



Mathematics is the language of STEM

Chicago Regional NCTM Meeting
November 30, 2017



people

STEM

audience

STEM

view?

STEAM

or

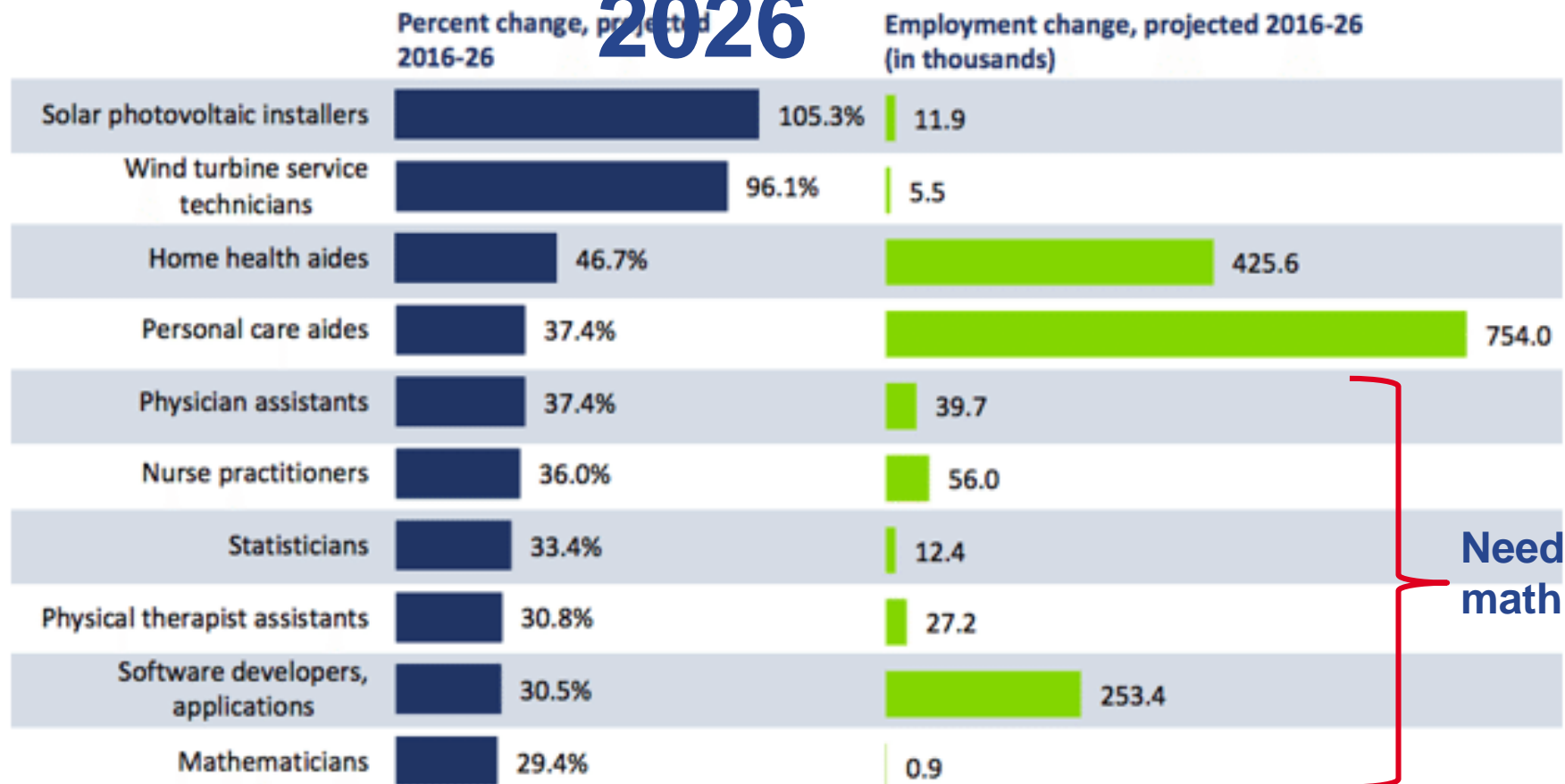
STREAM

or

STREAM

occupations

2016-
2026



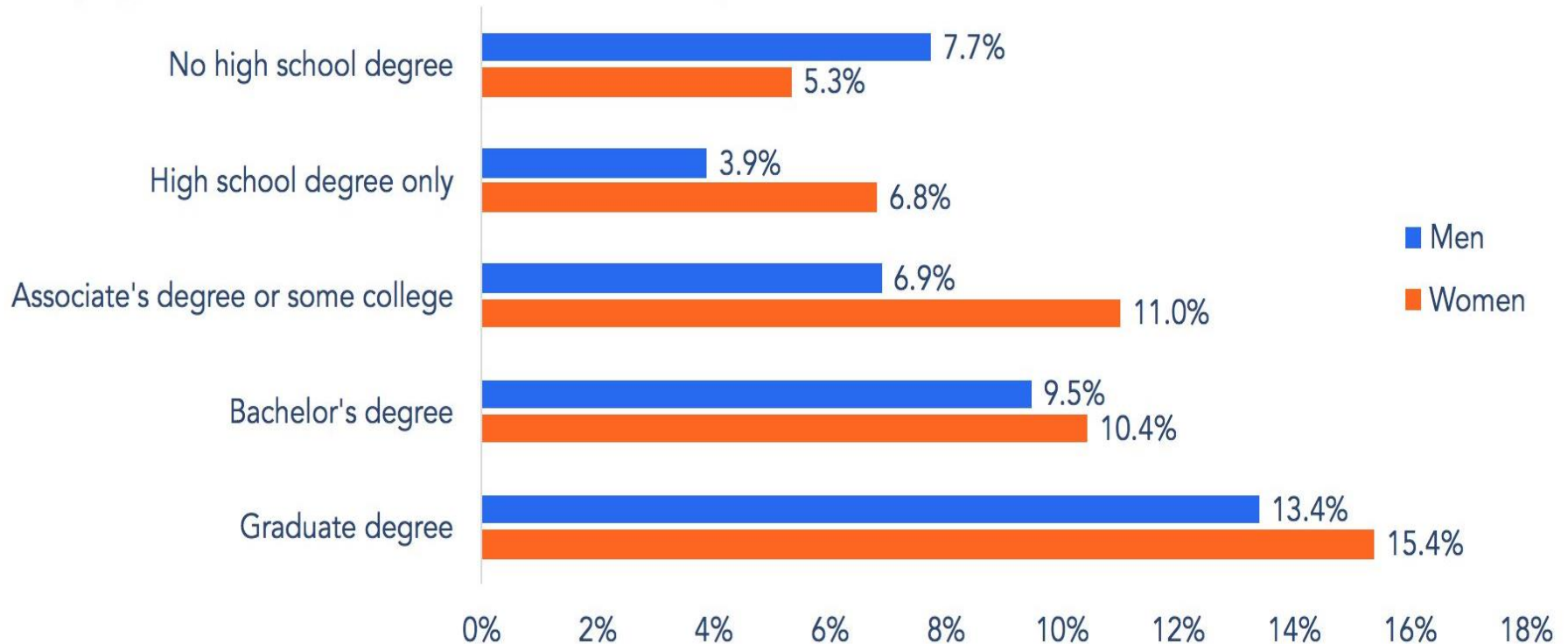
Need
math

Median Salaries of fast-growing occupations

	Percent change, projected 2016-26	2016 Median Pay	
Solar photovoltaic installers	105.3%	\$39,240	
Wind turbine service technicians	96.1%	\$52,260	
Home health aides	46.7%	\$22,600	
Personal care aides	37.4%	\$21,920	
Physician assistants	37.4%	\$101,480	More money
Nurse practitioners	36.0%	\$100,910	
Statisticians	33.4%	\$80,500	
Physical therapist assistants	30.8%	\$56,610	
Software developers, applications	30.5%	\$100,080	
Mathematicians	29.4%	\$105,810	

Projected Job Growth, by Education Required and Typical Gender

BLS projections, 2016-2026, and ACS 2016 occupational characteristics



STEM Capable Jobs

Computing jobs span the economy

According to the U.S. Bureau of Labor Statistics, 3.8 million people in the U.S. work in computing occupations. Yet Change the Equation finds that more than twice as many—**7.7 million Americans**—say they use computers in complex ways in their jobs. Many of these jobs are in non-STEM fields.



All
perform
tasks
such as



Developing
software or
modifying
computer
games



Programming
using languages
like Java, SQL,
PHP, or Perl



Maintaining
a computer
network

SOURCE: CTE; 2015 analysis of OECD's Programme for the International Assessment of Adult Competencies, 2012

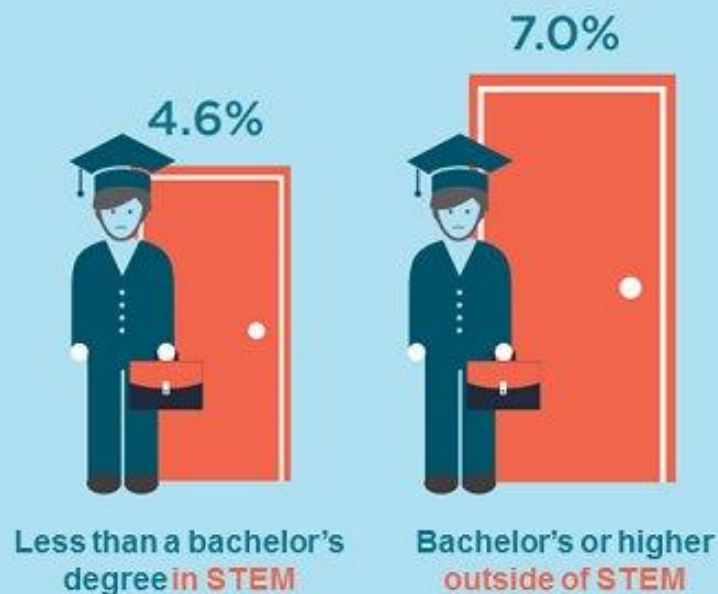
degrees



Career and technical education in STEM leads to bright futures

In tough economic times, recent grads with associate's degrees in STEM were less likely to be jobless than those with bachelor's degrees outside of STEM.

Unemployment among new grads, 2011–2014



SOURCE: CTEq analysis of data from the U.S. Census Bureau, Current Population Survey, June 2011–May 2014.

NOTE: "Recent grads" with "bachelor's or higher" are graduates aged 21 through 24 with a bachelor's or higher degree. "Recent grads" with "less than a bachelor's degree" are graduates aged 19 through 22 with an associate's degree or some college. For full methodology, see changetheequation.org/stem-springboard.

fundamental skills

Percent of Respondents

Very

Somewhat

Not

RELEVANT?

Reading & writing (fundamental)

82%

11%

7%

Mathematics (fundamental)

75%

21%

4%

PROBLEMATIC?

Mathematics (fundamental)

12%

47%

41%

Reading & writing (fundamental)

10%

32%

59%

0%

25%

50%

75%

100%

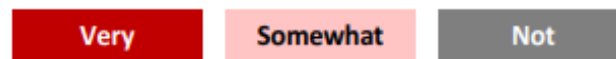
Responses: n = 73



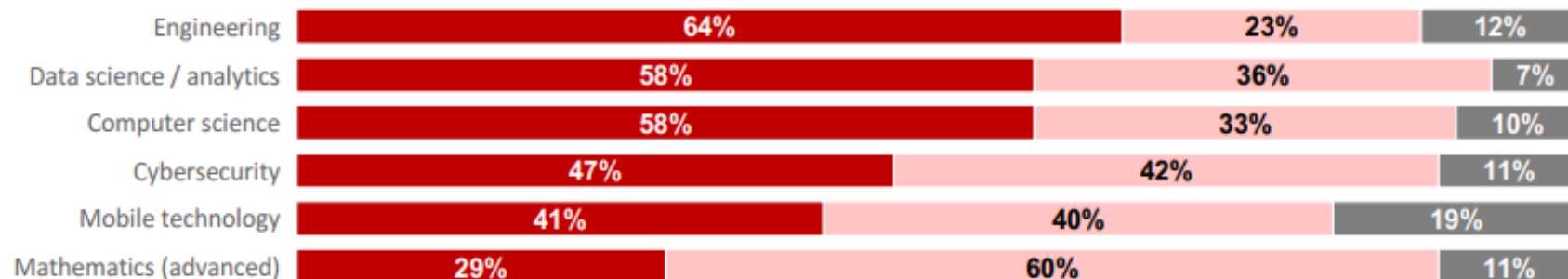
Source: Business Roundtable 2016 Member Company Talent survey

applicants

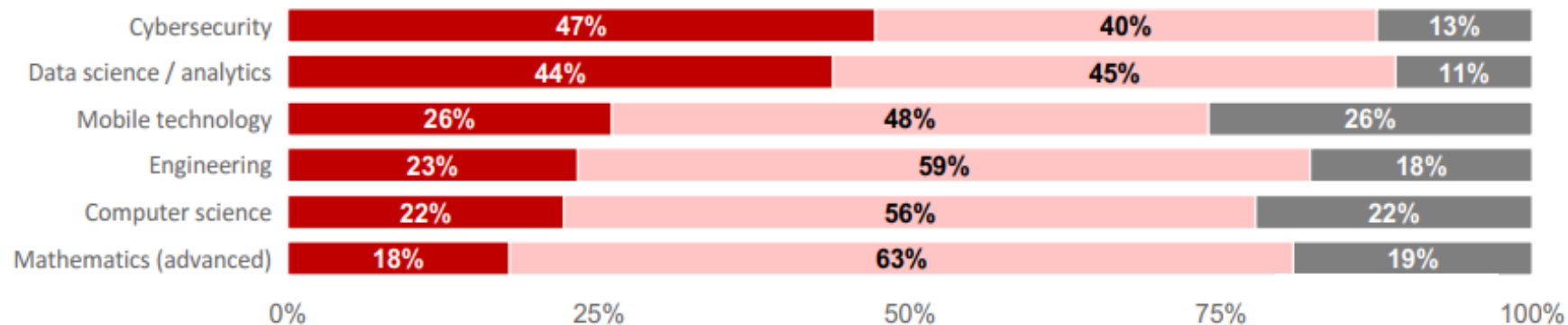
Percent of Respondents



RELEVANT?



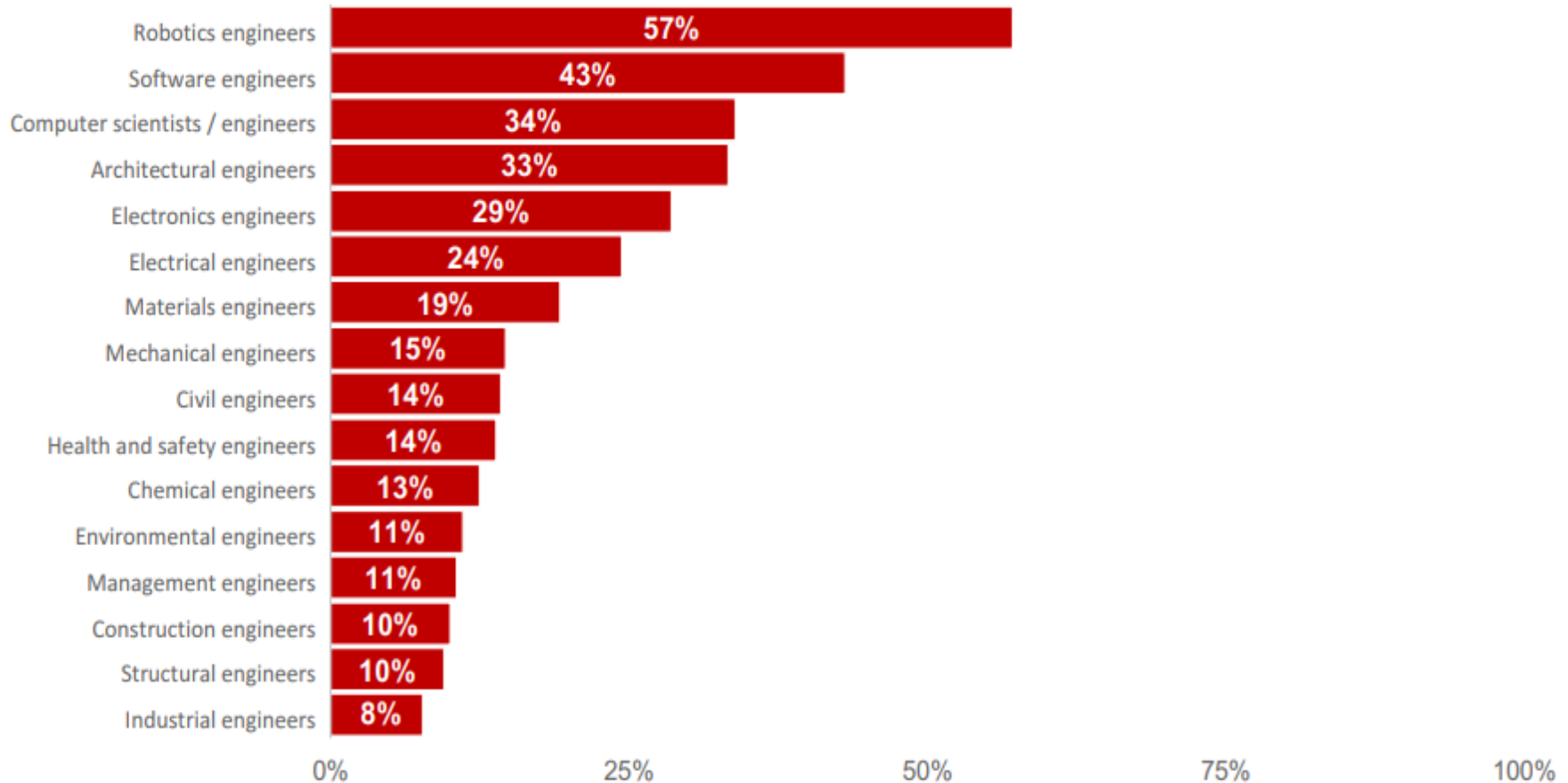
PROBLEMATIC?



Responses: n = 72 – 73, depending on skill / talent attribute

I am able to find qualified candidates as...

% of Respondents Indicating “Disagree” or “Strongly Disagree” Regarding Ability to Find Qualified Candidates



Responses: n = 12 – 56 depending on engineer type

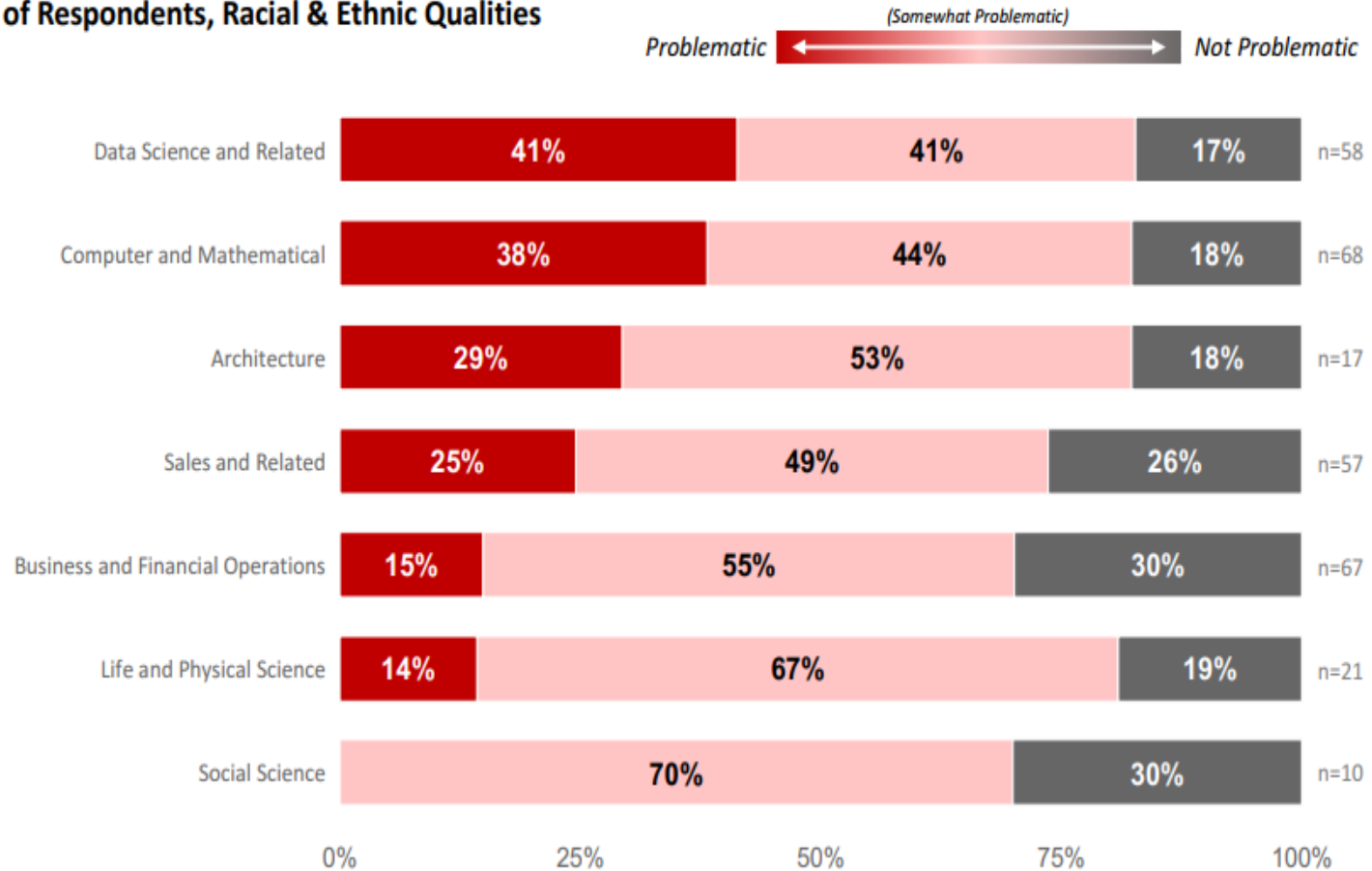
Note: this list excludes engineering occupations employed by less than 12 BRT member companies



Source: BRT 2016 Member Company Talent survey

diversity

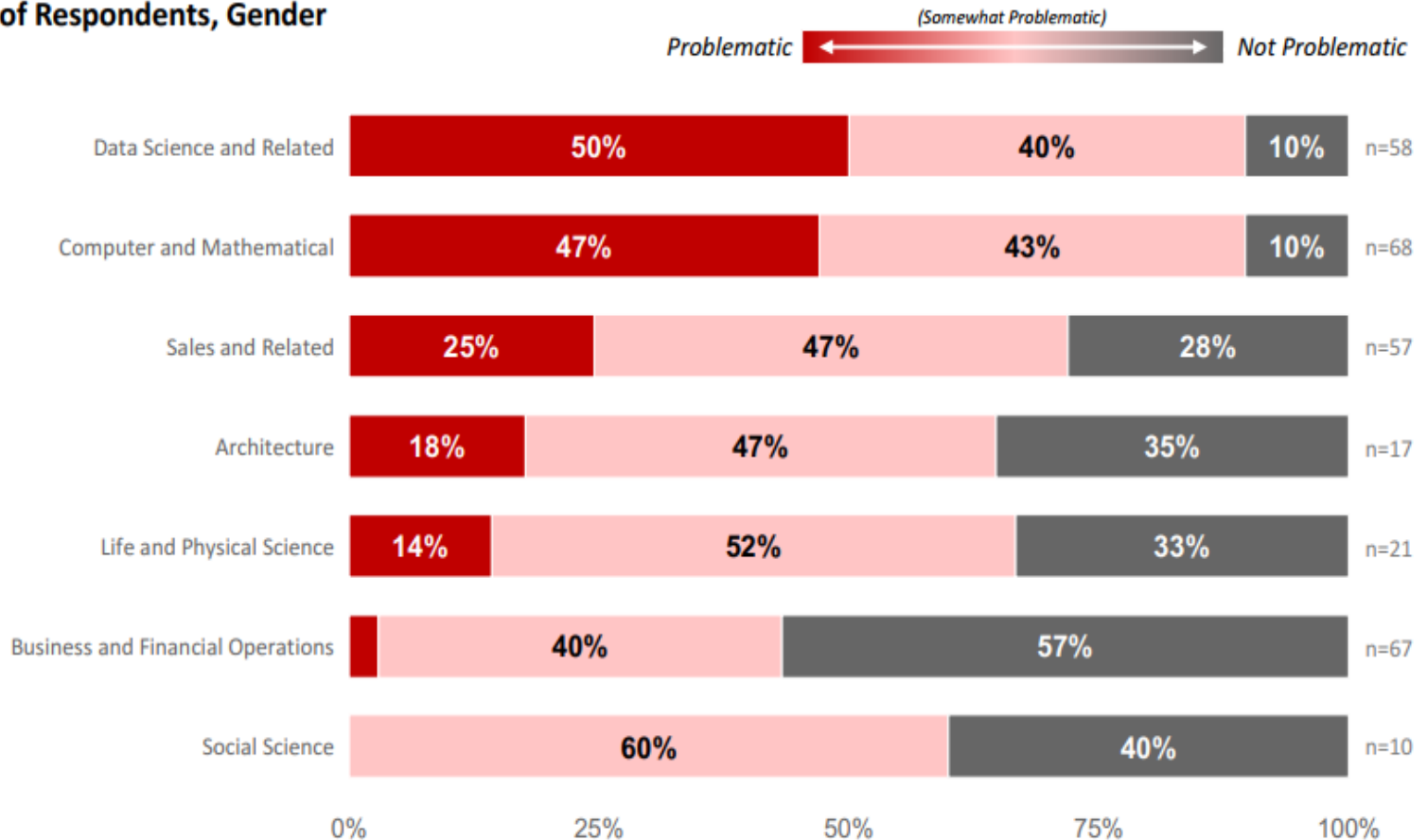
Percent of Respondents, Racial & Ethnic Qualities



Responses: n = 10 – 68, depending on other occupation type

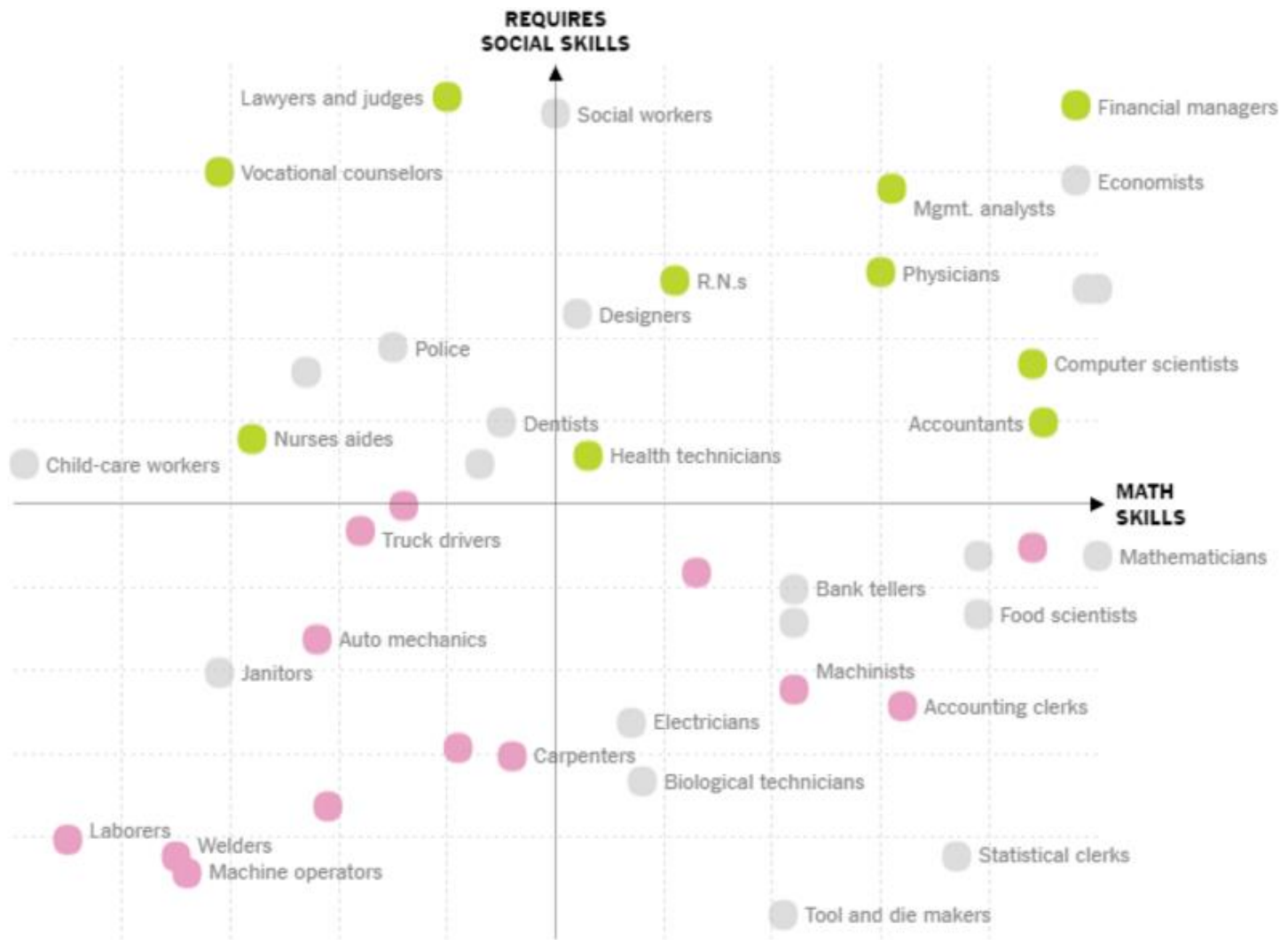
Difficulty in hiring qualified females

Percent of Respondents, Gender



Responses: n = 10 – 68, depending on other occupation type

beneficial



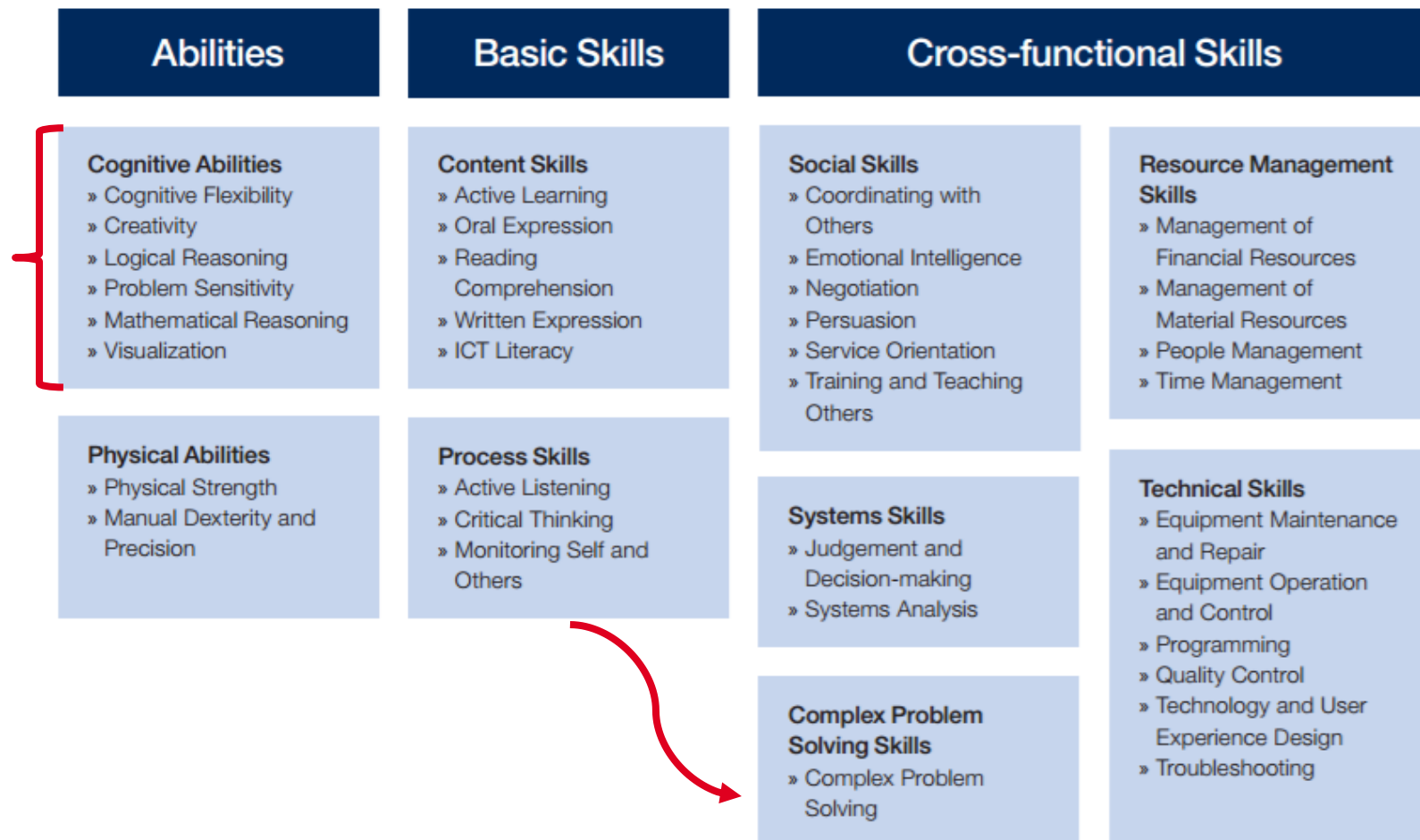
Source: David Deming, Harvard University



Change in share of jobs, 1980 to 2012

● Fell ● About the Same ● Grew

skills

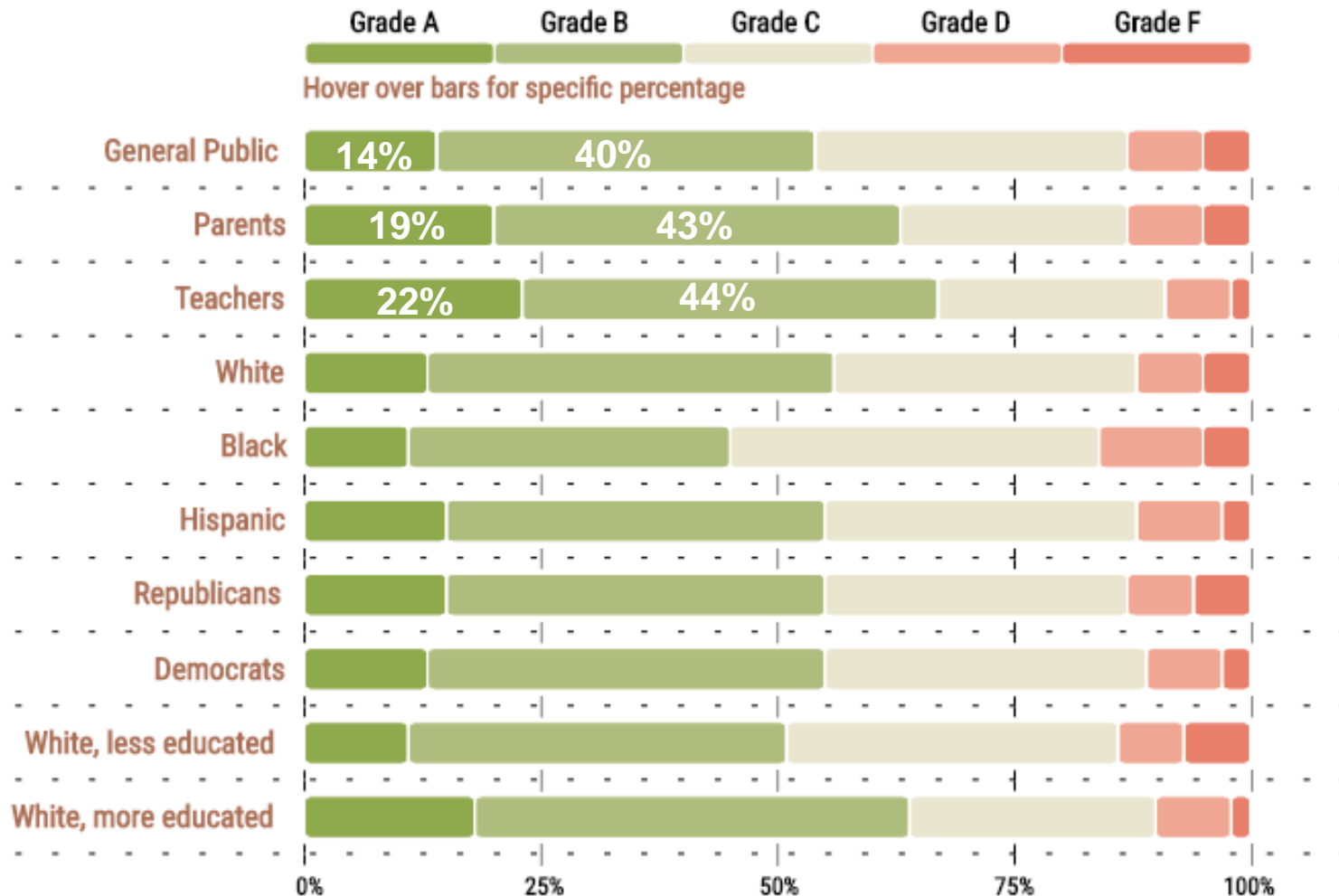


Source: World Economic Forum, based on O*NET Content Model.
Note: See Appendix A for further details.

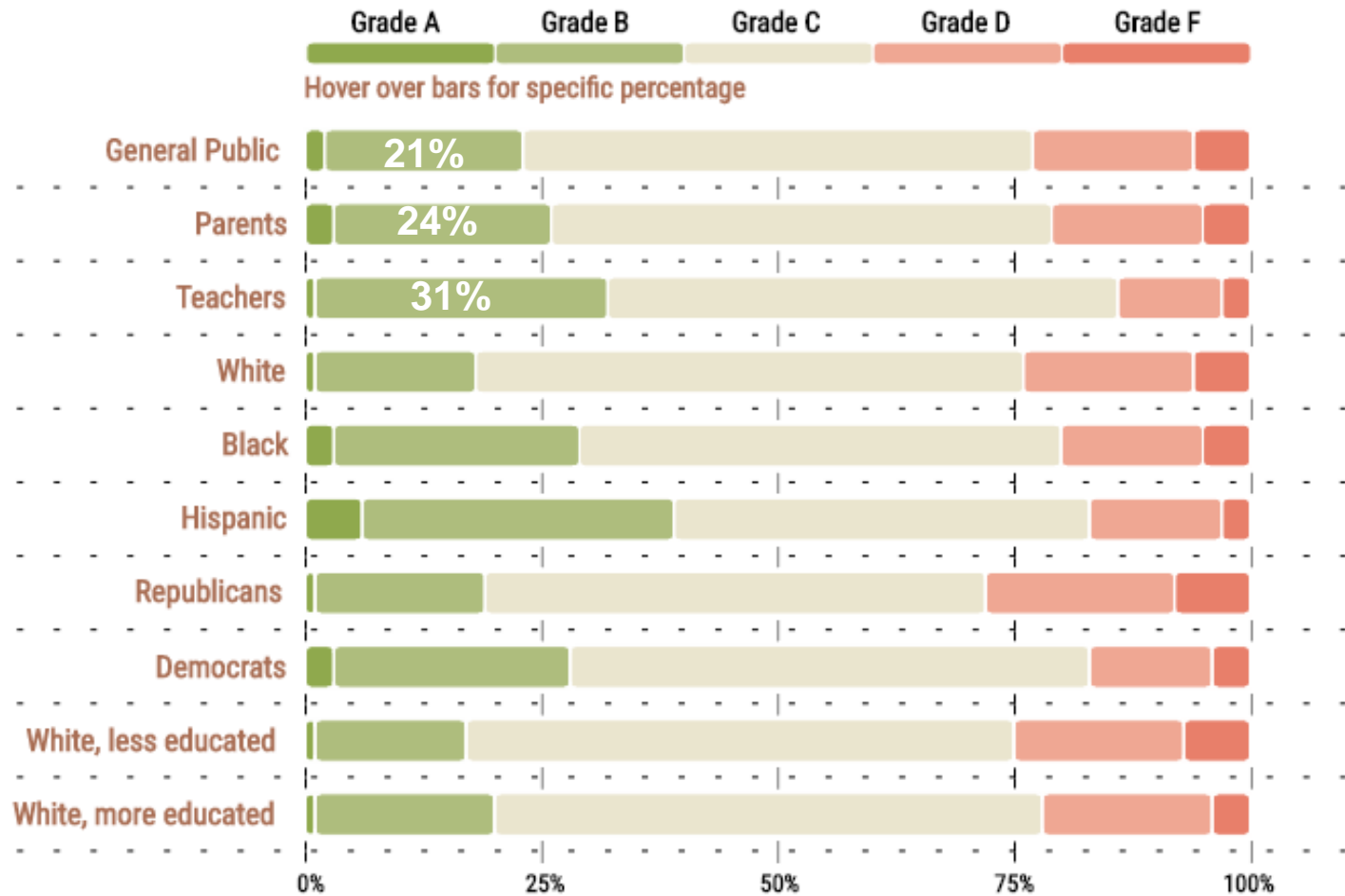


"Reading, writing, *and* arithmetic
— I'm too *young* to multitask!"

schools?



nationally?



Stereotypes Start Early



Tools of the trade?



Teachers in the poorest elementary schools lack teaching resources for math

Children who attend elementary schools where most students qualify for free or subsidized lunches are much less likely to have teachers who receive the resources they need to teach math.

Fourth-graders whose teachers have “all” or “most” of the resources they need to teach math, 2015



■ ≤25%-poverty schools ■ >75%-poverty schools

* Statistically significant difference from ≤25%-poverty schools

SOURCE: CTEq analysis of U.S. Department of Education, National Assessment of Educational Progress 4th-Grade Mathematics Assessment, 2015

NOTE: Survey questions: “Which of the following statements best describes how well your school system supplies you with the materials and other resources you need for mathematics instruction? (Teacher-reported: None, Some, Most, All).” “≤25%-poverty schools” are schools where 25% or less of students are eligible for free or reduced-price lunch. “>75%-poverty schools” are schools where at least 76% of students are eligible for free or reduced-price lunch.

Technology and Engineering Literacy Assessment

Female
students scored



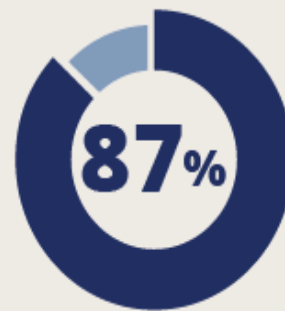
higher than
male
students.

NSLP¹ not eligible
students scored



higher than
eligible
students.

¹ NSLP = National School Lunch Program.



reported **figuring out**
why something was
not working in order
to fix it outside of
their school work.

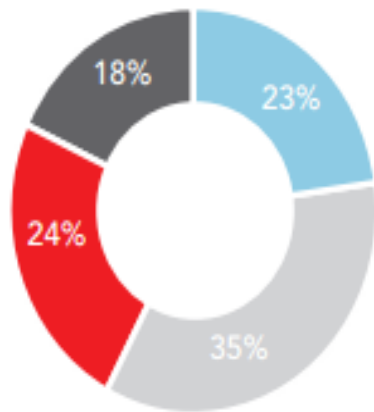


reported **using a**
computer to create,
edit, or organize
digital media at least
once a month in
school.

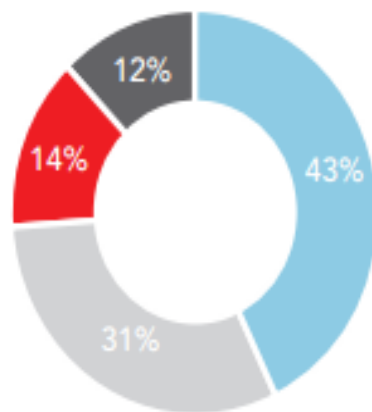
Opportunity to Tinker

In school, how often have you ever done the following activities?

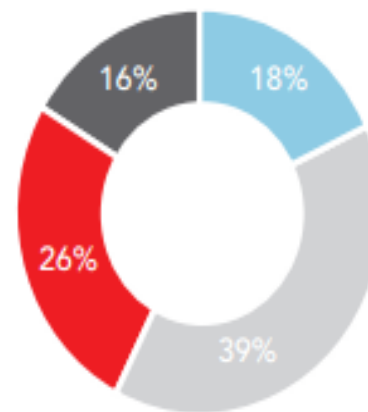
Figured out why something is not working in order to fix it



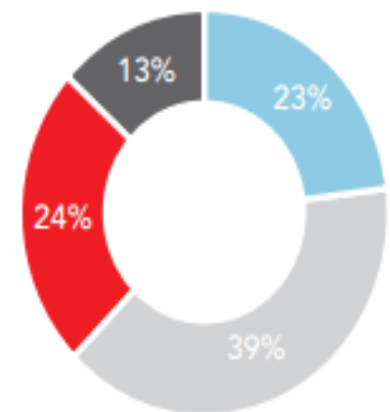
Taken something apart in order to fix it or see how it works



Used different tools, machines, or materials to see which are best for the given purpose



Built or tested a model to see if it solves a problem

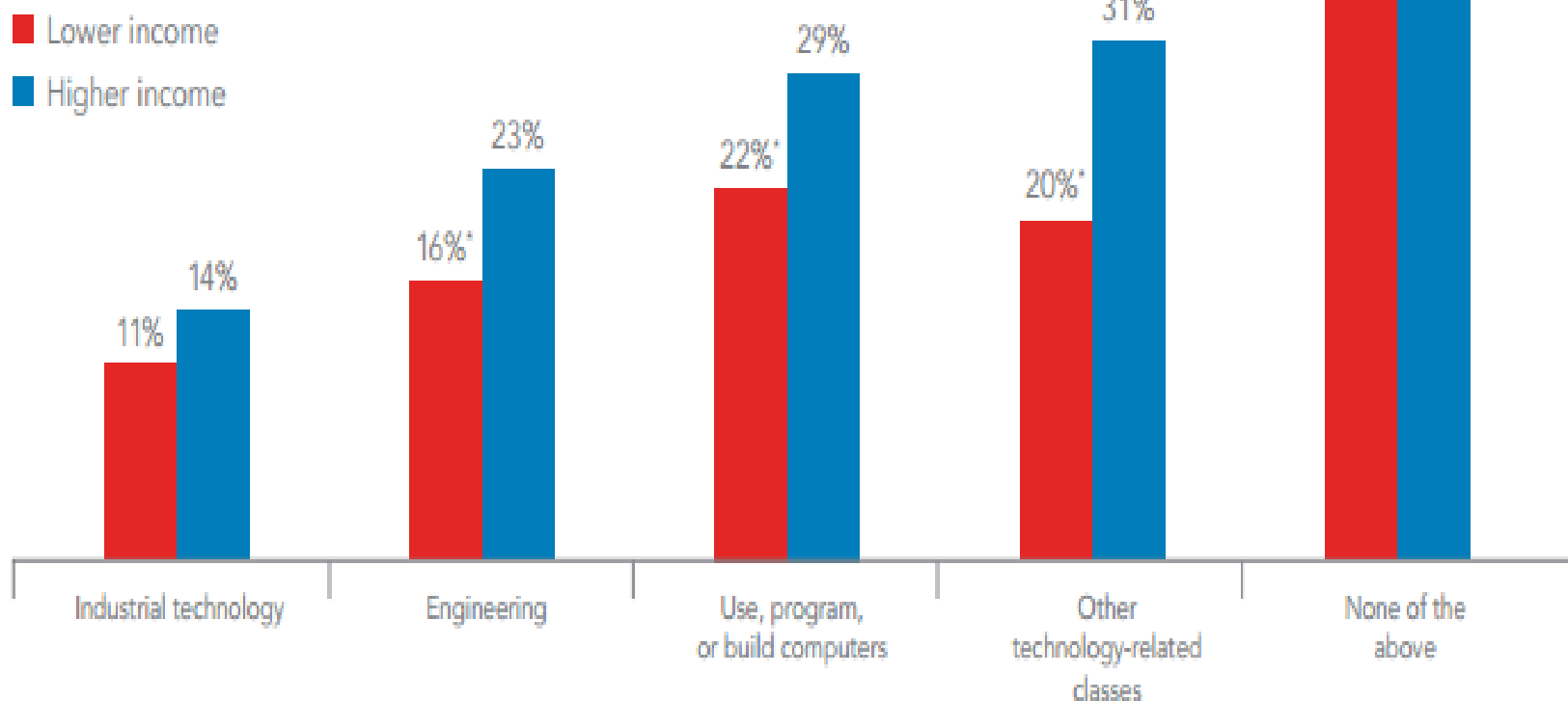


■ Six-plus times ■ Three/five times ■ Once/Twice ■ Never

Source: Change the Equation analysis of contextual data from The Nation's Report Card: Technology and Engineering Literacy, May 2016

Left to Chance

Have you ever taken or are you currently taking any of the following classes or subjects in school?



* Statistically significant difference from higher income

Minority talent is squandered

In the high school class of 2014:

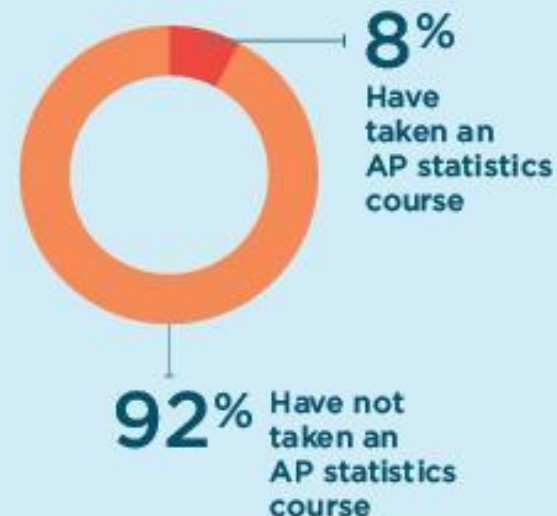
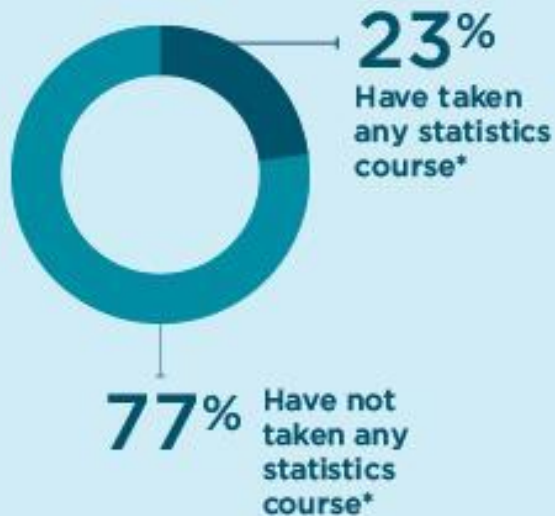
- More than 41,000 Black, Latino and Native American students had the potential to succeed on Advanced Placement exams
- About half did not take any

Despite many career opportunities...



Few 12th-graders have ever taken a stand-alone statistics course

Percentage of U.S. 12th-graders who say they have taken a probability or statistics course, 2015



SOURCE: CTEq analysis of data from the U.S. Department of Education, National Assessment of Educational Progress, 2015 Mathematics Assessment.

* "Any statistics course" includes both AP and non-AP statistics/probability courses.

Even worse in low-income communities...

Low-income students have less access to statistics courses

Percentage of 12th-graders whose high schools offer statistics courses, 2015

Any statistics course*

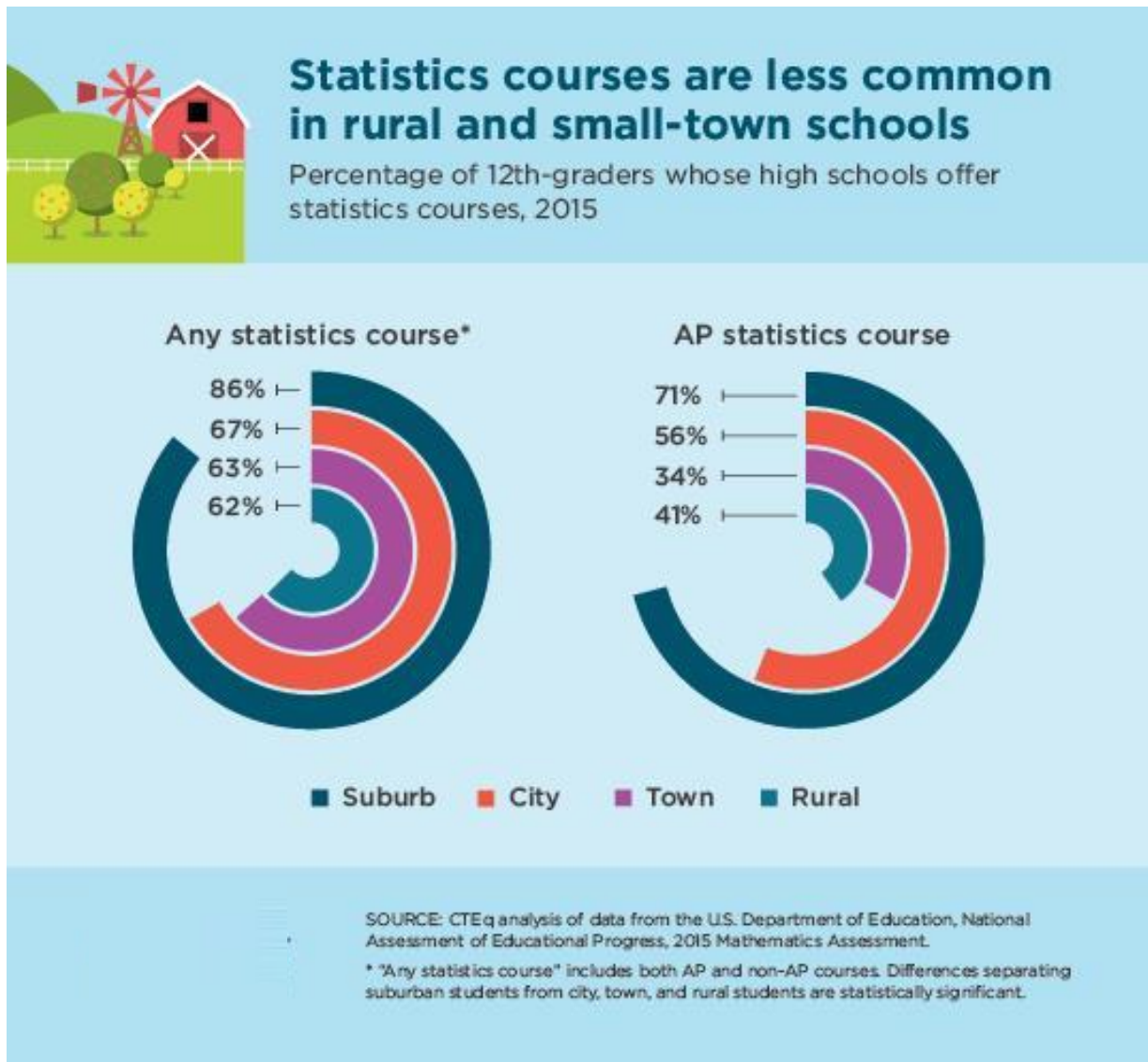


AP statistics course



SOURCE: CTEq analysis of data from the U.S. Department of Education, National Assessment of Educational Progress, 2015 Mathematics Assessment.

* "Any statistics course" includes both AP and non-AP statistics/probability courses.



Girls lose interest in computing



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