HISPANICS & STEM

Hispanics are underrepresented in STEM today, but Gen Z's interest can change the future

A report by

Hispanic Heritage FOUNDATION

STUDENT RESEARCH foundation

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Research Consortium on STEM Pathways

AAPT PHYSICS EDUCATION

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FOREWORD

By Sylvia Acevedo

The growth of Latino and Hispanic communities across the United States presents a profound opportunity for our country. Today, STEM jobs in areas like computer science, engineering, cybersecurity, data science, machine learning, and software development are on the rise, however, Hispanics comprise only 8% of the STEM workforce, despite being 17% of the workforce overall. By activating today's Hispanic and Latino youth as a talent pipeline for these fields, we can tap into a new generation of STEM leaders and workforce talent to spearhead innovation and progress.

We know many elements of our education and workforce development systems were not designed with the needs of students hailing from diverse backgrounds, like dual-language families and those with parents who are new Americans, in mind. While the numbers are improving, Latino students are still less likely to complete their college degrees and earn lower wages than their non-Hispanic White American and Asian American peers—with disparities especially prevalent for Hispanic women.

So, what's the good news? With research like this new study from the Hispanic Heritage Foundation and the Student Research Foundation, we're deepening our understanding of why these gaps in opportunity and attainment have persisted—and strengthening our ability to address them. We have the chance to do better for this generation and the next—especially for women and girls.

Things have changed somewhat for young women entering higher education and the workforce, but a troubling trend has stubbornly remained—the underrepresentation of women in STEM fields. Women are almost half of the current workforce, but hold only 25% of STEM jobs. And while Hispanic women represent about 7% percent of the total workforce, they hold less than 2% of STEM occupations.

We know this isn't because girls can't or don't want to pursue STEM careers—it is because we're not doing enough to help them believe they can and should. In fact, among students who report having STEM career aspirations, girls are more likely to have higher GPAs and be "A" students than boys of the same race/ethnicity.

Yet, our Hispanic students are not enrolling in as many STEM courses as their White and Asian peers, and they're reporting lower levels of one critical attribute young people absolutely must have to be successful in STEM: *confidence*. Ethnicity and gender combine to affect STEM confidence, with Hispanic females least likely to have high STEM confidence (22%), while White and Asian males are most likely to have high STEM confidence (35%).

The Girl Scouts of the USA reaches nearly 2 million young women and girls nationwide—we're committed to ensuring that the next generation of women and girls see themselves as the scientists, coders, software developers, doctors, computer scientists and cybersecurity experts who will solve the big problems of the future.

Over the past few years, Girl Scouts has greatly expanded its STEM curriculum, collaborating with a variety of STEM partners to develop cutting-edge programming in exciting areas girls are interested in, including robotics, coding, computer programming, mechanical engineering, space science, environmental advocacy, and cybersecurity. In 2019 alone, girls as young as 5 years old earned nearly one million STEM badges. Latinas in Girl Scouts represent over 200,000 in our membership.

The Hispanic Heritage Foundation's Code as a Second Language (CSL) program, in partnership with Google and the YWCA, is another example of getting more Hispanic girls and boys into the STEM pipeline, engaging 100,000 students to learn to code. After learning to code, participating students are then introduced to the LOFT (Latinos On Fast Track) leadership and workforce program for further development, connectivity to mentors and others in coding, and placement into the workforce, including the tech industry.

It is truly a national imperative and key to our continued competitive strength as a nation that we harness the power of all our youth—including our Hispanic female students—to be the STEM leaders of the future. We hope this report can serve as an important step in that direction.

Sylvia Acevedo is the CEO of Girls Scouts of the USA

EXECUTIVE SUMMARY

The U.S. workforce is forecast to grow 5.2% by 2028. Jobs in the STEM sector will grow by even more, 8.8%. The emergencies created by Covid-19 highlight the need for a strong domestic STEM sector. It also highlights the urgency for racial/ ethnic equity – in access to STEM technology and in cultivating the future STEM workforce.

Gen Z – today's students – will be critical to meeting the growing demand for STEM professionals. The U.S. already struggles to fill STEM jobs, with three in five U.S. employers taking 12+ weeks to fill positions like web developers, information security analysts, industrial engineers, etc. Gen Z could change that if more Gen Z Hispanics pursue STEM careers.

Hispanics are one in four U.S. students (25%) – second only to Whites (51%). Hispanic adults, historically underrepresented in STEM, continue to be an underutilized talent pool. They currently comprise 17% of the workforce overall but merely 8% of the STEM workforce.

This report analyzes data, collected prior to the Covid-19 crisis, from SRF's survey of 16K+ high school students in STEM classrooms nationwide. It compares Hispanic students with peers from groups historically overrepresented in STEM [ORGs] – Whites and Asians, identifying evidence-based insights to expand the STEM talent pool.

The data clearly show that Hispanic and White/ Asian students like STEM. They:

- like STEM subjects at similar rates (86% vs. 89%, respectively)
- aspire to STEM careers at similar rates (47% vs. 50%, respectively).

These similarities are remarkable, given that a more recent SRF survey found Hispanic high school students less likely than ORG peers to have internet access at home or feel school is preparing them for digital citizenship.

However, these similarities co-exist with divergences that may affect retention in the STEM pipeline:

- **STEM coursework.** Hispanic seniors are less likely than ORG peers to report taking 7+ high school STEM courses (20% vs. 31%).
- **GPA.** Among students aspiring to STEM careers, fewer Hispanics than ORGs report being "A" students (34% vs. 52%).
- **STEM confidence.** Among Seniors with 7+ STEM courses, fewer Hispanics than ORGs score high on STEM confidence (42% vs. 53%).
- **College plans.** Among seniors, Hispanics more frequently than ORGs aspire to attend community college (26% vs. 14%).

Hispanic girls merit special attention in efforts to attract more Hispanics to STEM:

- Hispanic girls are *less* likely than Hispanic boys to like STEM subjects (81% vs. 91%) or aspire to STEM careers (28% vs. 64%).
- Hispanic girls are *more* likely than Hispanic boys to report being "A" students (40% vs. 29%), but *less* likely than boys to score high on STEM confidence (22% vs. 30%).
- Hispanic girls' STEM confidence benefits less than boys' from STEM courses. The gender gap in STEM confidence jumps from 8 points overall, to 20 points among those with 7+ STEM courses.

Now that the STEM interest of Hispanics rivals that of students from groups historically overrepresented in STEM, evidence-based interventions addressing the four areas where Hispanics and ORGs diverge – as well as the gender gap – may be critical for retaining more Hispanics in the STEM pipeline. Success will provide the U.S. with the people to fill STEM jobs ***and*** maximize America's potential to leverage a unique advantage in global competition: diversity.

Research Design: Today's high school students in STEM classrooms provide insight into tomorrow's STEM pipeline. STEM career aspirations of youth predict adult career outcomes. High school courses determine which students will have the academic foundation to pursue STEM careers. That makes insights from the 16K+ high school students responding to SRF's survey invaluable to shaping evidence-based strategies to strengthen the STEM pipeline.

Surveys were sent to STEM teachers nationwide. 16,129 students responded to the survey. The results are a snapshot of students' interests and aspirations in the 2017-18 academic year.

INTRODUCTION

The U.S. workforce is expected to grow 5.2% between 2018 and 2028.[1] The STEM sector will lead the way, with anticipated growth of 8.8% overall, [2] and with an even higher growth rate in STEM's computing and mathematics subfield (12.7%).[3] Gen Z will be critical to meeting the challenge of growth, and Hispanics will be key to Gen Z's success.

Anticipated high growth in the STEM sector is both good news and a call to action. STEM jobs pay on average twice that of non-STEM jobs.[4] Yet even today, filling the existing STEM jobs can be challenging. Three in five U.S. employers already take 12+ weeks to fill positions such as web developers, information security analysts, industrial engineers, etc.[5] Research suggests that to fill even more STEM positions, the skills of college graduates must align better with the skills employers need. [6]

Gen Z is key to success. As the substantial share of today's students, they are well situated to acquire the skills needed to meet rising demand for STEM professionals. Their choices will determine the nation's ability to fill even more of these high-skill, in-demand STEM jobs that too often go unfilled for months. [7] Hispanics can be key to Gen Z's success closing that skills gap.

Boosting the STEM workforce depends heavily on attracting more Gen Z Hispanics to STEM careers. Hispanics are one in four U.S. students (25%) – second only to Whites (51%).[8] Hispanic adults, historically underrepresented in STEM, continue to be an underutilized talent pool. They currently comprise 17% of the workforce overall, but merely 8% of the STEM workforce. [9]

This report analyses survey data from 16,129 high school students in STEM classrooms nationwide. The analysis compares Hispanic students with peers from groups historically overrepresented in STEM [ORGs] – Whites and Asians. The result is evidence-based insights that shatter myths and identify opportunities for expanding the STEM talent pool. (For additional information about methodology, see Appendix A.)

WHY HISPANICS ARE CRITICAL

At least three factors make Hispanic Americans critical to U.S. technological success:

- **Workforce needs**
- **Population share**
- **Global competitiveness**

Need: The need for STEM workers continues to grow – an expected 8.8% between 2018 and 2028.[10] Three in four CEOs struggle to fill STEM jobs – a rate surpassing non-STEM jobs.[11]

As technology increasingly is infused across all sectors of the economy, the workers in most demand will have the cognitive knowledge, skills, and abilities a high-quality STEM education provides.[12] That was illustrated well by job growth during the recovery from the Great Recession. Between May 2009 and May 2015, STEM employment grew by 10.5%, compared with only 5.2% net growth in non-STEM employment.[13]

Success meeting the demand for STEM workers is a win-win-win proposition. It meets the needs of industry, provides workers higher paying jobs, and boosts local economies.[14]

The stakes are high. In a world where work can be moved across international borders, the U.S. must produce enough highly skilled workers to meet demand – or potentially lose those jobs forever. Meeting that demand depends on attracting more students into STEM career pathways – and retaining them. Changing demographics of the U.S. population and workforce mean the STEM pipeline must become more diverse.

Numbers: Hispanics are the second largest racial/ethnic group in the United States. The most recent report from the Bureau of Labor Statistics predicts Hispanics will grow from 17% of the workforce in 2017,[15] to 22.4% in 2030, and to 30.3% in 2060.[16] This means workforce diversity is more than nice – it is necessary. The future of the U.S. economy is integrally tied to the future of Hispanic Americans.

Historically, Hispanic Americans have been underrepresented in both higher education and STEM. Hispanics are 17% of the workforce but hold only 8% of STEM jobs.[17] Younger Hispanics are gaining ground, but continue to be markedly underrepresented. Hispanics may be 21% of 18-24 year olds, but they earn only 12% of Bachelor's degrees awarded and only 10% of Bachelor's degrees awarded in STEM fields.[18] Clearly, the Hispanic talent pool has not been fully tapped.

Untapped human talent is especially great among Hispanic American females. Among Hispanics earning Bachelor's degrees in STEM fields, females earn substantially fewer than males do (36% vs. 64%).[19] Since Hispanics will comprise almost one-third of the U.S. workforce in 2060, America's economic future depends on retaining more Hispanics – males *and* females – in the STEM pipeline.

Competitiveness: Diversity boosts the bottom line.[20] U.S. products compete domestically and globally for the dollars of increasingly multicultural markets.[21] With Spanish currently the second most common first language globally,[22] the bilingual skills of many in the U.S. Hispanic population may be a major asset. Cultural competency is critical as well.

Products designed by homogeneous teams may leave many consumers ill-served, fail in the marketplace, or inflict irreparable harm. Early car airbags served men well – but could injure women.[23] Virtual assistants better serve the health and safety needs of men than women.[24] Biometric security features more reliably recognize facial features of Caucasians than minorities historically absent from engineering labs.[25] AI tools designed to pick the best candidates – for jobs,[26] for release from jail,[27] to represent concepts (e.g., CEO)[28] – are biased against women and racial/ethnic groups historically underrepresented in STEM.

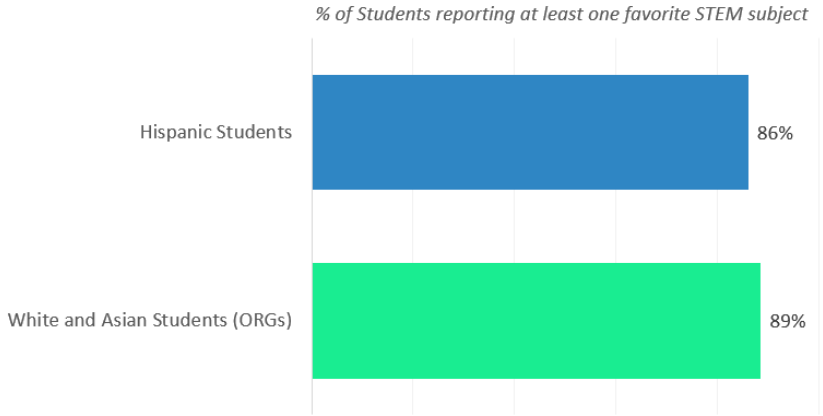
Diversity and the lived experiences of multicultural Hispanic Americans can give the USA the upper hand it needs to thrive in the competitive global tech industry. Yet the benefits of diversity can only be realized if the STEM pipeline reflects multicultural America. It does not yet.

FINDINGS

Hispanic and ORG Students Converge in STEM Attitudes and Aspirations

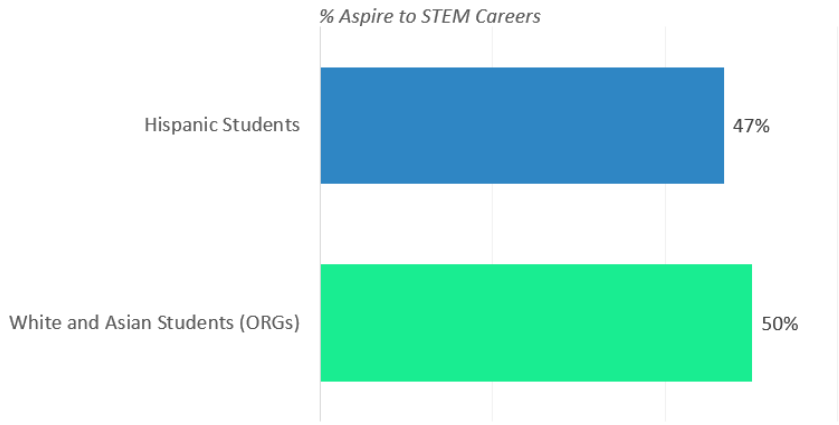
Liking STEM is a first step toward pursuing a STEM career.[29] Among high school students enrolled in STEM classes, *Hispanic students are about as likely as students from groups historically overrepresented in STEM (Whites and Asians, often referred to as ORGs) to have at least one favorite STEM subject* [Figure 1].[30]

Figure 1: Hispanic students and students from groups historically overrepresented in STEM (ORGs) overwhelmingly have favorite STEM subjects



Career aspirations are even more promising indicators of the future STEM workforce.[31] Among high school students in STEM classrooms, *Hispanics are about as likely as ORGs to aspire to STEM careers (47% vs. 50%)* [Figure 2].[32]

Figure 2: Hispanics in high school STEM classes aspire to STEM careers at levels rivaling ORGs



These similarities suggest today's Hispanic students *want* to claim their place in the future STEM workforce alongside students from groups historically overrepresented in STEM. Yet convergence in STEM interest and aspirations is no guarantee they *will succeed*. Indeed, earlier research found Hispanic and ORG high school students shared similar aspirations for a STEM career.[33] Nevertheless, Hispanics have continued to be underrepresented in STEM postsecondary education and career pathways.

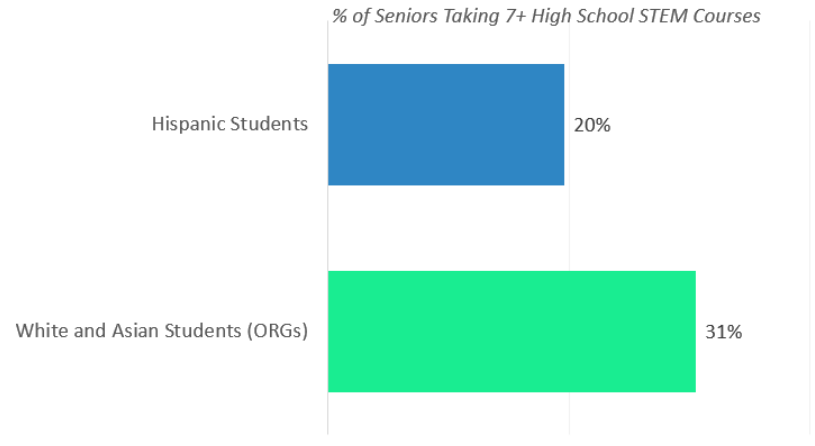
At the very least, this snapshot of students suggests Hispanic underrepresentation in STEM is likely ***not*** due to personal choice.

But the survey goes one step further. It identifies *how* Hispanic and ORG students diverge. Divergences signal challenges Hispanics encounter more often than ORGs. This knowledge can inform simple, timely interventions to level the playing field for students and, ultimately, strengthen U.S. ability to sustain its leadership internationally in science and technology.

Hispanic and ORG Students Diverge in Four Critical Ways

Divergence One: Hispanic students complete fewer STEM courses than ORG students. High school STEM courses are the foundation for postsecondary STEM coursework. Among seniors surveyed, fewer Hispanic than ORG students reported they had taken seven or more high school STEM courses (20% vs. 31%) [Figure 3].[34]

Figure 3: By Senior year, Hispanics students are less likely to have taken 7+ high school STEM courses



This preparation gap can be a major hurdle for Hispanics who aspire to STEM careers. Fewer high school STEM courses make it more difficult for students to be accepted into postsecondary STEM programs, and if accepted, to survive weed-out courses common in the early years.[35]

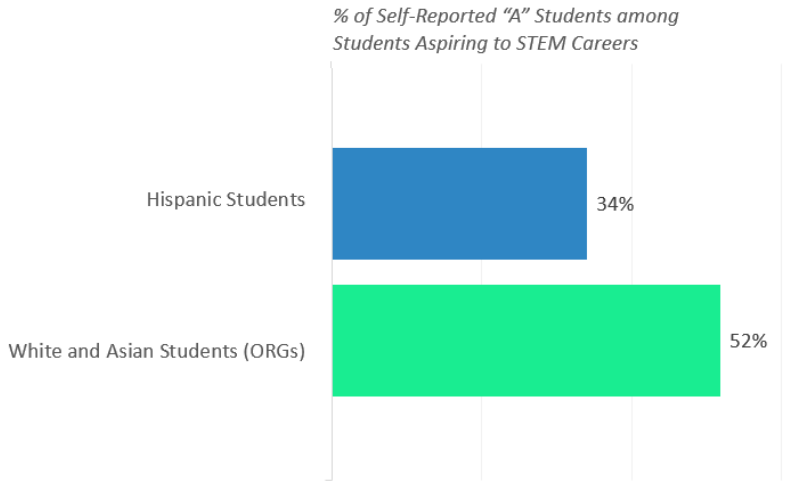
Students often have no choice. Fewer Hispanic than White/Asian students have access to high-level math and science courses.[36] When they do have access, micro-messaging may discourage Hispanic students from taking these classes or feeling they belong.[37] Fewer connections to adults with STEM-related social and cultural capital[38] can mean too few Hispanic students realize – until it is too late – how important it is to prepare with a solid foundation of challenging high school STEM courses.[39]

The playing field that previously seemed relatively level based on student attitudes about STEM subjects and career aspirations appears less level after considering divergence in academic preparation for postsecondary STEM pursuits.

Divergence Two: Hispanic students have lower GPAs than ORG students. Hispanics and their ORG (White/Asian) peers may share similar levels of interest in STEM subjects and STEM careers. But similar attitudes may yield divergent outcomes unless Hispanic students can overcome the achievement gap – represented in this analysis by a GPA gap.

Among STEM Career aspirants, fewer Hispanic than ORG students report being "A" students (34% vs. 52%) [Figure 4].[40]

Figure 4: Among STEM career aspirants, fewer Hispanic students are self-reported "A" students



This pattern persists even among STEM career aspirants who have completed 7+ STEM classes (71% vs. 54%, graph not shown).

This evidence of a GPA-gap is consistent with previous research showing Hispanics score lower on PISA mathematics and science literacy scales and are less likely to pass STEM AP tests than ORG peers.[41]

A level playing field for Hispanic and ORG students requires closing the GPA-gap and the broader achievement gap it represents. That means overcoming **three factors.**

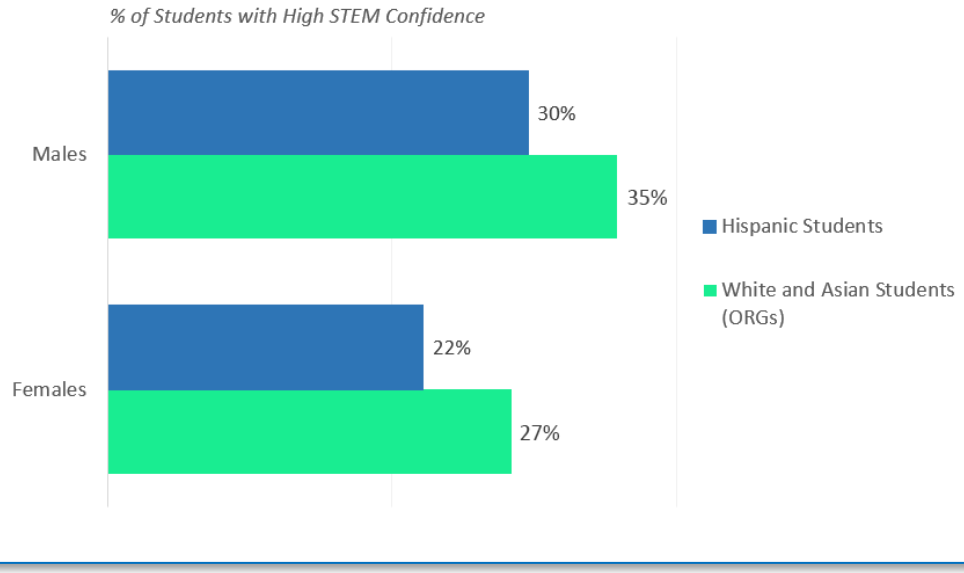
- **Structural inequalities**: Hispanic students on average are more likely than ORG students to attend under-resourced schools.[42]
- **Lower school-relevant social/ cultural/ economic capital:** Hispanic students on average come from families with more language barriers,[43] lower incomes,[44] more issues with legal status,[45] and fewer connections to STEM professional networks. These obstacles affect everything from the ability to successfully complete homework (due to lower rates of in-home broadband access,[46] parents less able to help with homework, and families less able to pay for tutors),[47] to less willingness to access community resources (due to fear), to less communication between schools and parents (due to multiple reasons ranging from work schedules, to costs, to language barriers), [48] and to less informal access to culturally-competent STEM mentors. Indeed, Hispanics are underrepresented in the classroom – comprising only nine percent of teachers compared with 16 percent of the population age 20 or older.[49]
- **Obstacles to higher education**: Limited access to higher education could reduce academic motivation. Hispanics have lower incomes than do ORGs, making college less affordable.[50] Undocumented students are not guaranteed access to higher education under U.S. law. That makes postsecondary education inaccessible in many states.[51] Even Hispanic students who are U.S. citizens may be reluctant to apply for the government-related financial aid, lest they expose undocumented family members.[52] To the extent Hispanic students' dreams of postsecondary education are limited by the realities of their lives, motivation to compete fiercely for As may be limited.

Closing the achievement gap could help level the playing field so more Hispanic students leave high school better positioned to pursue STEM career aspirations. This will be particularly important as challenges to affirmative action increase.

Divergence Three: Hispanic students have lower STEM confidence than ORG students. STEM confidence matters. Students with high STEM confidence are more likely to aspire to STEM careers[53] and to persist in math and science.[54] Some suggest high STEM confidence is a "protective factor," giving students the grit to persevere despite adversity.[55] Its potential as a protective factor makes it especially important for Hispanic students given the preparation and achievement gaps identified earlier.

However, the potential for STEM confidence to act as a protective factor for Hispanics is limited by a confidence gap. Fewer Hispanic than ORG (White/Asian) students have high STEM confidence (26% vs. 31%).

Figure 5: High STEM confidence is most common among ORG males and least common among Hispanic females

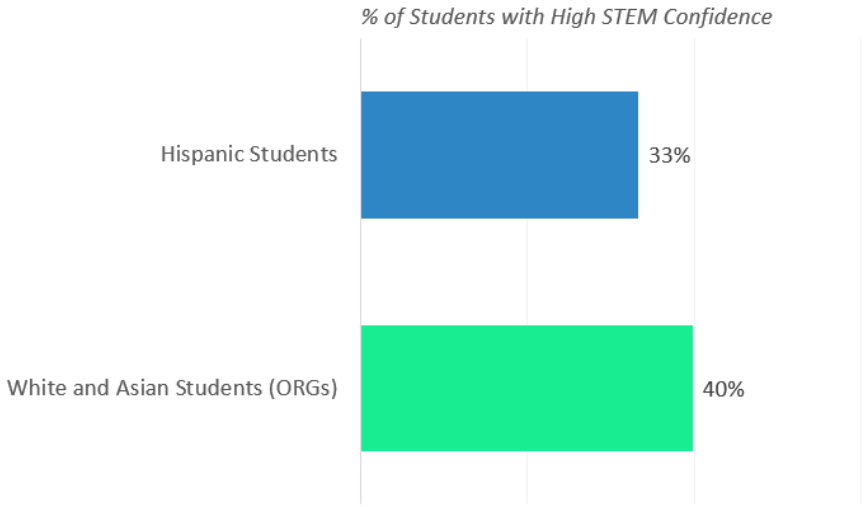


Race/ethnicity and gender combine to affect STEM confidence [Figure 5].[56] Hispanic females are least likely to have high STEM confidence (22%); in contrast, males from groups historically overrepresented in STEM are most likely to have high STEM confidence (35%).

Hispanics continue to be less likely than ORGs to have high STEM confidence among:

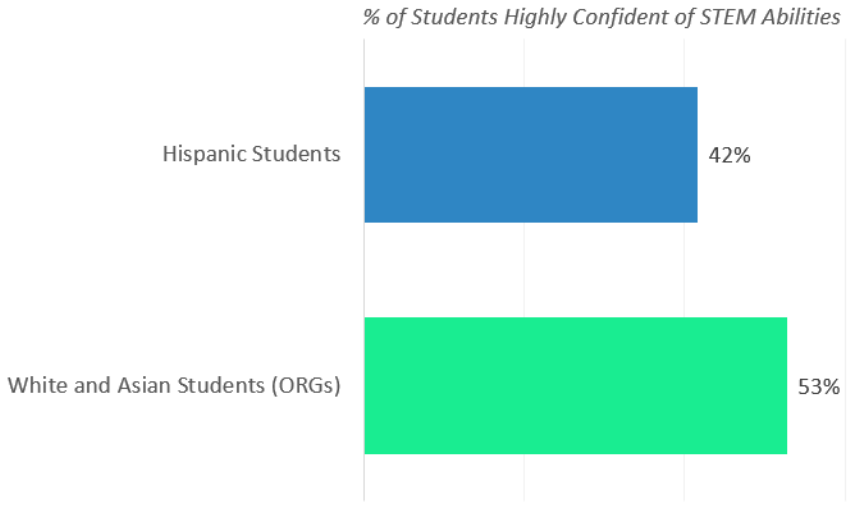
- STEM career aspirants. [Figure 6]
- Seniors with 7+ STEM courses. [Figure 7]

Figure 6: The confidence gap persists among students with STEM aspirations



Small, subtle messages – micro-messages – can depress STEM confidence among women, discouraging females from aspiring to STEM careers and encouraging women's exit from the STEM pipeline.[57] It is likely that micro-messaging rooted in xenophobia[58] may similarly depress STEM confidence among racial/ethnic groups historically underrepresented in STEM. Such micro-messages could deprive Hispanic students of a protective factor that would otherwise mitigate preparation gaps and achievement gaps discussed earlier, making it harder for Hispanics' and ORGs' STEM aspirations to be converted at comparable rates into STEM careers in adulthood.[59]

Figure 7: The confidence gap is greater among Seniors who have taken 7+ STEM courses

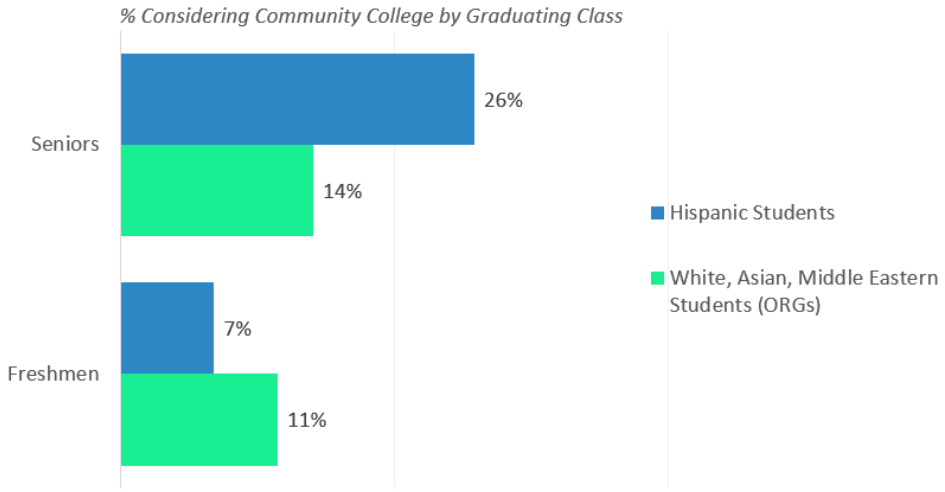


Divergence Four: Hispanic and ORG students chart different postsecondary educational paths. Among high school seniors aspiring to STEM, Hispanic students are almost twice as likely as ORG students to consider attending community college (26% vs. 14%). However, this is a striking contrast with the plans of high school freshmen.

As freshmen, Hispanic students are slightly ***less*** likely than ORGs to aspire to attend community colleges. But as graduation approaches, Hispanic students grow dramatically ***more*** likely to consider the community college option [Figure 8].[60]

The reason for the apparent evolution is unclear. Nevertheless, Hispanic students' growing interest in community colleges throughout high school is consistent with previous research showing community colleges are key to serving Hispanic students aspiring to STEM careers.[61] With adequate resourcing, the community college option *may* level the playing field for Hispanic students who aspire to STEM.

Figure 8: Among students aspiring to STEM careers, Hispanics' (but not ORGs') plans to attend community college increase dramatically between freshman and senior years



Yet the stakes extend beyond the Hispanic community and today's Hispanic high school students. If community colleges provide opportunities that level the playing field for Hispanic students, enabling them to realize their personal STEM aspirations, we all benefit.

Access to human resources to meet the tech industry's needs will be less subject to the vicissitudes of government policy and immigration preferences of international talent. Moreover, the U.S. will be better positioned to deploy its domestic diversity to maintain leadership in today's multicultural, global, tech-driven economy.

CONCLUSION: CALL TO ACTION

Hispanic high school students like STEM subjects and aspire to STEM careers. Their interest rivals that of students from groups historically overrepresented in STEM. Hispanic underrepresentation in STEM probably is not due to personal preferences.

Something seems to happen between classroom and career. SRF's 2017-18 academic year survey of students in STEM classrooms nationwide suggests students who share positive attitudes toward STEM subjects and STEM careers – but differ on race/ethnicity – diverge on four factors likely to affect STEM career outcomes: preparation for postsecondary education, academic achievement, STEM confidence, and preferred secondary education paths.

Data collected from high school students in STEM classrooms provide evidence-based insights to tailor interventions to maximize Hispanic presence in the STEM pipeline of the future – and strengthen U.S. competitiveness globally.

Appendix C examines gender differences and similarities that may provide critical insights to better tailor interventions to the sometimes-distinct needs of males and females.

Suggested actions based on the evidence presented in this report are:

- ***Continue efforts to raise Hispanics' interest in STEM.*** Interventions will affect the STEM pipeline only if Hispanic students' positive STEM attitudes and aspirations continue to rival or even exceed those of students from groups historically overrepresented in STEM.
- ***Ensure STEM equity regardless of zip code.*** Interventions are needed to ensure all schools provide a high-quality STEM curriculum. Once available, additional interventions may also be needed to ensure Hispanics and ORGs enroll in rigorous STEM courses at comparable rates.
- ***Boost academic achievement of Hispanic students.*** Lower GPAs and STEM test scores could complicate the path to a more diverse STEM pipeline. Policymakers and communities need to work together to identify culturally-compatible interventions

that address a range of inequalities – e.g., home access to the Internet, bias in assessments, access to tutoring and mentoring.

- ***Increase STEM confidence.*** Hispanics are least likely of the racial/ethnic groups studied to have high STEM confidence. Hispanic females are particularly low. Concerted efforts to implement evidence-based interventions that boost confidence (e.g., encouragement from teachers) may be especially important to retain Hispanic females in the STEM pipeline.
- ***Support postsecondary education across the spectrum.*** Sustaining and expanding support of community colleges is critical for retaining Hispanic students in the STEM pipeline. The strength of community colleges may determine whether the STEM pipeline of the future draws on the talents of all segments of the workforce or continues to rely disproportionately on those historically overrepresented in STEM.

Gen Z Hispanics want to enter the STEM pipeline at rates comparable to peers from groups historically overrepresented in STEM. Evidence-based, culturally competent interventions should not only enhance opportunities of individual Hispanic students and the Hispanic community, but also benefit every American by better positioning the U.S. to maintain leadership in STEM fields amidst dramatic demographic and market changes.

Appendix A: Research Design

Today's high school students in STEM classrooms provide insight into tomorrow's STEM pipeline. STEM career aspirations of youth predict adult career outcomes. High school courses often determine which students will have the academic foundation to pursue STEM careers.

That makes insights from the 16K+ high school students responding to SRF's survey invaluable to shaping evidence-based strategies to strengthen the STEM pipeline.

Surveys were sent to STEM teachers nationwide. Student respondents completed the survey in class. The results are a snapshot of students' interests and aspirations in the 2017-18 academic year.

The snapshot can identify ways Hispanic American students diverge from peers in groups historically overrepresented in STEM (ORGs). Such divergences may be early signals of systematic challenges students will encounter in pursuing their STEM aspirations. These signals can identify opportunities for effective interventions which will help retain more Hispanic American students in the STEM pipeline, cultivate a STEM workforce mirroring the U.S. population, and continue America's leadership in science and technology.

Appendix B: Definition of STEM Fields

SRF's definition of STEM majors/careers align with that of the Bureau of Labor Statistics. The majors/ careers from the SRF surveys classified as STEM are:

Agriculture
Accounting Technology
Animal Science
Animation
Mobile Technician
Architecture
Astronomy
Automotive / Truck Technology
Aviation / Airline Industry
Biological Sciences
Biomedical Engineering Technology
Biomedical Engineering Tech
CAD Operator
Chemistry
Coding
Computer Programming
Computer Aided Design
Computer Aided Drafting
Computer Network Engineering
Computer Network Mgt / Network Admin (CNA)
Computer Network Technology
Computer Repair
Computer Science
Computer & Info Science & Engineering (CISE)
Computer Technician
Computer Technology
Cybersecurity
Data Science/Business Analytics
Earth Science / Geosciences
Ecommerce
Electrician
Electronics
Electronics & Computer Engineering Tech
Electronics Technician
Engineering
Environmental / Eco Studies
Exercise Science
Forensic Science
Forestry
Game Design
Game Art & Design
Game Software Development
Health Information Technology
Information Technology
Internet / E-Commerce Tech
Internet Information Systems
Manufacturing
Materials Research
Mathematics
Mechanical Drafting
Military Science
Network System Support
Network Technology
Oceanography / Marine Science
Physics
Plumbing / HVAC
Robotics
Science
Small Engine Technology
Sustainability Management / Green Jobs
Telecommunications
Web Design
Wildlife Management

Appendix C: Re-examining Prospects for Equity Through a Gendered Lens

This report began as a project exploring the opportunities to increase the presence of Hispanics in the ranks of STEM professionals. Yet females and males who share racial/ethnic identities often face different challenges in many endeavors.

Identifying the impact of *intersectionality* of race, ethnicity and gender on prospects for STEM equity is a critical component of the effort to ensure our nation and the sector benefit from diversity.

Overall, the report's conclusions regarding racial/ethnic similarities and differences hold when males and females are analyzed separately. However, if gender gaps belie racial/ethnic similarities and differences, but are ignored, gains in diversity will have been only partially successful in achieving their goals.

Therefore, analysis presented in this appendix goes step-by-step through the key conclusions of the report, discussing, and when appropriate displaying, data that speak to intersectionality.

Convergences between Hispanics and ORGs

Favorite STEM Subjects

Liking STEM is an important step toward retaining students in the STEM pipeline. Analysis presented earlier in the report shows Hispanic and ORG (Asian/White) students share substantially similar fondness for STEM subjects.

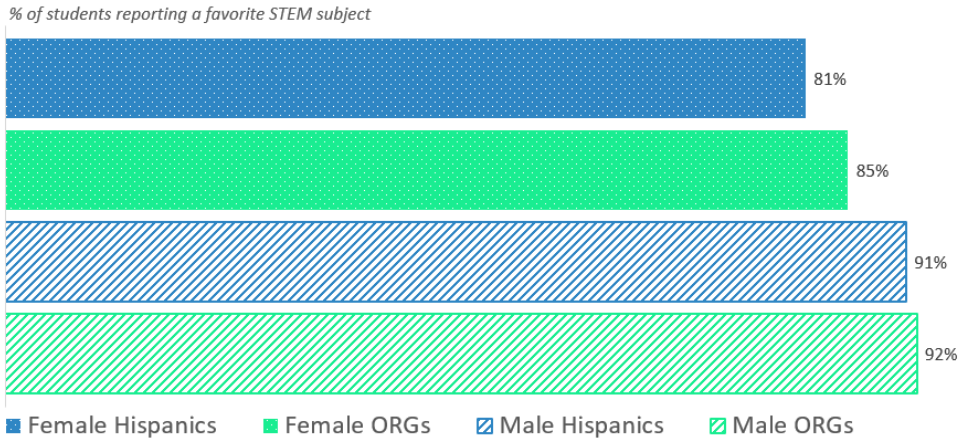
This same pattern holds when males and females are analyzed separately. [Figure A1]

However, within racial/ethnic groups, girls are less likely than boys to have at least one favorite STEM subject [Figure A1].

- The gender gap among Hispanics is 10 points.
- The gender gap among ORGs is 7 points.

Without specific strategies to increase appeal of STEM subjects among girls, steps to increase racial/ethnic diversity could nevertheless leave girls behind.

Figure A1: Hispanic students and students from groups historically overrepresented in STEM (ORGs) overwhelmingly have a favorite STEM subject. Yet within both racial/ethnic groups, males more often have a favorite.



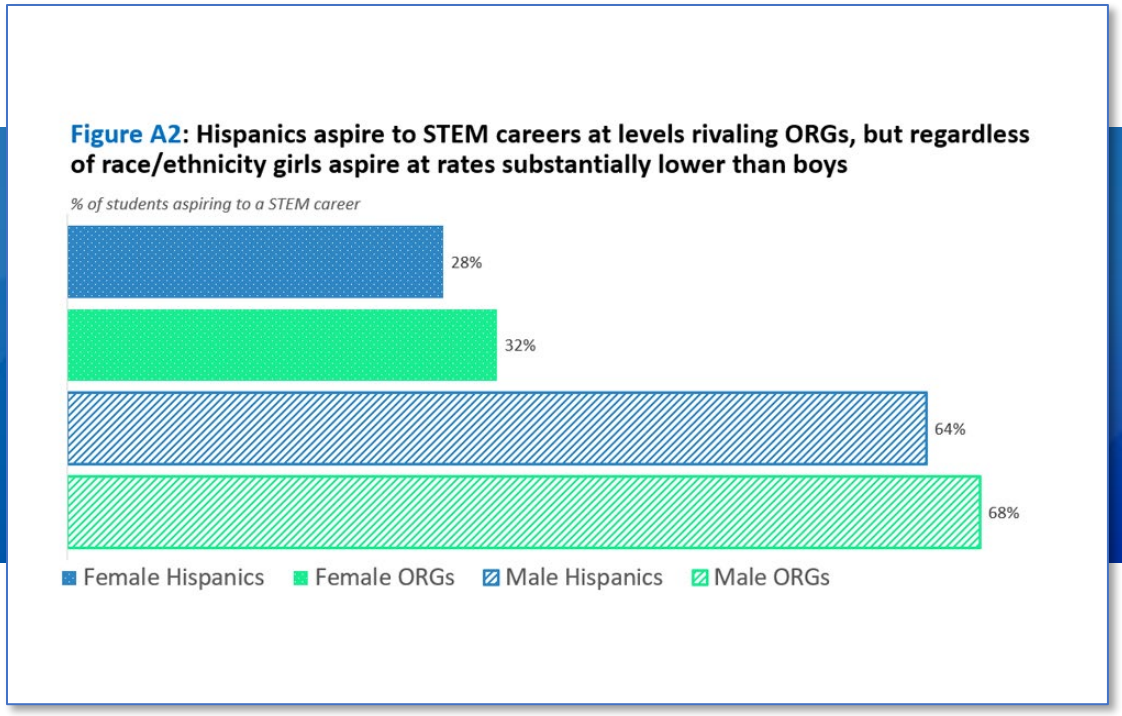
Aspirations for STEM Careers

Talk about the STEM pipeline is ultimately about expanding the talent pool and filling STEM jobs.

Hispanic underrepresentation in STEM not only means they are an underutilized talent pool from which the best and brightest may be recruited. It also means underrepresentation in STEM's high-paying fields perpetuates economic inequality and increases the potential that STEM products may unintentionally perpetuate bias and reduce prospects for social justice.

Results presented earlier showed Hispanic and ORG students in high school STEM classrooms expressed similar levels of aspiration to pursue STEM careers. This pattern holds among males and among females when they are analyzed separately [Figure A2].

However, racial/ethnic equity in the STEM talent pool may still fail to achieve the benefits of diversity. Whether the focus is Hispanics or ORGs, girls are *36 points less likely* than boys to aspire to a STEM career.



Without specific strategies to increase interest in STEM careers among *Hispanic girls*, increased representation of Hispanics in the STEM talent pool may fall short of realizing the promises of diversity. While the gender gaps are comparable among ORGs and Hispanics, interventions to close the gender gap must consider the possibility that solutions to attract more girls into STEM fields may need to be culturally competent.

Divergences between Hispanics and ORGs

STEM Courses

A solid foundation of STEM courses at the high school level determines whether students are prepared to pursue post-secondary work required for securing a STEM degree or a STEM career.

Whether male or female, Hispanics are less likely than ORGs to have taken 7+ STEM courses by senior year [Figure A3]. There are no substantial gender differences in the number of STEM courses.

GPA

Data presented earlier in the report showed Hispanics were *less likely* than ORGs to report they are "A" students.

However, girls tend to have higher GPAs than boys – whether the focus is on Hispanics or on ORGs. [Figure A4]

Figure A3: Regardless of gender, Hispanic seniors are less likely than ORG seniors to report 7+ STEM classes in high school

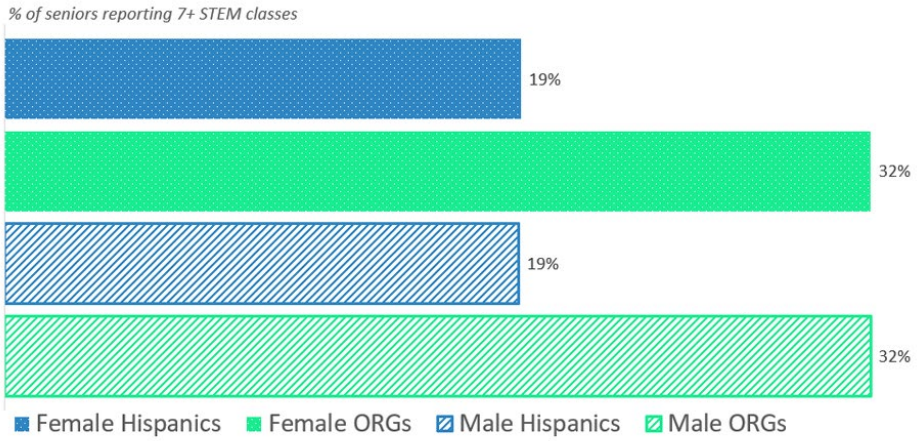
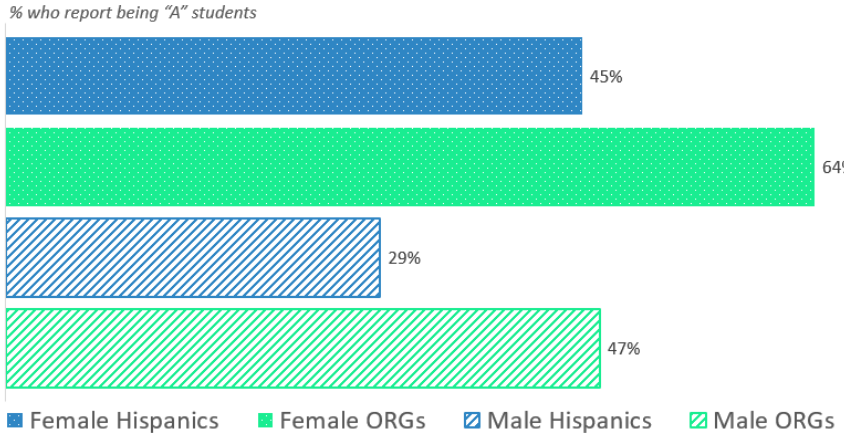
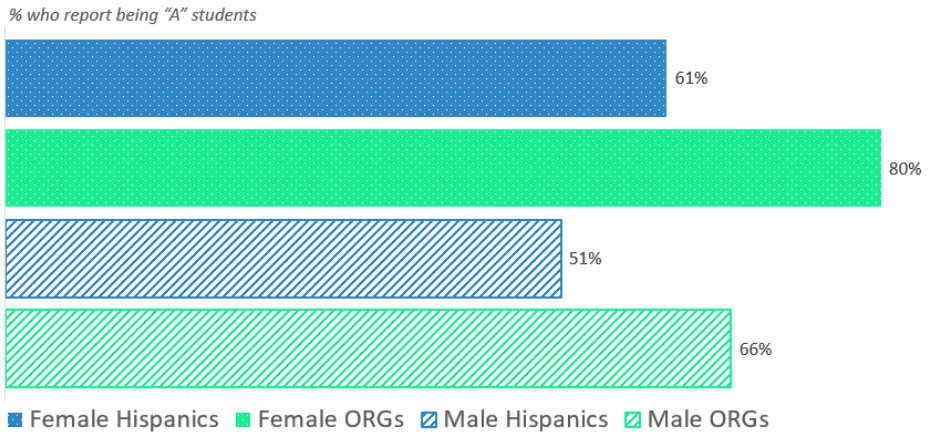


Figure A4: Among STEM career aspirants, girls have higher GPAs than boys of same race/ethnicity



This trend holds within racial/ethnic groups overall, among STEM aspirants, and among STEM aspirants who have taken 7+ STEM courses [Figure A5].

Figure A5: Among STEM career aspirants who have taken 7+ STEM courses, girls are more likely than boys of same race/ethnicity to be "A" students



The sizeable gender gaps may be important factors to consider in shaping interventions to better support Hispanic students in achieving equity in STEM fields.

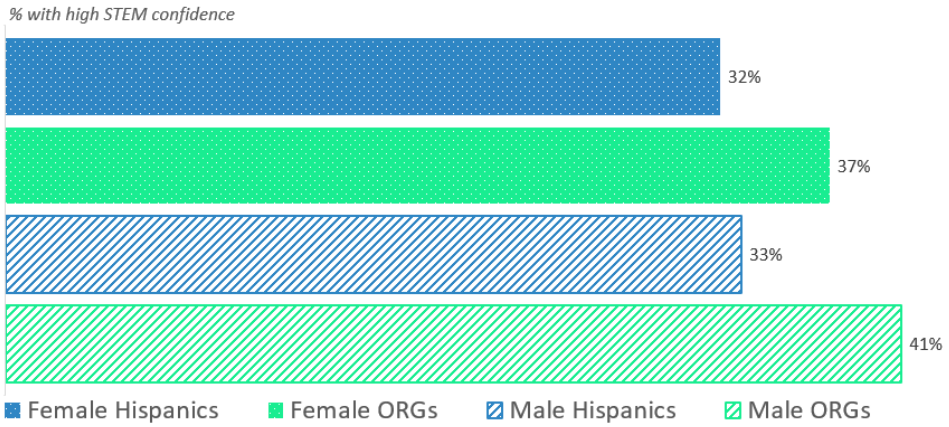
STEM Confidence

Some assert STEM confidence is a protective factor – helping students persevere in the face of inevitable challenges. As noted earlier in the report, Hispanics are *less likely* than ORGs to score high on STEM confidence – and thus benefit from this protective factor.

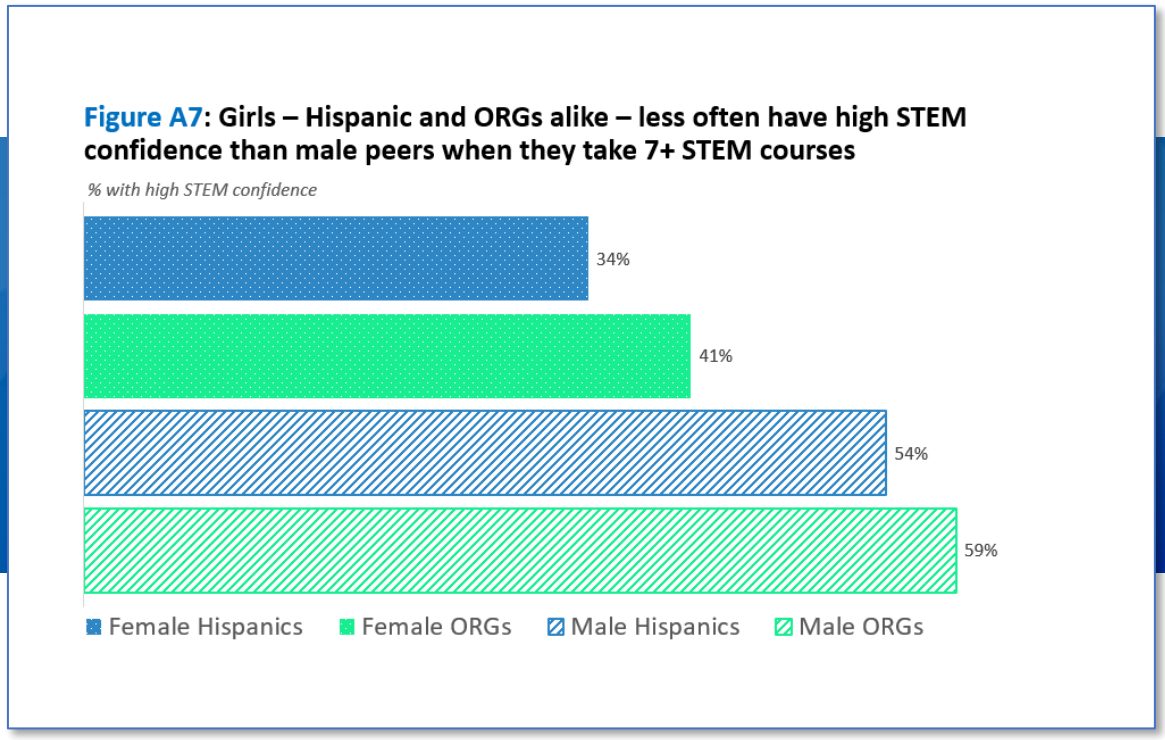
Earlier in the report we showed gender matters. Among Hispanics, as among ORGs, girls lag boys by 8 points in high STEM confidence. (This holds even though girls are more likely than boys to be "A" students.) The intersection of race/ethnicity and gender leaves Hispanic girls least likely of the four subgroups to score high on STEM confidence. [See Figure 5, main body of report]

However, the gender gap among Hispanics narrows from 8 points to only 1 point among those with STEM aspirations. Hispanic girls with lower confidence appear to reject STEM careers at higher rates than male peers. [Figure A6]

Figure A6: The gender gap in STEM confidence narrows among students aspiring to STEM careers – but male and female Hispanics still lag ORGs in confidence



Taking 7+ STEM classes is associated with greater STEM confidence among both Hispanic girls and ORG girls. However, 7+ STEM classes is associated with an even higher boost in confidence among males [Figure A7].



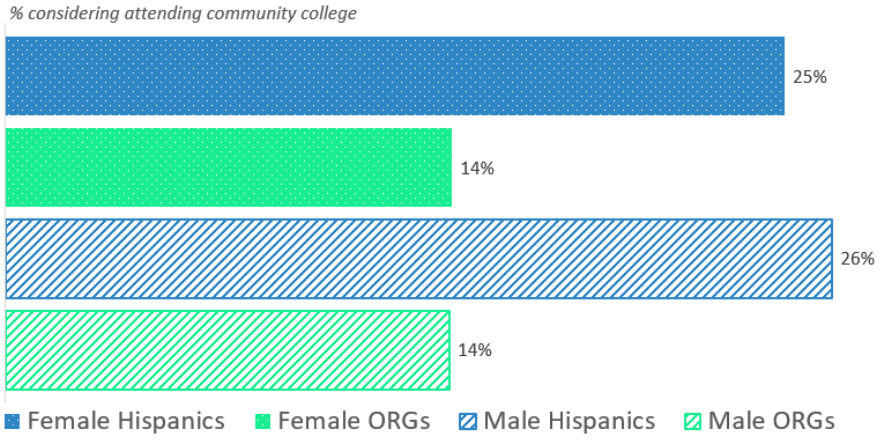
The result: gender gaps in STEM confidence of 20 and 18 points, respectively among Hispanics and ORGs (Asians/Whites) with 7+ STEM courses. The differential impact of more courses may be important to bear in mind to design interventions that work equally well for Hispanic girls and boys.

Community College Aspirations

As noted earlier in the report, Community Colleges are particularly important to Hispanic students. Among Seniors aspiring to STEM careers these same racial/ethnic differences hold among male and among female students [Figure A8].

Their shared interest is likely driven by similar factors associated with race/ethnicity. Those may include financial resources, academic records, and quality of the STEM curriculum at the high school level.

Figure A8: Among Seniors aspiring to STEM careers, male *and* female Hispanics are more likely than ORG peers to consider community college



Notes

[1] See https://www.bls.gov/emp/tables/stem-employment.htm. Table 1.11 Employment in STEM occupations, 2018 and projected 2028.
[2] See https://www.bls.gov/emp/tables/stem-employment.htm. Table 1.11 Employment in STEM occupations, 2018 and projected 2028.
[3] See https://www.bls.gov/emp/tables/stem-employment.htm. Table 1.2 Employment by detailed occupation, 2018 and projected 2028.
[4] See https://www.bls.gov/emp/tables/stem-employment.htm. Table 1.11 Employment in STEM occupations, 2018 and projected 2028.
[5] See 2017 CareerBuilder Survey. https://www.businessnewsdaily.com/6038-skills-gaps-cost-companies-thousands.html.
[6] See http://press.careerbuilder.com/2016-03-02-New-CareerBuilder-and-Emsi-Analysis-Finds-College-Degrees-Are-Not-Keeping-Up-With-Demand-in-Critical-Areas.
[7] Comparisons of post-secondary degree completions against monthly job postings and job hires show colleges ***currently*** produce too few graduates with in-demand skills. The result? Thousands of STEM jobs remain vacant each month – e.g., 480,650 computer and information science positions vacant, 38,299 engineering positions vacant, and 13,980 positions requiring biology degrees vacant. See http://press.careerbuilder.com/2016-03-02-New-CareerBuilder-and-Emsi-Analysis-Finds-College-Degrees-Are-Not-Keeping-Up-With-Demand-in-Critical-Areas
[8] de Brey, C., Musu, L., McFarland, J., Wilkinson-Flicker, S., Diliberti, M., Zhang, A., Branstetter, C., and Wang, X. (2019). Status and Trends in the Education of Racial and Ethnic Groups 2018 (NCES 2019-038). U.S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved October 10, 2019 from https://nces.ed.gov/ pubsearch/.
[9] See https://www.bls.gov/cps/cpsaat11.htm. Statistics are based on aggregation of three summary categories in the Current Population Survey: computer and mathematical occupations, architecture and engineering occupations, and life, physical, and social science occupations. These categories provide a close approximation to categories classified by the Bureau of Labor Statistics as STEM occupations. The calculation includes social scientist (which is not defined as a STEM occupation by the BLS) and does not include managerial roles and postsecondary STEM teachers who are defined by BLS as STEM professionals.
[10] https://www.bls.gov/emp/tables/stem-employment.htm. This is dramatically higher than the 5% growth expected in non-STEM sectors.
[11] http://fortune.com/2018/06/22/business-roundtable-jamie-dimon-worker-training/.
[12] U.S. Department of Education, Office of Innovation and Improvement. (2016). STEM 2026: A Vision for Innovation in STEM Education. Washington, DC.
[13] Stella Fayer, Alan Lacey, and Audrey Watson. "STEM Occupations: Past, Present, and Future." Spotlight on Statistics, January 2017.
[14] Indeed, in 2017 STEM jobs paid almost twice as much as non-STEM jobs. See www.vitalsigns.ecs.org/state/united-states/demand based on Economic Modeling Specialists, 2017. Also see http://www.modernwellnessguide.com/news/how-to-engage-latinos-to-diversify-the-stem-workforce.
[15] https://www.bls.gov/opub/reports/race-and-ethnicity/2017/pdf/home.pdf
[16] Bureau of Labor Statistics, https://www.bls.gov/spotlight/2016/a-look-at-the-future-of-the-us-labor-force-to-2060/home.htm
[17] See https://www.bls.gov/cps/cpsaat11.htm. Statistics are based on aggregation of three summary categories in the Current Population Survey: computer and mathematical occupations, architecture and engineering occupations, and life, physical, and social science occupations. These categories provide a close approximation to categories classified by the Bureau of Labor Statistics as STEM occupations. The calculation includes social scientist (which is not defined as a STEM occupation by the BLS) and does not include managerial roles and postsecondary STEM teachers who are defined by BLS as STEM professionals.
[18] http://www.pewsocialtrends.org/2018/01/09/diversity-in-the-stem-workforce-varies-widely-across-jobs/
[19] https://nces.ed.gov/pubs2017/2017051.pdf
[20] Geoffrey Precourt and Stephen Whiteside, (2017), ANA Multicultural Marketing and Diversity Conference.

[21] Neilsen, (2015) *The Multicultural Edge: Rising Super Consumers;* WARC News, (2016) "Asian American Spending to Top $1Tr." Also see Geoffrey Precourt and Stephen Whiteside, (2017), ANA Multicultural Marketing and Diversity Conference.
[22] https://www.babbel.com/en/magazine/how-many-people-speak-spanish-and-where-is-it-spoken/
[23] https://www.baltimoresun.com/news/bs-xpm-1996-11-07-1996312009-story.html
[24] Susan Leavy, (2018) "Gender Bias in Artificial Intelligence: The Need for Diversity and Gender Theory in Machine Learning." GE'18, Gothenburg, Sweden. ACM ISBN 978-1-4503-5738-8/18/05. See https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing
[25] https://www.nytimes.com/2018/02/09/technology/facial-recognition-race-artificial-intelligence.html
[26] http://fortune.com/2018/10/10/amazon-ai-recruitment-bias-women-sexist/
[27] https://www.weforum.org/agenda/2018/11/algorithms-court-criminals-jail-time-fair/; also see Han-Wei Liu, Ching-Fu Lin, Yu-Jie Chen; Beyond *State v Loomis*: artificial intelligence, government algorithmization and accountability, *International Journal of Law and Information Technology*, , eaz001, https://doi.org/10.1093/ijlit/eaz001
[28] https://www.newscientist.com/article/2166207-discriminating-algorithms-5-times-ai-showed-prejudice/
[29] Maltese, A. V., & Tai, R. H. (2011). Pipeline persistence: Examining the association of educational experiences with earned degrees in STEM among U.S. students. Science Education, 95, 877-907.
[30] Hispanics are about as likely as ORGs to have favorite STEM subjects among girls as well as among boys. However, the girls are less likely than boys of the same racial/ethnic group to have a favorite STEM subject. The gender gap is seven points among ORGs and ten points among Hispanics.
[31] Archer, L., Dewitt, J., Osborne, J., Dillon, J., Willis, B., & Wong, B. (2010). "Doing" science versus "being" a scientist: Examining 10/11-year-old schoolchildren's constructions of science through the lens of identity. Science Education, 94(4), 617 – 639.
[32] This pattern holds among females and among males. However, regardless of racial/ethnic group, girls are substantially less likely than boys to aspire to STEM careers. A 35-point gender gap in aspirations occurs among Hispanics and among ORGs.
[33] Riegle-Crumb, C., Moore, C., & Ramos-Wada, A. (2011). Who wants to have a career in science or math? Exploring adolescents' future aspirations by gender and race/ethnicity. Science Education, 95(3), 458 – 476. Also see Anderson, E., & Kim, D. (2006). Increasing the success of minority students in science and technology. Washington, DC: American Council of Education; Hanson, S. L. (2006). African American women in science: Experiences from high school through the postsecondary years and beyond. In J. Bystydzienski & S. Bird (Eds.), Removing barriers: Women in academic science, technology, engineering, and mathematics. Bloomington: Indiana University Press.
[34] This racial/ethnic disparity holds among males as well as females.
[35] The National Center for Educational Statistics confirms the relative disadvantage of Hispanics based on analysis of transcripts. NCES finds that by graduation, fewer Hispanics than ORGs have taken calculus, AP science, or AP math. In addition, that analysis like this, finds Hispanics graduate high school with relatively fewer STEM course credits than do ORGs. However, the absolute number of STEM courses reported is lower among all groups of students when self-reported than when transcripts are analyzed. https://nces.ed.gov/pubs2017/2017051.pdf. Hispanic students are less likely to take holds regardless of SES. National Science Board (2018), Science and Engineering Indicators 2018.
[36] See National Science Board (2018), Science and Engineering Indicators 2018.
[37] See examples of how conscious efforts to reduce micro-messaging through teacher training can boost STEM performance: https://www.austinisd.org/sites/default/files/dre-surveys/NAPE_2015-2016_final.pdf
[38] For example, Hispanic girls are less likely than White girls to know an adult in a STEM career, have a parent employed in a STEM field, or turn to their parents for career advice. See Girl Scout Research Institute (2012) Generation STEM: What Girls Say about Science, Technology, Engineering, and Math.
[39] Granted some STEM fields may be open to those without a solid foundation of high school coursework; however, switching from a non-STEM to STEM career pathway can be extremely difficult after high school. See Maltese, A. V., & Tai, R. H. (2011). Pipeline persistence: Examining the association of educational experiences with earned degrees in STEM among U.S. students. Science Education, 95, 877 – 907; Syed, M., Azmitia, M., & Cooper, C. R. (2011). Identity and academic success among underrepresented ethnic minorities: An interdisciplinary review

and integration. Journal of Social Issues, 67(3), 442 – 468; Tai, R. H., Liu, C. Q., Maltese, A. V., & Fan, X. (2006). Planning early for careers in science. Science, 312, 1143 – 1144.

[40] This pattern holds among females as well as among males. However, girls are more likely than boys of the same racial/ethnic group to report they are "A" students.

[41] See National Science Board (2018), Science and Engineering Indicators 2018.

[42] See National Science Board (2018), Science and Engineering Indicators 2018, pg. 1-80. Conclusions based differences in access to high level math and science courses.

[43] In 2015, 47.9% of the Hispanic adult population was foreign born. Foreign born Hispanics are less likely to speak English very well (34.6%). http://www.pewhispanic.org/2017/09/18/facts-on-u-s-latinos/#share-foreign-born

[44] Hispanic personal earnings in 2015 averaged $24,000 compared with $35,000 for non-Hispanic Whites and $38,000 for non-Hispanic Asians. www.pewhispanic.org/2017/09/18/facts-on-u-s-latinos-trend-data.

[45] Kalina M. Brabeck, Erin Sibley, and M. Brinton Lykes (2016) "Authorized and Unauthorized Immigrant Parents: The Impact of Legal Vulnerability on Family Contexts."

[46] While 10% of white families with school aged children lack at-home access to high-speed internet, that rises to 23% for Hispanic families. See http://www.pewresearch.org/fact-tank/2018/10/26/nearly-one-in-five-teens-cant-always-finish-their-homework-because-of-the-digital-divide/

[47] eMarketer. (n.d.). Internet usage penetration in the United States from 2016 to 2021, by ethnicity. In Statista - The Statistics Portal.

[48] Jamie D. Alexander, Ronald B. Cox Jr., Andrew Behnke, and Robert E. Larzelere (2017) "Is All Parental "Noninvolvement" Equal? Barriers to Involvement and Their Relationship to Latino Academic Achievement. Hispanic Journal of Behavioral Sciences 2017, Vol. 39(2) 169 –179.

[49] https://www.edweek.org/ew/articles/2017/08/15/the-nations-teaching-force-is-still-mostly.html; https://www.bls.gov/opub/reports/race-and-ethnicity/2017/pdf/home.pdf .

[50] Hispanic personal earnings in 2015 averaged $24,000 compared with $35,000 for non-Hispanic Whites and $38,000 for non-Hispanic Asians. www.pewhispanic.org/2017/09/18/facts-on-u-s-latinos-trend-data.

[51] See Andorra Bruno (2010) *Unauthorized Alien Students: Issues and "DREAM Act" Legislation*. Congressional Research Service. Also see Neeta Kantamneni, Kavitha Dharmalingam, Jessica M. Tate, Beth L. Perlman, Chaitasi R. Majmudar, and Nichole Shada (2016) "DREAMing Big: Understanding the Current Context of Academic and Career Decision-Making for Undocumented Students." Journal of Career Development, Vol. 43(6) 483-497.

[52] For explanation of challenges facing students with undocumented parents see: https://studentloanhero.com/featured/financial-aid-for-immigrants-obstacles-affect/; also see Andorra Bruno (2010) *Unauthorized Alien Students: Issues and "DREAM Act" Legislation*. Congressional Research Service.

[53] Lori Andersen and Thomas J. Ward (2014) "Expectancy-Value Models for the STEM Persistence Plans of Ninth-Grade, High-Ability Students: A Comparison Between Black, Hispanic, and White Students," Science Education, Vol. 98, No. 2, pp. 216–242.

[54] For review of the literature see Lori Andersen and Thomas J. Ward (2014) "Expectancy-Value Models for the STEM Persistence Plans of Ninth-Grade, High-Ability Students: A Comparison Between Black, Hispanic, and White Students," Science Education, Vol. 98, No. 2, pp. 216–242. Also see Jessica J. Gottlieb (2018) "STEM career aspirations in Black, Hispanic, and White ninth-grade students." J Res Sci Teach. 55:1365-1392; Bandura, A., Barbaranelli, C., Caprara, G. V., & Pastorelli, C. (2001). Self-efficacy beliefs as shapers of children's aspirations and career trajectories. Child Development, 72: 187 – 206; Eccles, J. S. (2005). Studying gender and ethnic differences in participation in math, physical science, and information technology. New Directions for Child and Adolescent Development, (110), 7 – 14; Simpkins, S. D., Davis-Kean, P. E., and Eccles, J. S. (2006). Math and science motivation: A longitudinal examination of the links between choices and beliefs. Developmental Psychology, 42, 70 – 83; Mau, W. C. (2003). Factors that influence persistence in science and engineering career aspirations. Career Development Quarterly, 51, 234 – 243.

[55] Because Hispanics and ORGs in STEM classrooms aspire to STEM careers at similar rates, the role of confidence as a protective factor seems more appropriate. See Ming-Te Wang, Feifei Ye, and Jessica Lauren Degol. (2017) "Who Chooses STEM Careers? Using A Relative Cognitive Strength and Interest Model to Predict Careers in Science, Technology, Engineering, and Mathematics." Journal of Youth Adolescence. 46:1805-1820.

[56] Hispanic females are least likely to be highly confident of their STEM abilities (22%) – less likely than ORG males (35%), Hispanic males (30%), or ORG females (27%).

[57] See J Ellis, BK Fosdick, C Rasmussen (2016) Women 1.5 Times More Likely to Leave STEM Pipeline after Calculus Compared to Men: Lack of Mathematical Confidence a Potential Culprit. PLoS ONE11(7): e0157447.doi:10.1371/journal. pone.0157447. In some cases this self-doubt is fueled by micro-messaging. See Women in Physics Face Big Hurdles – Still: http://www.nature.com/news/women-in-physics-face-big-hurdles-still-1.20349?utm_content=buffer2f61f&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer; also see Why do so many women who study engineering leave the field? https://hbr.org/2016/08/why-do-so-many-women-who-study-engineering-leave-the-field?utm_source=twitter&utm_medium=social&utm_campaign=harvardbiz.

[58] See Michael Hale, Martha Kransdorf, Lynne Hamer. "Xenophobia in Schools." Educational Studies, 01 July 2011, Vol.47(4), p.317-322.

[59] Archer, L., Dewitt, J., Osborne, J., Dillon, J., Willis, B., & Wong, B. (2010). "Doing" science versus "being" a scientist: Examining 10/11-year-old schoolchildren's constructions of science through the lens of identity. Science Education, 94(4), 617 – 639.

[60] Among STEM aspirants, there is no gender difference within racial/ethnic groups in the proportion of students aspiring to attend community college.

[61] Tsapogas, J. (2004). The role of community colleges in the education of recent science and engineering graduates. Washington, DC: National Science Foundation.