randstad

overcoming the barriers to STEM.

An inclusive guidebook to solving the STEM shortage based on research and feedback from 13 of the country's leading female STEM executives.

While there is ongoing discussion surrounding the STEM (science, technology, engineering and math) skills shortage, what is not widely deliberated is the lack of women in these critical careers. According to the U.S. Bureau of Labor Statistics (BLS), women make up 47 percent of the total U.S. workforce[1] and hold 60 percent of all bachelor's degrees[2], yet they hold only about 25 percent of all computer and mathematical occupations. The number drops to 15 percent for architecture and engineering jobs.[3]

At the same time, the Department of Commerce and the BLS project growth in STEM jobs. The Department of Commerce predicts that STEM job openings will grow 17 percent by 2018[4], a much faster rate than most other careers, while the BLS reports an estimated one million STEM jobs are likely to be created by 2022.[5]

Randstad conducted a study to uncover key motivations, beliefs and perspectives of STEM-related topics among kids aged 11 to 17. The Randstad STEM Study and Insights Report highlights major trends and barriers among young children in both interest and intended pursuit of STEM professions. Based on these findings, Randstad conducted in-depth interviews with 13 of America's leading female STEM executives with the goal of understanding and addressing these challenges.

The following is an informative guidebook about what may be behind the lack of participation in STEM professions and key strategies to start changing these dynamics.

the importance of early intervention.

Although the solution to the shortage of women in STEM is multilayered, like anything related to education, it begins with the critical K-12 experience. As the Randstad study uncovers, students in these early stages have high interest and curiosity about STEM-related professions.

In fact, for many postsecondary students pursuing STEM professions, the decision to study STEM started long before college. Nearly 4 in 5 STEM college students (78%) say they decided to study STEM in high school or earlier, and 1 in 5 (21%) decided in middle school or earlier.

This comes as no surprise to Susan Brennan, chief operating officer of Bloom Energy, who has worked to encourage young girls to enter STEM fields for many years. “I believe middle school is the deciding point for most young girls,” says Brennan. “If you don’t get them by high school, you’ve lost them. As a country, we don’t focus enough on early education and these all-important years.”

Perhaps most compelling is evidence that interest in STEM professions begins to dwindle the older the child grows. The Randstad study found that 11- to 14-year-olds are 18 percent more likely than students aged 15 to 17 to consider math one of their favorite subjects.

students between the ages of 11 and 17 have a natural curiosity for STEM topics.

85%	say they often wonder how stuff works
84%	say they enjoy working on computers
73%	say that when they sit in science class they enjoy it all or most of the time
60%	say that when they sit in math class they enjoy it all or most of the time
54%	say science is one of their favorite subjects
46%	say math is one of their favorite subjects

why STEM needs rebranding.

A common theme among both the Randstad research and our experts' insights is the need to change the way we look at STEM. Today, STEM professions are narrowly perceived — scientists, IT workers, engineers and mathematicians. But when you broaden the scope to look at specific skills, and not jobs, the true scale of the skills gap becomes even more evident.

A whole range of STEM skills — from statistics to software development — have become essential for jobs that never would have been considered STEM professions in the past. Coding, for example, could be considered the gateway to the world of science, technology, engineering and math. It includes the use of JavaScript and HTML for building websites, statistical programs such as R and SAS, AutoCAD programs and general purpose computer programming. By that standard, there were 7 million job openings in 2015 in occupations that value coding skills[6], according to research by Oracle Academy. That one-year figure is seven times the BLS estimate of STEM jobs over a 10-year period.

Another crucial driver behind broadening our perception of STEM is to address a lack of understanding among youth when it comes to STEM professions and their relevance in the world. This was clearly illustrated in the Randstad research study.

In the United States, 80 percent of the fastest-growing jobs depend on a mastery of mathematics and scientific knowledge and skills.[7]

Ellen Morris, president and founder of Sustainable Energy Solutions, has pushed for broadening the exposure and understanding of STEM fields. “I’m always an advocate for exposing young people to the underbelly of these jobs,” says Morris. “It isn’t necessarily the STEM field, but do you need the skills? Maybe it’s more intimidating to be thinking about a STEM career, and instead we should focus on building a STEM foundation.”

Morris believes the more we connect STEM skills to careers in the arts, business and even fashion, the more we will succeed in broadening the appeal of these skills to young women.

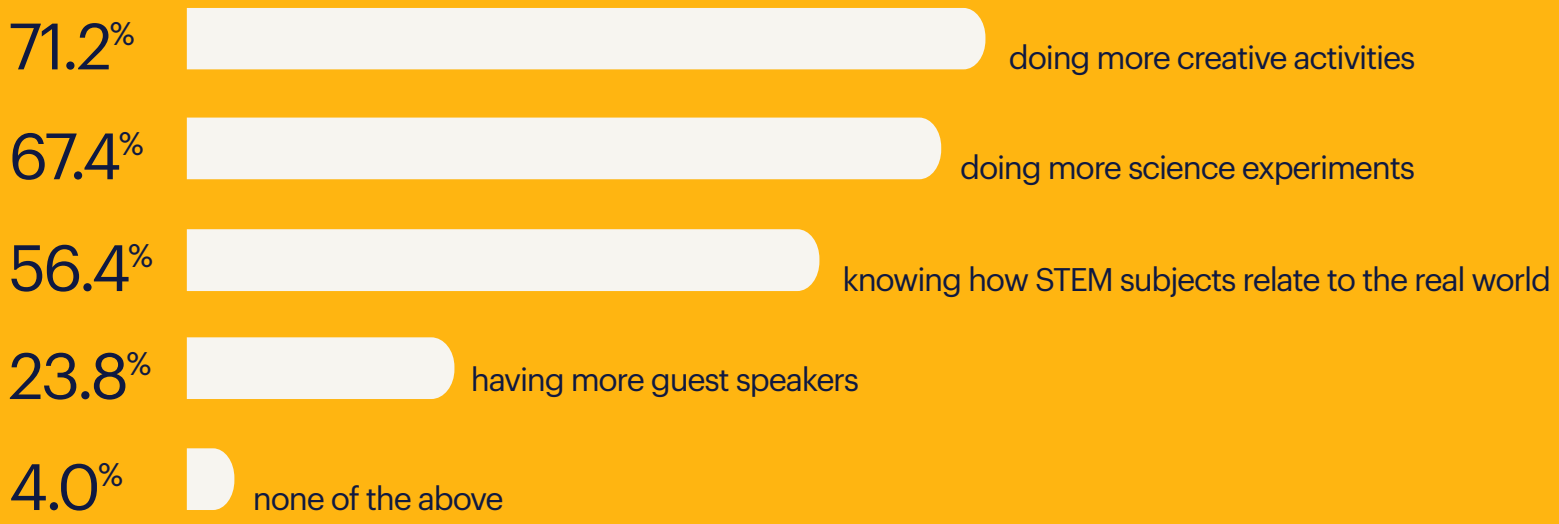
As Jane Bove, principal program manager of Microsoft Office 365, puts it, “STEM skills are just tools in your career toolbox. You don’t have to be a computer programmer, but you will likely need to use those skills at some point in your career.” A point Alcoa Corporation Executive Vice President and Chief Administrative Officer Leigh Ann Fisher vehemently agrees with.

According to Fisher, “there are jobs that certainly require a specific set of skills, accountants, electrical engineers and mechanical engineers for example, but the vast majority of jobs in companies (regardless of what they produce or their services) require a broader skill set that STEM education develops — how to solve problems, how to relate point A to point B and other critical thinking skills.”

practical uses of STEM jobs are difficult for students between the ages of 11 and 17 to see.

56%	say knowing how STEM subjects relate to the real world would make STEM classes more interesting
49%	don't know what kind of math jobs are out there
47%	don't know what kind of engineering jobs are out there
69%	don't know a lot about what accountants do
76%	don't know a lot about what engineers do

what would make STEM classes more interesting?



making better connections to real-world environments.

A similar solution also emerged among our experts, supported by Randstad STEM research, around the need for youth to have better exposure and understanding of how a company operates — its functions, departments, the process of product development and service delivery. The idea is that this understanding would allow young children to identify where STEM skills are utilized in every organization and in every field — from NASA to fashion design.

Educating young children about the link between business and what is learned in the classroom can help students see real-world application. Yet Randstad research discovered a high number of students have misperceptions about where these skills can be applied. Eighty-seven percent of students between the ages of 11 and 17 think that people who study STEM work at companies like NASA, but only 40 percent believe they work at companies like Instagram, 26 percent at Coca-Cola and 9 percent at companies like Forever 21.

As the study indicates, one of the primary reasons behind this misperception is a general lack of exposure to, and discussions with, STEM experts.

“The challenge we face is that, generally speaking, professionals within STEM-related careers are not great communicators,” says Trina Salvisberg, senior region engineer at Enbridge Energy Partners. “I haven’t met an engineer who doesn’t love what they do. The problem is they aren’t naturally driven to communicate that love and passion for their careers.”

From the educator's standpoint, partnerships with businesses are also critical to shaping curriculums and efforts to help all kids better understand and pursue STEM skills. For example, 86 percent of STEM teachers agree that businesses should play a role in helping teachers understand what skills students need to pursue a STEM career.

"Connecting the dots between businesses and learning in the classroom can help students see the real-world applications," says Laura Smith, VP of technical sales for IBM. "When students can relate what they learn in the classroom to links outside the classroom, there is a tremendous boost in motivation for STEM. Where businesses can make a real difference is through providing teachers and students with resources, which help both parties to build better context, careers and STEM awareness. It truly does take a village."

knowledge of STEM careers is low for students between the ages of 11 and 17.

52%	say they don't know someone with a job in STEM
27%	haven't talked to anyone about jobs in STEM
50%	talk to their teachers about STEM jobs
54%	talk to their parents or family about STEM jobs
25%	talk to their friends about STEM

are we using the wrong equation for math education?

Our study indicates that math is the least favorite subject among students. When it comes to math and how students view this skill, the Randstad STEM survey found that half of all students (49%) between the ages of 11 and 17 say they don't know what kind of math jobs are out there. Surprisingly, only 18 percent of kids thought they were smart enough to be an accountant — the lowest percentage of all STEM professions.

As the STEM experts featured in this guidebook discussed these findings, a clear theme emerged about the way in which math is taught in classrooms — specifically, a tendency among educators to emphasize the answers as opposed to emphasizing the process of problem-solving. Particularly for female students, the black and white nature of right vs. wrong can often derail confidence in math skills and ability.

Smith's philosophy about math highlights the value in showing the work done to solve a problem. "Sometimes it's the path to get you to the answer that demonstrates capabilities in math," she says. "A student could have been 95 percent right in the way the problem was solved, and a small misstep at the end is what contributed to an incorrect answer."

Cynthia Johnson, VP and CIO at California Resources Corporation, agrees. "I was always told that the reason we learn math is that we're learning how to think, how to organize," says Johnson. "By broadening the approach to math in the classroom, we can better convey to students that math is an important skill set you'll need in life — not necessarily just a career."

As Brennan puts it, "If you work for SpaceX, you better not get the math wrong. For most other professions, the ability to problem-solve and the process of reasoning and critical thinking are far more important than the right or wrong answer to a math problem."

For Wendy Walasek, executive director in technology for Credit Suisse, it's all about showing kids that math is cool. "In many ways, math is super interesting and fun — particularly when you get to solving equations and analytics. It's important that we demonstrate this to our kids, but also convey that even if you want to be a sociologist, historian or fashion designer, you need math."

gender bias in STEM.

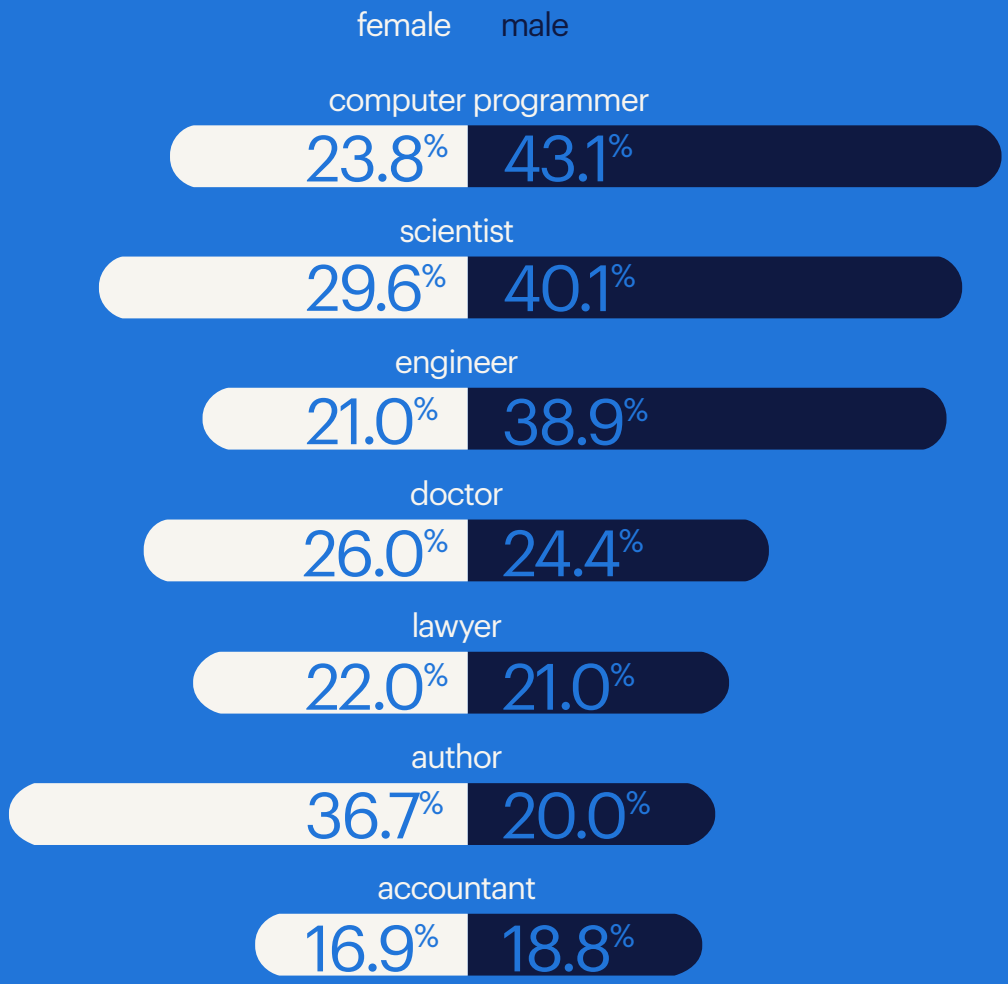
Negative stereotypes about girls' abilities in mathematics and science are still very much alive, despite the significant progress made over the past several decades in both participation and performance in these disciplines. The reality remains: many believe girls are not as good as boys in math and men are better suited for scientific work.

A recent report by the AAUW titled "Why So Few?"[8] examined this issue in great detail. According to the report, "a large body of experimental research has found that negative stereotypes affect womens' and girls' performance and aspirations in math and science through a phenomenon called 'stereotype threat.' Even female students who strongly identify with math — who think they are good at math and to whom being good in math is important — are susceptible to its effects."

The report's research indicates that "negative stereotypes about girls' suitability for mathematical and scientific work are harmful in measurable ways. Even a subtle reference to gender stereotypes has been shown to adversely affect girls' math test performance. Stereotypes also influence girls' self-assessments in math, which influence their interest in pursuing science, technology, engineering and mathematics careers. Fortunately, research also shows that actively countering stereotypes can lead to improvements in girls' performance and interest in math and science."

34 percent of females are more likely to say that STEM jobs are hard to understand than male students of the same age.

how good do you think you would be at the following jobs?
(percentage answering very good)



insights from STEM leaders.

Strategies for change: when it comes to solutions to the many aspects of poor STEM participation, particularly among women, the STEM executives offered advice and insight from the front lines.

Catriona Fallon, CFO, Silver Spring Networks

"Research has found that it's not just gender barriers keeping women from entering STEM jobs. Even among those who are persistent enough to enter the STEM labor force, too many are exiting relatively early in their careers. The discussion about fixing our shortage of STEM workers needs to go beyond the need to increase supply so that we understand why so many women are leaving."

Laura Smith, VP of technical sales, IBM

"We have to improve our efforts in teaching and empowering young girls that differences are wonderful and should be embraced. We need to encourage them to have a more flexible or malleable mindset about intelligence in order to reduce their susceptibility to stereotypes or lack of confidence."

Marcia Brey, lean enterprise leader, GE Appliances

"More exposure to hands-on learning will greatly improve our children's development of spatial skills, which have been proven to promote interest in mathematics, physics and other areas among elementary and middle school students. Show kids videos on how things work, encourage them to create with clay, Legos, blocks — even old sheets make great forts. Provide them unforgettable experiences of taking things apart and putting them back together again."

Jane Bove, principal PM, Microsoft Office 365

"Helping girls recognize their career-relevant skills and encouraging them to see their success in math and technology as a stepping stone to most professions is paramount. We need to begin to expose kids to technology in a way that isn't intimidating. The most important thing we can do as influencers is to make kids not afraid of technology."

Trina Salvisberg, senior region engineer, Enbridge Energy Partners

"We know from anecdotal research that female students approach math problems differently from their male counterparts. They tend to write down every single step they use to solve the math problem, whereas boys often 'do it in their heads.' When teachers and educators focus too heavily on the 'right or wrong' answer, we do a disservice to students who demonstrate effective problem-solving and reasoning skills. The more teachers and professors can help reduce uncertainty about students' performance, the less they will rely on stereotypes to judge themselves."

Wendy Walasek, executive director in technology, Credit Suisse

"More time needs to be spent in the classroom and in curriculums actually explaining the business world and how it works, particularly how each person has their place within it and how STEM skills are interwoven through every facet. We must plan for ways in which students can pick up the individual STEM skills that are increasingly present in jobs across the economy, not just in STEM fields."

Mary Beth Heydrick, VP operations, Ethylene Envelope, Dow Chemical

"Educators and business executives alike must consider any implicit or unconscious biases they may have toward females when it comes to STEM and the business world and take steps to correct these biases. They must consider the influence their biases may have on their teaching, advising or evaluation of students and female executives."

Ellen Morris, president and founder, Sustainable Energy Solutions

"More recognition of the unique and powerful ways in which women tackle problems, add value to the workplace and even how they enhance team performance will begin to chip away at gender biases and stereotypes. By spreading the word about girls' and women's achievements in math, science and in business in general, we can drive progress. The more people are exposed to this kind of information, the more difficult it becomes for people to believe that boys and men are better in these areas."

Leigh Ann Fisher, executive vice president and chief administrative officer, Alcoa Corporation

"The world is not producing enough engineers or scientists – particularly female. In fact, the profile of those who do go on to pursue STEM careers is too narrow, with women and minorities underrepresented. This not only means a large pool of potential talent is being lost, but those industries are missing out on the many benefits of a more diverse workforce. Every business must do its part in the community in which it operates, working with young people to teach them about the types of jobs offered and that they can pursue in the future."

Cynthia Johnson, VP and CIO, California Resources Corporation

"I think one of the keys to building up young girls' confidence is to teach them that the brain is like a muscle. Every time they work hard and learn something new, their brains form new connections and a new part of their brain is activated. Over time, these connections help them become confident to learn or try the next thing. We must create an environment where it's safe and rewarded to work hard, challenge oneself, and even make a mistake. This builds your confidence."

Rachel Hudson, CFO, global corn processing, Archer Daniels Midland Company

"I've noticed a lot of young women in the workforce who come out of school with a lack of confidence, endurance and willingness to dig in to complex problems or projects. We must teach girls that passion, dedication and persistence — not simply intellect or talent — are the road to achievement and contribution. We ought to be praising girls for their effort, not just their intelligence."

Susan Brennan, COO, Bloom Energy

"As a country, we don't focus enough on middle school teachers and helping them combat the very real stereotypes and pressure that most middle school girls face. Middle school is the deciding point for most young girls when it comes to sticking with STEM-related courses and careers. Educating teachers about this "stereotype threat"[9] and providing techniques and tools to create an environment where young girls feel free from ridicule or pressure to move away from STEM-related curriculum is critical to solving our shortage of female STEM professionals."

sources.

[1] http://www.bls.gov/cps/cpsaat03.htm

[2] https://nces.ed.gov/programs/digest/d16/tables/dt16_318.30.asp

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[6] http://burning-glass.com/research/coding-skills/

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