figure 15). This perception is a positive sign for the computer science field because a broader understanding of the relevance of computer science skills across industries may encourage more students to learn these skills and more schools to offer computer science learning opportunities.

Students who are more positive about computer science careers in general (based on responses to the items mentioned previously) are more likely to say they will learn computer science in the future, and more likely to have confidence that they can learn it. Parents, teachers, principals and superintendents who have a more positive perception of the value of a computer science career are more likely to support computer science learning in schools. Parents with a positive perception of computer science careers are also more likely to say they want their children to learn computer science.

Figure 15.

COMPUTER SCIENCE CAN BE USED IN A LOT OF DIFFERENT TYPES OF JOBS.



LEARNING COMPUTER SCIENCE

Students Who Are Female, Hispanic or From Lower-Income Households Are Less Likely Than Their Counterparts to Have Learned Computer Science

A slim majority of students (53%) say they have learned some type of computer science, such as using programming to create software, apps, games, websites or electronics. About three in four of these students say they learned through a class at school (see Figure 16), although only half of this group (53%) say it was through a class specifically devoted to computer science. This suggests that computer science is being integrated into other subjects at these schools; however, the extent to which computer science skills are taught in these settings is unclear. The *Searching for Computer Science: Access and Barriers in U.S. K-12 Education* report finds that programming/coding is often excluded from what administrators consider to be computer science courses.

Slightly more than half (56%) of students who have learned computer science say they learned some on their own outside of a formal class or program, and nearly a third (31%) say they learned online through a class, program or online community. About one in four (23%) say they learned through a formal group or program outside of school, and 23% say they learned through a group or club at school.

Figure 17 shows that students who are Hispanic, female or from lower-income households are less likely than their counterparts to have learned any computer science. Majorities of White and Black students say they have learned some type of computer science, compared with 44% of Hispanic students. Less than half of students (47%) from households with annual incomes of $54,000 or less have learned some computer science, compared with 57% of students living in households with higher annual incomes. While the gender gap is slightly smaller than the race/ethnicity or income gaps, female students (49%) are less likely to have learned computer science than male students (57%).

Most students are confident that if they wanted to, they could learn computer science. More than half (54%) say they are very confident they could learn it, and 39% are somewhat confident (see Figure 18).

Figure 16.

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

	Yes
In a class at school	73%
On your own outside of a class or program	56%
Online through a class, program or online community	31%
In a formal group or program outside of school, such as a camp or summer program	23%
In a group or club at school	23%

Figure 17.

LEARNING COMPUTER SCIENCE BY GENDER, INCOME AND RACE/ETHNICITY
% STUDENTS

F	ALL STUDENTS	GENDER		HOUSEHOLD INCOME		RACE/ETHNICITY		
		Male	*Female*	*$54,000 or less*	*$54,001 or higher*	*White*	*Black*	*Hispanic*
Have you ever learned ANY computer science, such as using programming to create software, apps, games, websites or electronics? *(% Yes)*	53%	57%	49%	47%	57%	55%	60%	44%

Figure 18.

HOW CONFIDENT ARE YOU THAT YOU COULD LEARN COMPUTER SCIENCE IF YOU WANTED TO? VERY CONFIDENT, SOMEWHAT CONFIDENT OR NOT VERY CONFIDENT?

% STUDENTS	
Very confident	54%
Somewhat confident	39%
Not very confident	7 %

Black Students and Hispanic Students Lack Opportunities to Learn Computer Science

Expanding exposure to computer technology and opportunities to learn computer science in schools is key to attracting and preparing the next generation of Black and Hispanic computer scientists.

Black students are less likely than White and Hispanic students to have access to clubs or groups that teach computer science. Hispanic students in the U.S. have less exposure to computer technology at home and in school, are less confident in their ability to learn computer science and are less likely to perceive that people who work in computer science have good-paying jobs.

Despite this, more than 80% of Black and Hispanic students say it is very or somewhat likely that they will learn computer science sometime in the future, and roughly 90% say they expect to have a job someday where they will need to know some computer science (see Figure 19). This is a positive sign that these underrepresented minorities expect to learn foundational computer science skills; however, the opportunity to learn computer science must be available for them.

Teachers at Schools With a Higher Percentage of Students Who Qualify for Free or Reduced Lunch Are More Likely to Value Computer Science Learning

Teachers are key to introducing computer science learning opportunities into everyday subjects. In some schools, this could be a student's only opportunity to learn computer science. Teachers at schools with a higher percentage of students who qualify for free or reduced lunch are more likely to value computer science learning, but are less likely to have it available.

Schools with a higher percentage of students who qualify for free or reduced lunch are much less likely to have computer science learning opportunities available, and less likely to say their school boards think it is important to offer

Figure 19.

LIKELIHOOD TO LEARN AND ENGAGE IN COMPUTER SCIENCE

		ALL STUDENTS	WHITE	BLACK	HISPANIC
How likely are you to learn [more] computer science in the future? Are you very likely, somewhat likely or not at all likely?	*Very likely*	27%	26%	31%	26%
	Somewhat likely	57%	57%	53%	59%
	Not at all likely	17%	17%	16%	15%
How likely are you to have a job someday where you would need to know some computer science? Is it very likely, somewhat likely or not at all likely?	*Very likely*	38%	37%	43%	36%
	Somewhat likely	52%	52%	46%	58%
	Not at all likely	10%	12%	10%	6%

computer science — but teachers in these schools are more likely than teachers in other schools to perceive the value of computer science learning (see Figure 20). Incidentally, the *Searching for Computer Science: Access and Barriers in U.S. K-12 Education* report found that parents from lower-income households are also more likely to value computer science learning in schools.

Overall, about two-thirds of teachers, principals and superintendents surveyed agree that it is a good idea to try to incorporate computer science learning into other classes. Three in four teachers also say they would be interested in learning more about computer science if given the opportunity. Additionally, teachers at schools where more than 50% of students are eligible for free or reduced lunch are more likely to agree that computer science should be incorporated into other subjects, more likely to say that computer science classes are more important to a student's future success than elective courses and more likely to say that most students should be required to take a computer science course.

Figure 20.

VALUE OF COMPUTER SCIENCE IN SCHOOLS BY PERCENTAGE OF FREE-/REDUCED-LUNCH STUDENTS
% TEACHERS

		TEACHERS FROM PUBLIC SCHOOLS WITH DATA ON FREE-/REDUCED-LUNCH-ELIGIBLE STUDENTS		
	Total	***<25% free or reduced lunch***	***25%-50% free or reduced lunch***	***>50% free or reduced lunch***
Do you think offering opportunities to learn computer science is more important, just as important or less important to a student's future success than other elective courses like art, music and foreign languages? *(% More important)*	16%	10%	13%	21%
It is a good idea to try to incorporate computer science education into other subjects at school. *(% Completely agree/Agree)*	66%	63%	63%	73%
Most students should be required to take a computer science course. *(% Completely agree/Agree)*	56%	51%	55%	63%
My school board believes computer science education is important to offer in our schools. *(% Completely agree/Agree)*	39%	45%	39%	32%

Conclusion

Widespread support for computer science learning and positive perceptions about the opportunities that computer science can unlock are encouraging. However, inequitable access to learning opportunities and ingrained stereotypes about who can be a computer scientist may discourage some students — particularly females and underrepresented racial and ethnic minorities — from participating.

Many groups favorably view computer science careers. At least eight in 10 students, parents, teachers and administrators agree that computer science can be used in many different types of jobs and most students, parents and principals say people who work in computer science make things that help improve people's lives. More than 90% of students and parents and 82% of teachers perceive computer science work as fun and exciting.

However, students, parents and educators often have a limited view of who is best suited to learn computer science. About half of students and 57% of parents surveyed think people need to be very smart to learn computer science or engage in computer science activities. Students, parents and teachers are more likely to say boys are more interested in learning computer science than girls, and that boys are more likely to be successful in their learning. Additionally, students and parents rarely report seeing females, Blacks or Hispanics represented in computer science in TV and film roles. Fostering diverse computer science role models in real life and the media, as well as creating accessible learning opportunities that appeal to all youth, may help increase participation.

Equally important is ensuring that all stakeholder groups have a better understanding of what constitutes computer science so that learning opportunities include key skills, such as programming/coding and computational thinking. Currently, most students, parents, teachers and school administrators do not properly distinguish between general computer literacy and computer science activities.

Computer science skills are essential to many areas of life. Students who learn these skills during their K-12 education have the opportunity to continue to develop and use them in college and in the workforce. The *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* reports provide vital information on how students in grades seven through 12 perceive computer science and what opportunities they have to learn it. This information, along with the perspectives of parents, teachers, principals and superintendents, reveals the underlying barriers that, if adequately addressed, could complement K-12 schools' efforts to offer quality computer science education. Read about Google's recommendations based on this research.

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.

About Gallup

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Appendix A: Methods

Results for the *Images of Computer Science: Perceptions Among Students, Parents and Educators in the U.S.* report are based on surveys conducted with students, parents, teachers, principals and superintendents.

Telephone interviews were conducted for students, parents and teachers currently living in all 50 states and the District of Columbia using a combination of two sample sources: the Gallup Panel and the Gallup Daily tracking survey. The Gallup Panel is a proprietary, probability-based panel of U.S. adults selected using random-digit-dial (RDD) and address-based sampling methods. The Gallup Panel is not an opt-in panel. The Gallup Daily tracking survey sample includes national adults with a minimum quota of 50% cellphone respondents and 50% landline respondents, with additional minimum quotas by time zone within region. Landline and cellphone numbers are selected using RDD methods. Landline respondents are chosen at random within each household based on which member had the most recent birthday. Eligible Gallup Daily tracking respondents who previously agreed to future contact were contacted to participate in this study. Student and parent interviews were conducted in English and Spanish. Teacher interviews were conducted in English only.

Student interviews were conducted Nov. 19-Dec. 17, 2014, with a sample of 1,673 students in grades seven to 12.

Parent interviews were conducted Nov. 19-Dec. 8, 2014, with a sample of 1,685 parents with at least one child in grades seven to 12.

Teacher interviews were conducted Nov. 25-Dec. 14, 2014, with a sample of 1,013 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.

For results based on the total sample of parents, the margin of sampling error is ±3.5 percentage points at the 95% confidence level.

For results based on the total sample of teachers, the margin of sampling error is ±4.0 percentage points at the 95% confidence level.

Web surveys were completed by principals and superintendents contacted using a sample provided by established education sample providers. The sample sources are comprehensive but not representative of all principals and superintendents currently in the U.S. Interviews were conducted in English only.

Principal surveys were completed Nov. 11-Dec. 10, 2014, with a sample of 9,693 principals at the elementary, middle and high school levels.

Superintendent surveys were conducted Nov. 12-Dec. 19, 2014, with a sample of 1,865 school district superintendents.

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*

Knowledge of Computer Science

Figure B1.

BASED ON WHAT YOU HAVE SEEN OR HEARD, WHICH OF THE FOLLOWING ACTIVITIES DO YOU CONSIDER PART OF COMPUTER SCIENCE?

STUDENTS

			RACE/ETHNICITY		
		Total	*White*	*Black*	*Hispanic*
Programming and coding	*Yes*	80%	83%	71%	79%
	No	17%	15%	28%	14%
	Don't know	2%	1%	1%	5%
Creating new software	*Yes*	81%	83%	73%	78%
	No	17%	16%	24%	16%
	Don't know	2%	0%	2%	6%
Creating documents or presentations on the computer	*Yes*	78%	77%	75%	82%
	No	21%	22%	24%	17%
	Don't know	1%	1%	1%	1%
Searching the Internet	*Yes*	57%	53%	63%	64%
	No	42%	46%	37%	35%
	Don't know	1%	1%	0%	1%

* "Don't know" responses below 5% do not appear in most tables in Appendix B.

Figure B2.

HOW OFTEN DO YOU SEE PEOPLE WHO DO COMPUTER SCIENCE IN MOVIES OR TV SHOWS WHO ARE ... ?

		Students	Parents
White	*Most of the time*	58%	48%
	Some of the time	33%	40%
	Not very often	6%	6%
	Never	2%	2%
	Don't know	1%	3%
Black or African-American	*Most of the time*	7%	4%
	Some of the time	47%	46%
	Not very often	37%	37%
	Never	7%	9%
	Don't know	1%	3%
Hispanic/Latino	*Most of the time*	7%	4%
	Some of the time	30%	31%
	Not very often	47%	45%
	Never	14%	15%
	Don't know	2%	4%
Asian	*Most of the time*	34%	28%
	Some of the time	39%	49%
	Not very often	19%	14%
	Never	6%	5%
	Don't know	2%	4%
Women	*Most of the time*	15%	8%
	Some of the time	47%	53%
	Not very often	31%	30%
	Never	5%	5%
	Don't know	1%	2%
Wearing glasses	*Most of the time*	55%	46%
	Some of the time	30%	39%
	Not very often	11%	6%
	Never	2%	3%
	Don't know	1%	5%

Computer Science Stereotypes

Figure B3.

STUDENTS

			GENDER	
		Total	*Male*	*Female*
How confident are you that you could learn computer science if you wanted to?	*Very confident*	54%	62%	46%
	Somewhat confident	39%	34%	45%
	Not very confident	6%	4%	9%
How likely are you to learn more computer science in the future?	*Very likely*	27%	35%	18%
	Somewhat likely	56%	52%	61%
	Not at all likely	17%	13%	21%
How likely are you to have a job someday where you would need to know some computer science?	*Very likely*	38%	42%	33%
	Somewhat likely	52%	47%	57%
	Not at all likely	10%	11%	10%

Figure B4.

		STUDENTS	
		Male	*Female*
Who do you think is MORE INTERESTED in learning computer science?	*Boys*	75%	72%
	Girls	10%	17%
	Both equally	11%	8%
	Don't know	3%	3%
Who do you think is MORE LIKELY TO BE SUCCESSFUL in learning computer science?	*Boys*	43%	45%
	Girls	27%	34%
	Both equally	20%	15%
	Don't know	8%	6%

Figure B5.

		STUDENTS			PARENTS		
		White	*Black*	*Hispanic*	*White*	*Black*	*Hispanic*
Who do you think is MORE INTERESTED in learning computer science?	*Boys*	76%	80%	60%	68%	66%	49%
	Girls	11%	13%	24%	6%	14%	20%
	Both equally	10%	5%	11%	20%	15%	28%
	Don't know	3%	1%	5%	5%	6%	3%
Who do you think is MORE LIKELY TO BE SUCCESSFUL in learning computer science?	*Boys*	44%	45%	41%	39%	39%	29%
	Girls	25%	41%	38%	17%	29%	39%
	Both equally	21%	11%	13%	36%	26%	28%
	Don't know	7%	4%	8%	7%	4%	3%

Figure B6.

		Students
You mentioned you learned computer science as part of a class at school. Was the class a computer science class or some other kind of class? *(Asked only of students who learned computer science in a class at school)*	***Computer science class***	53%
	Some other kind of class	45%

Figure B7.

		Students	Parents
People who do computer science need to be very smart.	***Agree***	49%	57%
	Disagree	47%	41%

Figure B8.

		Teachers	Principals
Students who are good at math and science are much more likely to succeed in learning computer science.	***Strongly agree***	27%	18%
	4s	35%	38%
	3s	28%	29%
	2s	7%	10%
	Strongly disagree	2%	2%

Perceptions of Computer Science

Figure B9.

		Teachers
People who do computer science have the opportunity to work on fun and exciting projects.	***Strongly agree***	51%
	4s	31%
	3s	14%
	2s	3%
	Strongly disagree	1%

Figure B10.

		Principals
People who do computer science make things that help improve people's lives.	***Strongly agree***	41%
	4s	41%
	3s	15%
	2s	1%
	Strongly disagree	0%

Figure B11.

		Parents
Most people who work in computer science have good-paying jobs.	*Agree*	79%
	Disagree	15%
	Don't know	6%

Figure B12.

MOST PEOPLE WHO WORK IN COMPUTER SCIENCE HAVE GOOD-PAYING JOBS.

STUDENTS

		GENDER		RACE/ETHNICITY		
	Total	*Male*	*Female*	*White*	*Black*	*Hispanic*
Agree	68%	72%	63%	70%	70%	60%
Disagree	20%	20%	20%	18%	23%	24%
Don't know	12%	8%	16%	12%	7%	15%

Figure B13.

COMPUTER SCIENCE CAN BE USED IN A LOT OF DIFFERENT TYPES OF JOBS.

	Students	*Parents*
Agree	96%	96%
Disagree	4%	3%

Figure B14.

COMPUTER SCIENCE CAN BE USED IN A LOT OF DIFFERENT TYPES OF JOBS.

	Teachers	*Principals*	*Superintendents*
Strongly agree	69%	55%	43%
4s	20%	34%	38%
3s	7%	8%	13%
2s	3%	2%	3%
Strongly disagree	1%	1%	1%

Learning Computer Science

Figure B15.

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

		TOTAL
In a class at school	*Yes*	73%
	No	27%
On your own outside of a class or program	*Yes*	56%
	No	44%
Online through a class, program or online community	*Yes*	31%
	No	69%
In a formal group or program outside of school, such as a camp or summer program	*Yes*	23%
	No	76%
In a group or club at school	*Yes*	23%
	No	77%

Figure B16.

COMPUTER SCIENCE LEARNING BY GENDER, HOUSEHOLD INCOME AND RACE/ETHNICITY

STUDENTS

			GENDER		ANNUAL HOUSEHOLD INCOME			RACE/ETHNICITY		
		Total	*Male*	*Female*	*$54,000 or less*	*$54,001 to $105,000*	*More than $105,000*	*White*	*Black*	*Hispanic*
Have you ever learned ANY computer science, such as using programming to create software, apps, games, websites or electronics?	*Yes*	53%	57%	49%	47%	55%	59%	55%	60%	44%
	No	46%	43%	50%	52%	45%	41%	44%	40%	56%

Figure B17.

TEACHERS

			TEACHERS FROM PUBLIC SCHOOLS WITH DATA ON FREE-/REDUCED-LUNCH-ELIGIBLE STUDENTS		
		Total	*<25% free or reduced lunch*	*25%-50% free or reduced lunch*	*>50% free or reduced lunch*
Do you think offering opportunities to learn computer science is more important, just as important or less important to a student's future success than other elective courses like art, music and foreign languages?	*More important*	16%	10%	13%	21%
	Just as important	73%	77%	75%	70%
	Less important	11%	12%	12%	9%
It is a good idea to try to incorporate computer science education into other subjects at school.	*Completely agree*	35%	32%	37%	37%
	4s	31%	31%	26%	36%
	3s	22%	21%	26%	20%
	2s	9%	13%	7%	6%
	Completely disagree	3%	3%	4%	2%
Most students should be required to take a computer science course.	*Completely agree*	33%	34%	28%	37%
	4s	23%	17%	27%	26%
	3s	26%	28%	27%	24%
	2s	11%	12%	12%	9%
	Completely disagree	7%	9%	6%	5%
My school board believes computer science education is important to offer in our schools.	*Completely agree*	18%	23%	14%	18%
	4s	21%	22%	25%	14%
	3s	29%	25%	31%	33%
	2s	20%	22%	19%	22%
	Completely disagree	10%	7%	9%	13%