MAKING STEM EDUCATION INCLUSIVE:
OPENING DOORS TO ENGAGE GIRLS AND WOMEN WITH DISABILITIES

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When was the last time you contemplated the societal changes that have impacted your professional field? Furthermore, have you ever considered what the dynamic nature of the United States' workforce means for people who are differently-abled and work in the more than 156 million jobs that are available across the country? (U.S. Department of Labor, 2017a). Employees and aspirants who have been historically marginalized, including women (Black, Whitmore Schanzenback, & Breitwieser, 2017), people with disabilities (Griffiths, Giannantonio, Hurley-Hanson, & Cardinal, 2016), and people of color (Landivar, 2013), possess perspectives and experiences that benefit the ever-changing milieu of the U.S. marketplace. Their contributions to professional sectors, including fields related to science, technology, engineering, and mathematics (STEM) disciplines, offer essential perspectives that should be actively welcomed and championed.

While a large portion of the U.S. workforce is employed in computer, engineering, and science (15%), healthcare (9%), and education (6%) industries (U.S. Department of Labor, 2017b), technological advancements, a diversifying national population, and the unswerving reality of global competition all warrant a consistent differentiation of thought in the country's efforts to remain at the cutting edge across all disciplines. The projected 0.7% annual increase in available jobs over the next 10 years is a valid reminder of the need to prepare employees in innovative ways (U.S. Department of Labor, 2017a). Likewise, these changes call for educators and employers to consider the training needs of people who have been traditionally marginalized.

FUTURE WORKFORCE NEEDS

A critical component of the United States' ability to sustain readiness for future workforce demands rests in the country's inclusion of a varying range of backgrounds and viewpoints. As 85% of the employment opportunities available in 2030 are for jobs that do not yet exist (Institute for the Future & Dell Technologies, 2017), it is essential to develop systemic pathways to professional opportunities that acknowledge and include the contributions of employees who offer unique and varied manners of approaching and completing tasks. In particular, female employees, differently-abled employees, and differently-abled female employees, are equipped to offer a range of contributions based on their abilities

to navigate educational and professional spaces that were not originally designed to include them.

STEM WORKFORCE

The nature of the job opportunities that will increase the most rapidly (over the next 8 years) is a clarion indication of the constantly evolving workforce. Of the top 30 occupations that will grow the fastest by 2026, 100% are in STEM-related fields (U.S. Department of Labor, 2018). While the projected occupations range across fields (e.g., energy industries, medical care, mathematics disciplines), projections contending that 50% of the country's jobs will be freelance positions by 2020 (Rashid, 2016) reify the need to prioritize autonomy and individuality in job training and professional development. Likewise, the threat of automation and artificial intelligence fulfilling millions of available jobs in the next 15 years makes it evident that educators and employers should prepare students for new career opportunities and marketplace challenges in the near future (Institute for the Future & Dell Technologies, 2017; World Economic Forum, 2018). These certainties also corroborate the importance of diversifying the STEM workforce by involving employees whose skills provide valued input in fields that are constantly transforming.

GIRLS AND WOMEN IN STEM

Currently, men occupy 64% of the jobs in the U.S. STEM business sector. In specific STEM fields, 13% of engineers, 26% of computer scientists, and 17% of tenured/tenure-track engineering faculty are women (Society of Women Engineers, 2018). Further, women hold 28.4% of the positions in science and engineering occupations (National Science Foundation, 2017a). These and similar marketplace statistics illuminate obvious gender disproportionality across STEM fields. These unbalanced figures are the results of historicized inequities in STEM educational opportunities, the lack of professional support established to uplift women along their career paths, and discriminatory practices. Women's experiences in STEM fields greatly impact their propensity to stay in the occupations in which they have been historically marginalized. Overt and subtle discriminatory practices, including stereotype threat (Gregory, 2016; Spencer, Steele, & Quinn, 1999; Steele & Aronson, 1995), implicit bias (Jackson, Hilliard, & Schneider, 2014), and lack of targeted professional support, affect the career climates that women traverse as they seek to contribute, grow, and lead in the fields. As women navigate the deficitized expectations and beliefs about their abilities in STEM jobs, they face hardships that influence their success. Likewise, they are impacted by implicit biases that predetermine employers' and colleagues' perceptions of their abilities.

WOMEN IN THE P-20 STEM PIPELINE

The present state of gender disproportionality in the STEM workforce is rooted in the underserved nature of their experiences in the P-20 pipeline. Of the 188,000 bachelor's degrees awarded in engineering and computer science, only 36,000 were to women (Society of Women Engineers, 2018). Their disproportionality demonstrates how this lack of diversity transfers to the related workforce when they pursue careers. Across all sectors, women are more likely to work in business or industry sectors than government or education.

DISABILITY AND STEM

Considering the common nature of marginalization and the causes of underrepresentation that girls, women, and people with disabilities all face across STEM educational contexts and professional realms, it is critical to understand how to support their success. Grievously, no empirical literature exists that intentionally investigates the intersecting realities that influence girls and women with disabilities in STEM fields. Research that unearths the challenges they endure and champions their contributions to STEM is urgently necessary.

LABOR MARKET DATA

In order to properly position and prepare girls and women with disabilities for success in STEM fields, we must understand the current and future needs of the labor market. When evaluating labor market data, we will focus on three areas: (a) high demand skills (based on supply and demand) and related qualifications, (b) in-demand jobs, and (c) projected job growth. It is important that we look at the jobs available and the specific skills needed to be successful in the job market so we can ensure we are properly preparing women and girls with disabilities for available opportunities in STEM.

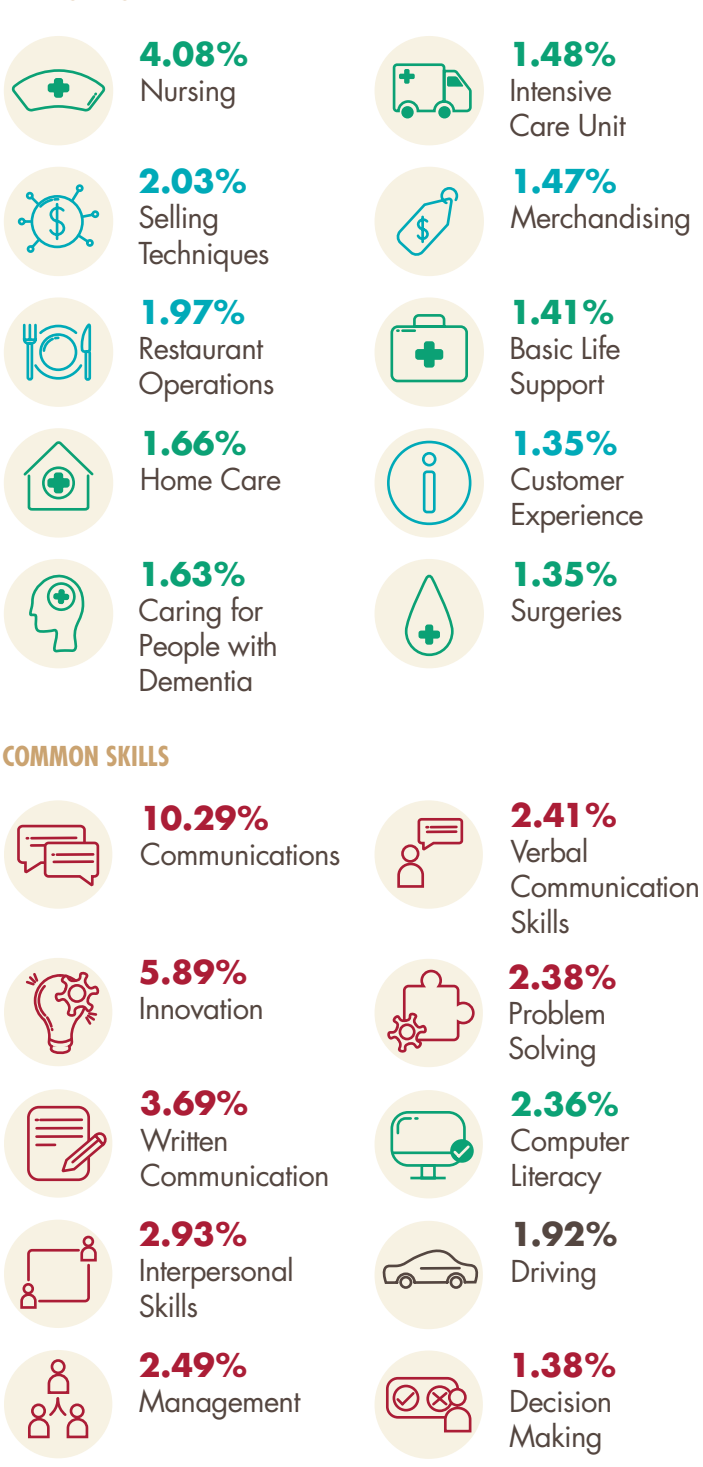
We may consider both national and local data to inform the planning and intervention process. The data below are an illustration of the types of data that may be used to make such decisions in intervention planning. Labor market data for the United States will be shared along with examples for state and county specific information that can be used to make data-informed decisions about planning and programming. We will also look at skills needed in today's market and those projected to be important in the next 10 years (Walrod & Walrod, 2018).

HIGH DEMAND SKILLS AND TOP QUALIFICATIONS

The following provides insight into the supply and demand of relevant skills by comparing the frequency of skills present in job postings against skills present in today's workforce. Along with job posting analytics, this comparison leverages a dataset of more than 100 million online resumés and profiles. According to the data source used (Walrod & Walrod, 2018) all resumés and profiles used in these comparisons have been updated within the last 3 years, and the skills associated with workforce profiles represent workers of all educational and experience levels.

FIGURE 1: High Demand Skills

Hard skills versus common skills and discrepency between supply and demand



These skills were categorized by "hard" skills, which are more specialized to a specific job, are likely more technical or hybridized, and require some level of training. "Common" skills are broad skills that are not typically job specific, may be intangible, and are generally transferable. The top 10 in demand hard and common skills are listed in Figure 1.

The percentage next to each skill reflects the discrepancy between supply (number of potential employees who list this skill) and demand (number of employer postings seeking the skill). Those with higher numbers indicate that more employers are seeking the listed skill, but fewer people report having these skills.

In addition to specific skills listed, data in Figure 2 indicate which qualifications are in high demand in job postings across the United States.

IN-DEMAND JOBS

A list of jobs that are actively available in the United States in the last 2 years is represented in Figure 3. Analysis was limited to the active posting of the top 1000 job titles. Job postings are listed for the United States, as are sample data for state and county regions.

PROJECTED JOB GROWTH

Projected job growth is calculated by evaluating the percentage change in the largest occupations across the next 10 years largest occupations. Figure 4 includes data for the United States, as well as for California and Orange County, to illustrate similarities and differences by region.

Once a clear picture of the needs of the current and future labor market are established, tailored intervention approaches can be designed with these needs in mind.

FIGURE 2: Top Qualifications

Top 10 qualifications and number of postings

FIGURE 3: In-Demand Jobs

Top 5 In-demand jobs and number of active job postings

● *STEM related skill*

UNITED STATES	CALIFORNIA	ORANGE COUNTY
737,542 Truck Drivers	**31,171** Truck Drivers	**1,879** Truck Drivers
321,764 Commercial Driver's License Drivers	**20,659** Registered Nurses	**1,813** Customer Service Representatives
238,595 Registered Nurses	**20,248** Software Engineers	**1,796** Taxi Drivers
179,067 Unknown	**17,989** Retail Sales Associates	**1,712** Retail Sales Associates
157,038 Retail Sales Associates	**16,818** Unknown	**1,527** Registered Nurses

INTERVENTION APPROACHES

A core component of the intervention framework for this project is based on an ecological systems approach. Bronfenbrenner developed the original ecological systems theory, which has been highly influential and incorporated into a variety of research topics (Neal & Neal, 2013). Bronfenbrenner (1979) believed that human development is best understood by considering all systems in which the individual is embedded. Specifically, the individual's development is impacted by the settings in which they directly interact and by the larger systems indirectly connected to them. Interactional influences are not unidirectional; each person and system level affect the other (Bronfenbrenner, 1977). When addressing the critical points of intervention for preparing girls and women in STEM, we propose intervening at the following systems levels: individual, preschool through 12th grade (PK-12), higher education, and employment. All of these levels are uniquely influenced by home, community, and cultural systems.

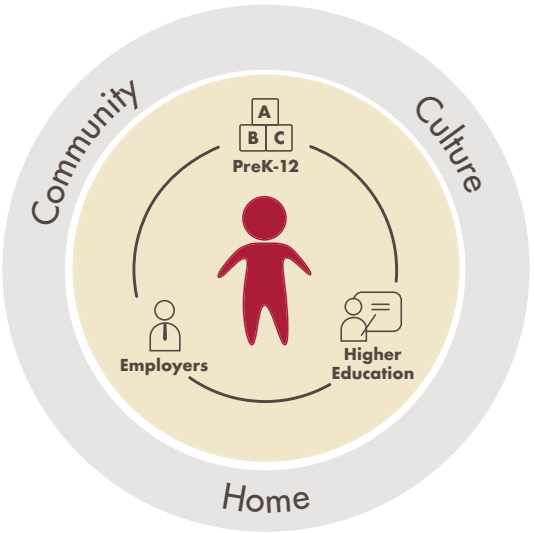
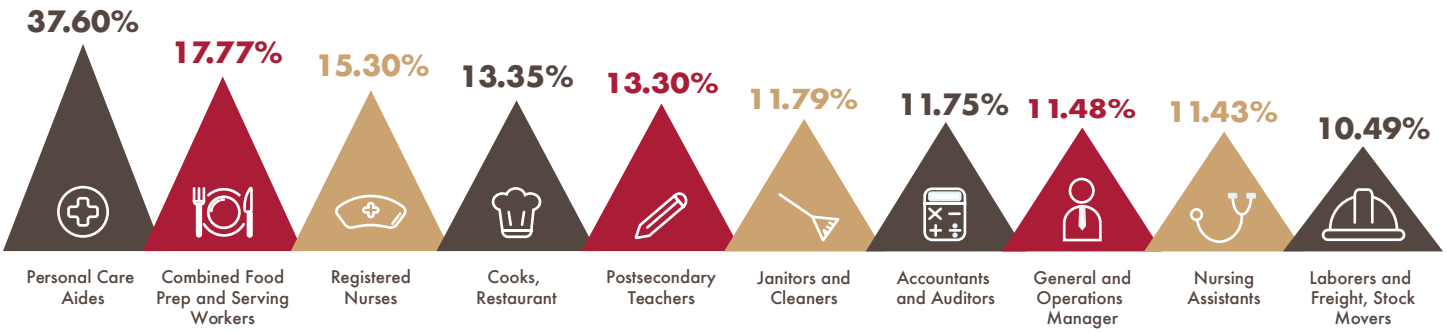


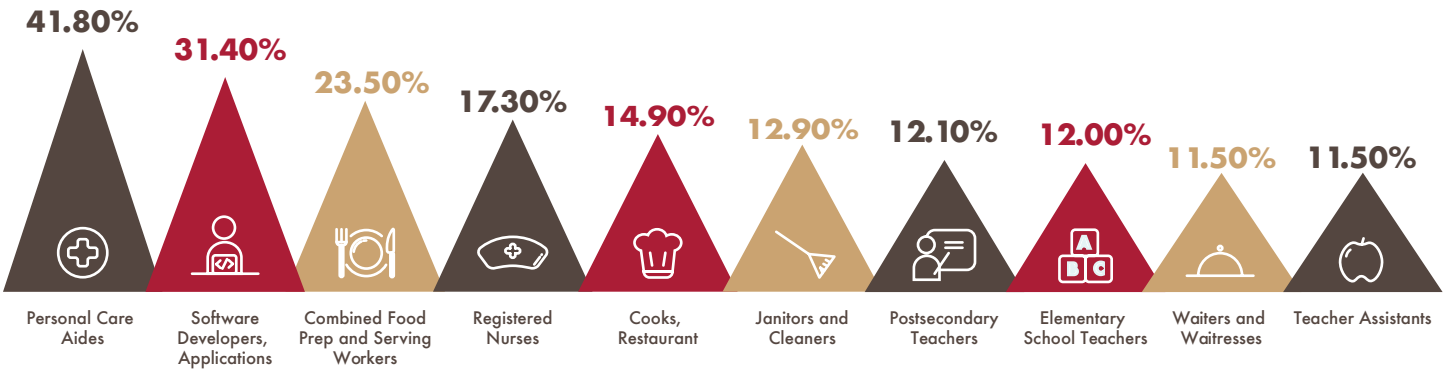
FIGURE 4: Projected Job Growth

Top 10 for projected job growth in each area and percent change

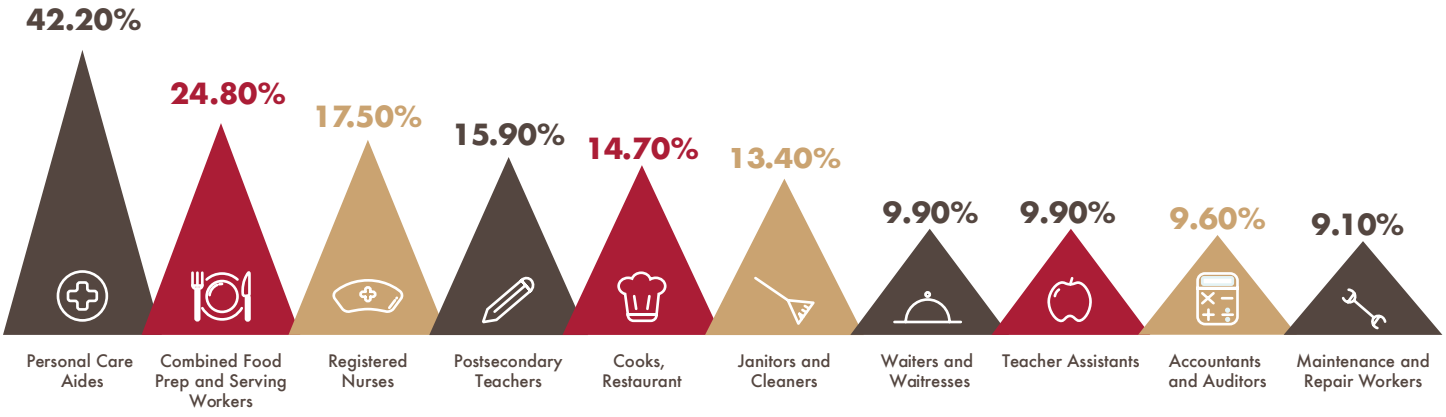
UNITED STATES



CALIFORNIA



ORANGE COUNTY



As we consider the various systems that impact individuals' development, we have identified four critical points of intervention to enhance STEM employment and engagement outcomes for historically underserved individuals, termed the **ACES** intervention framework. The four components of the ACES intervention framework are defined as:

Awareness: Broadening individuals, institutions, and communities' knowledge of the need for girls and women with disabilities to be included in STEM fields. It is essential to increase and sustain an understanding of their influence on the world through STEM.

Connection: Creating opportunities for girls and women to understand the relationship between their current STEM learning and their professional and personal aspirations in the future. When girls and women see how their use of STEM positively impacts the world around them, they are more likely to persist in the STEM pipeline from education to employment. Encourage them to contribute the voice and value they have to offer through their involvement in STEM. This is attainable through engaging hands-on curricula that is relatable to their surrounding context.

Exposure: Providing access to the types of jobs and activities in which they can participate is critical to meaningful exposure. Opportunities for training, internships, and mentorship should be made available to girls and women across developmental levels and settings (e.g., in special education programs, in the community). Likewise, along their educational paths, access to professors and STEM-related professionals with whom they have an affinity helps girls and women with disabilities persist, as it demonstrates that success and fulfillment in STEM careers are a real possibility.

Support: Offering evidence-based tools and accommodations to be successful at each educational and professional level. It is critical that support is based on the needs of the individual, in the context of the subject matter, and occurs early and often in STEM education and professional settings.

In Table 1 we provide examples of potential interventions for each system level; however, it is assumed that many of these approaches will be applicable across settings. These interventions may be individualized and implemented across multiple systems/contexts.

TABLE 1: ACES Intervention Framework

	A Awareness	C Connection	E Exposure	S Support
Individual	Strengths and struggles related to 21st century skills Self advocacy in sharing value	Match interests and skills to labor market needs Career assessment	Unique skills and needs matched to mentors and models	Person-centered assessment and labor market informed planning Targeted intervention based on strengths and struggles
PK-12	Professions and careers impact on society Start early | Growth mindset	"Hands-on" curriculum and learning Future aspirations development Internship and work experience	Mentors Access to special programs	School counselors and service providers Accommodations such as sign language needs and technology Adapted curriculum
Higher Ed	Targeted campaign | Sponsor events Organizational partnerships	Career planning Add voice and agency	Professors | Mentors and role models Tailored classes	Instructor support | Childcare | Accommodations in institutions Universal Design for Learning
Employers	Diversity adds value to organizations Change in gendered misperceptions	Career training Diversity adds value Employer initiatives	Leadership examples Impact disability in positive and lasting ways	Hiring application and interview Accommodations for diversity of support across disciplines Training for employees with and without disabilities
Home/ Community/ Cultural	Community events Mindful of messages conveyed and language used	Connect to changing the world Discuss as an attainable possibility Apply to cultural/community context	Parents and schools create opportunities for community exposure Include everyone in special events Enroll in camps and enrichment	Tutors with awareness of bias Accommodations based on specific needs

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**All labor market data were obtained from W. Walrod and P. Walrod of Qidian, workforce and labor market research specialists.*