FUTURE FORWARD
Education

Cultural & Academic Analysis

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Background

Mission

Future Forward Education (FFE) Improve the education experience for students and their families through analysis and reform by creating solutions through increased access to resources, building partnerships and monitoring student progress. By maximizing our whole-family approach, we enable our youth to harness their growth potential for an ever-changing tomorrow.

Vision

That all youth are given proper educational opportunities empowering them to harness their full potentials and become the next leaders of world change.

Program(s)

Future Forward Education strives to unlock the creativity of young people and empower them to become the next generation of world leaders. Beyond perceived program hours, FFE also wants to develop a learning-based dashboard that can be accessed anytime and anywhere.

FFE wants to provide students with opportunities for writing code that enable the exploration of troubleshooting real-world problems, as opposed to following a preset command. In tandem with ongoing data collection and partnerships created through the **Teacher Empowerment Circle (TEC)**, FFE is planning to generate a dynamic, student-centered content that empowers scholars to find ways to integrate technology-based projects into their communities. In doing so, FFE is generating content that is relevant to students' lives, offers opportunities for real-world applications, and encourages students to be creative problem solvers for the digital world.

Purpose of the Literature Review

This literature review has been conducted to provide pertinent background data in the field of STEM education, as well as the unique barriers facing underrepresented minority students pursuing STEM-related education activities and recommendations for overcoming these challenges by experts in the field. An overview of organizations local to the Los Angeles has also been completed to provide familiarity and insight into the current practices of organizations offering similar services. By understanding the programs that already exist,

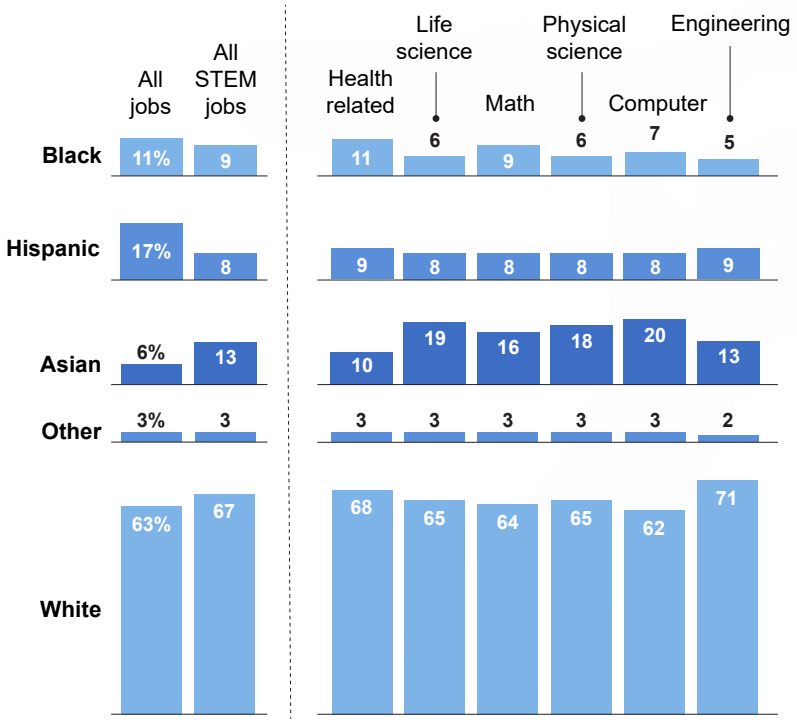
Future Forward Education will be better equipped to identify possible gaps in the STEAM education field, and plan programming and curriculum to address those gaps. Following preparation of this review, a school-specific needs assessment will need to be created to determine what specific barriers to participation exist for students in the South LA area partner school, as future participants in BIY's programming.

Minority Student Participation in STEM-related fields: Barriers to Success

Representation and Relatable Role Models

Black and Hispanic workers remain underreprsented in the STEM workforce

% who are...



Notes: based on employed adults ages 25 and older. STEM stands for science, technology, engineering and math occupations. Engineering includes architects. White, Black and Asian adults include those who report being only one race and are not Hispanic. Hispanics are of any race. Other includes non-Hispanic American Indian or Alaskan native, non-Hispanic Native Hawaiian or Pacific Islander and non-Hispanic two or more major racial groups. Source: Pew Research Center analysis of 2017-19 American Community Survey (IPUMS) "STEM Jobs See Uneven Progress in Increasing Gender, Racial and Ethnic Diversity"

PEW RESEARCH CENTER

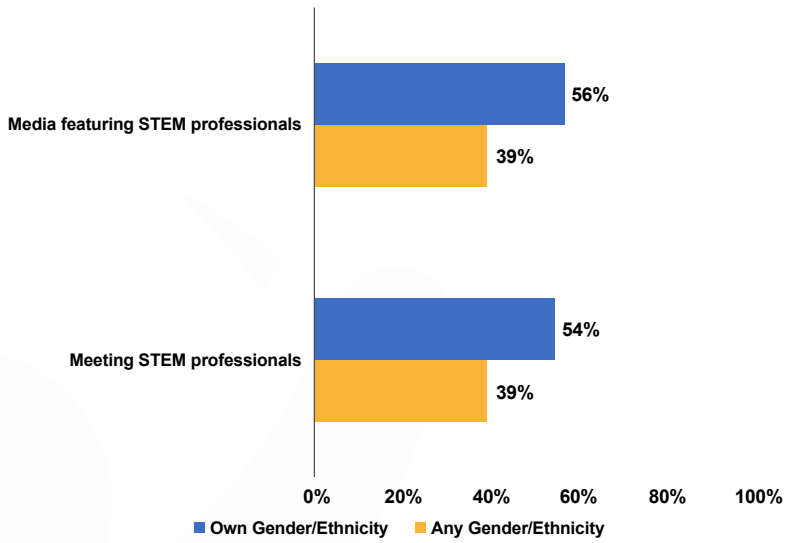
Under 10% of STEM scholars in higher education consist of minority groups or underrepresented minority groups (URMs), including women, black/ African Americas, Latina/o/x, and Native American/Alaska natives. In particular, women of color earn fewer than 5% of STEM bachelor's degrees in the United States. Some gains have been made in areas such as psychology, health sciences, biology, and the social sciences, however, there are still significant gaps characterized by stagnated growth in areas including physics, computer science, and engineering. This gap has been attributed to the **drop off in interest that occurs during students' elementary and middle school years**, the causes of which will be described further in this review.

According to the **Pew Research Center (2021)**, people of color remain

underrepresented in STEM careers, despite gains that have been made over the course of the last decade. Additionally, their research shows that there is also a wage gap (74%) that exists for Black and Hispanic women that is even more severe than the general labor market-wide gender pay gap (80%). Whites and Asians continue to be overrepresented in the field at all degree levels.

Survey data from **Kricorian (2020)**, featured at the right, demonstrates the need for **gender- and ethnicity-matched STEM mentors and role models** in order to inspire underrepresented groups to pursue careers in the STEM fields. There is a clear desire on behalf of students for stronger representation. **This is particularly critical to students in Southern California, which has one of the lowest percentages of Black and Latinx technology sector workers in the country**.

Fig. 2



Preferences regarding gender-and ethnicity-matched mentors. What do you think would encourage more people of your gender and ethnicity to pursue STEM careers? The majority of respondents (54%) believed that exposure to a STEM professional of their own gender and ethnicity would encourage them to pursue STEM. A similar percentage (56%) believed that media exposure to gender-and ethnicity-matched STEM professionals would be effective encouragement

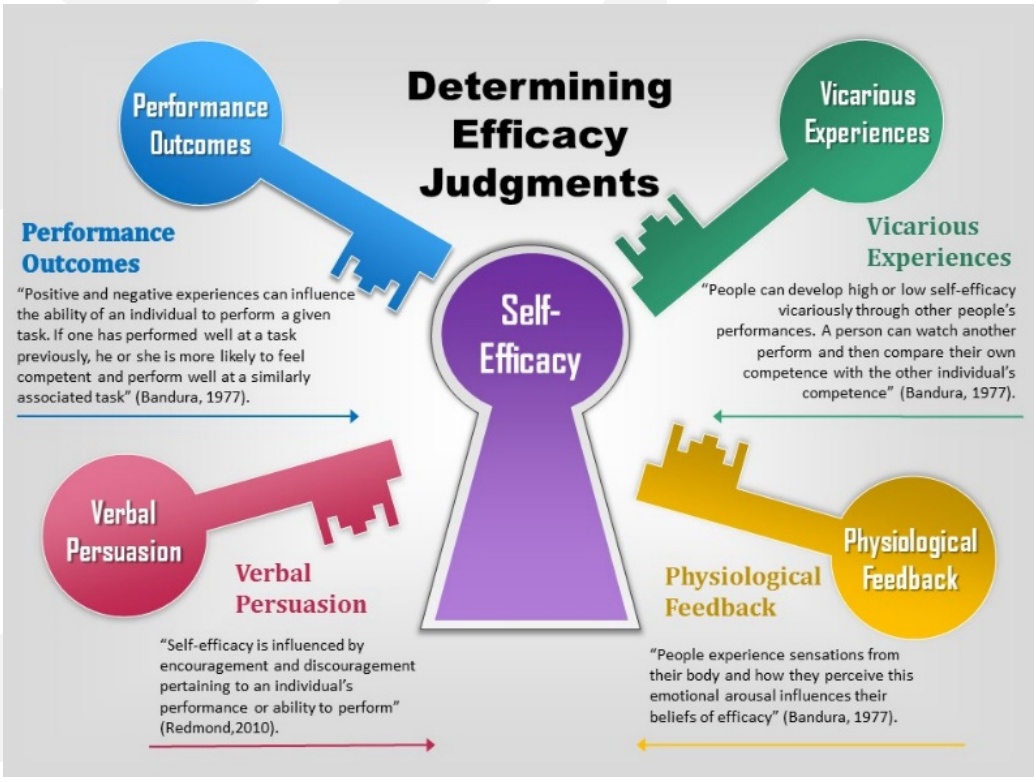
Access to Technology

Research conducted through the **University of California and the California Emerging Technology Fund** indicates that progress has been made in regards to the percentage of Californians that have access to the internet. However, it remains true that low-income households in Californians are at a clear disadvantage when it comes to connectivity, as income is directly related to broadband access. According to the study, **29% of households earning less than $40,000 per year either have no internet connection** or only can connect to the internet using a mobile device (or, **"underconnected"**). 20% of low-income families also have reported experiences in which they have lost internet for period of time due to financial hardship. This **digital divide** is clearly evident along racial and ethnic lines, with 24% of Hispanics being reported as unconnected or underconnected, while this is the case for only 5% of the white population. Digital inequities are even more severe along language barriers, with **35% of Spanish-speaking population reporting as unconnected or underconnected**.

Students in the Los Angeles Unified School District are particularly at the mercy of education inequality as a result of the digital divide, a situation which has only been exasperated by the COVID-19 pandemic. While many students in LAUSD schools without access to the internet were provided with hotspots and laptop devices, there has not been enough broadband infrastructure to support the use of this technology. Research conducted by the **SURGE project and SoLa I CAN Foundation found that 87% of students in the 13 largest LAUSD high schools lack access to tech-related activities**.

Self-Efficacy

Social cognitive career theory (SCCT) dictates that people's beliefs about their capability to attain career goals are partly determined by their background such as racial/ethnic group, socioeconomic status, and early learning experiences. Individuals are more likely to make educational and occupational choices that are consistent with their interests and self-esteem.



Furthermore, **self-efficacy** has been demonstrated to be the most reliable predictor of academic satisfaction, and therefore, later career success. Self-efficacy refers to one's judgement or belief that they can achieve a specific task. Rather than the level of actual skill or knowledge, self-efficacy reveals what people believe to be true about themselves and their capabilities. For students looking into computer science (CS) careers, if they do not believe that they are "good" at math or science, they won't "see" themselves in the field or pursuing a STEM major. A person gains self-efficacy by experiencing success at a given task, receiving encouragement from others, and the moods/associations experienced with a given task.

Lee (2019) points to various studies proving that self-efficacy about an activity can be positively influenced by seeing someone similar to oneself being successful in similar activities. On the other hand, when students see someone who is dissimilar or who has disparities in experience (consider: race, language, class, gender, etc.), it can lead students to believe that those skills are beyond their reach. Therefore, students may become less inclined to pursue such opportunities for learning. **Lee also notes that near-peer mentorship can be very positive, however, it is important to keep discrepancies in mind, such as class, gender, language, and race, as such differences could potentially do more harm than good**.

Stereotype Threat

Another major barrier for minority students in STEM education is the impact of **stereotype threat**, which refers to the idea that a person's ethnic background and pre-existing beliefs about ethnic group membership can influence their performance, and their beliefs about their capabilities. For example, a common stereotype such as "girls aren't good at math" may in fact lead young girls to believe that they are not as naturally talented in math as their male counterparts. **Dowey (2013)** asserts that encouragement and support from parents, school, peers, and the community fosters perceived self-efficacy and combats stereotype threat, which could lead to greater participation and success in the STEM field for underrepresented groups.

Recommendations for Overcoming Barriers

Culturally Responsive Teaching (CRT)

Culturally Responsive Teaching (CRT) is a pedagogical framework that recognizes and infuses the culture of students who have been historically marginalized and socially alienated from their public education. This educational orientation contends that academic engagement of minority students is best facilitated by the creation of instructional materials, assignments, and learning environments that reflect students' backgrounds and experiences. **CRT is centered on the importance of personal relationships and the power of caring for students' unique talents**, as well as the acknowledgement of the positive contributions that culturally diverse students bring to the learning environment. Personal relationships and collaborative learning have proven to be particularly important for African American/Black students. Furthermore, a framework for STEM instruction called **Culturally Responsive Computing (CRC) is based on the fundamental belief that students are capable of digital innovation, and teachers should have high expectations for their capabilities**. Culturally responsive pedagogy is a critical practice for

helping minority students feel a sense of belonging.

Hur (2021) suggests that STEM programs seeking to engage underrepresented minority students invite role models from the same ethnic group in order to help students imagine themselves in the STEM field and dismiss stereotypes about computer science. He warns that ethnic minority students tend to feel less welcome and at-home in the STEM field compared to white students, and this feeling tends to result in negative student outcomes, such as poor study progress and early withdrawal from STEM-related activities. In other words, **computer science lessons that are not culturally responsive may make minority students less likely to enjoy learning STEM subjects and negatively impact their decision to pursue a STEM-related major in college**.

Access to Role Models and Near-Peer Mentors

Lee (2019) completed a study in which all participants (28) were underrepresented minorities in STEM (13 black, 15 Hispanic) and eligible for free/reduced cost lunch. They were paired with first year college students majoring in STEM fields. He noted that, prior to the program, students only really knew of white/Caucasian male celebrities in computing, like Steve Jobs and Bill Gates. He notes that this is not helpful because it does not help minority students see themselves in leadership positions, which puts them at a disadvantage following the principals of social cognitive career theory and stereotype threat. **He recommends that programs foster role model and mentoring relationships where students can interact with local professionals and near-peer mentors that students can identify with and relate to**. He says that this will contribute to increasing diversity and representation in computing careers.

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Current Organization Practices

This section serves as a review of nonprofit organizations local to the Los Angeles area that provide enrichment services for youth, particularly in STEM related subjects. This review provides an overview of the current nonprofit landscape for the purposes of informing best practices and identifying potential needs in the community.

The following data points were collected for analysis in this section: mission, vision, and values; geographic focus and reach; operational budget, including information pertaining to revenues and expenses; staff, volunteer, and board capacity; key activities and goals; target audience; and key philosophies/practices that guide programming decisions.

STEAM:CODERS

STEAM:CODERS is a Pasadena-based nonprofit that began operations in 2020. Given the fact that this is new organization, financial data has not yet been made available to the public. Programs facilitated by the organization are free, with the exception of a nonrefundable registration fee. While the thirteen board members are clearly named on their website, staff capacity is unclear at the moment. There are at least three paid employees, and they are in the process of hiring new instructors, instructional assistants, and volunteers.

The mission of **STEAM:CODERS** is to inspire "**underrepresented and underserved students and their families through science, technology, engineering, art, and math (STEAM), in**

preparation for academic and career opportunities." The organization's stated objective is to engage one million students in the fundamentals of STEAM by 2045. **STEAM:CODERS** is currently offering week-long courses in topics such as Music and Sound, Digital Art, Video Editing, and Game Design. They offer beginner, intermediate, and advanced level courses with pre-developed curriculum, which teachers then use to prepare individual lesson plans, presentations, and handouts. They have also created some 8-week modules that are pre-made for teachers. The organization emphasizes the importance for hands-on learning and field trips, and seem to be focused on teaching coding languages such as Scratch**, Python, and HTML**.

STEAM:CODERS targets K-12 students in Los Angeles who qualify for free or reduced lunch, as well as "underrepresented and underserved students." They offer financial assistance for those who qualify (to cover the registration fee), and try to supply the computers and snacks for the students who do not have their own. This has been made possible through their various partnerships with colleges, corporations, and other nonprofits.

While the curriculum written by **STEAM:CODERS** is not available for public consumption, it is important to note that the organization has named and acknowledged violence against unarmed African Americans and the pandemic publicly on their website, and is actively positioning their program in such a way to uplift students of color and marginalized communities. They have stated that the "logic, critical thinking and problem solving skills that they develop in our program [will help] build a foundation that will make this nation stronger and safer for everyone."

9 Dots Community Learning Center

9 Dots is a Los Angeles-based nonprofit that targets K-6th graders at Title I schools in Los Angeles and Compton. Founded in 2011, **9 Dots** is overseen by a board of 7 and managed by a paid staff of 44 with limited volunteer capacity. According to their most recent Form 990 (2020), their operational budget is approximately $1M, with most revenue coming from individual contributions, foundation grants, and a small amount of government grants. Most of the organization's expenses are related to salaries/benefits and programs, including the purchase of project materials. Their overall mission is to "**provide transformative computer science education for every student**." The organization's activities are guiding through the principals of joy and "fearlessness in problem solving." **The organization specifically names and seeks to address the barriers that racial inequities and stereotypes pose to underserved youth in the area**.

9 Dots engages in 3 key program activities, including their Academy, the Get Coding Program, and research. The Academy is the organization's after-school program that takes place during the school year. Students engage in **9 Dots**' STEM curriculum, with six different courses offered, as well as an AP computer science principles program for 6th graders. The courses feature various levels that are appropriate for students of different grade levels, with or without prior coding experience, with the exception of kindergarteners, who all start together. By the time students reach Course F, they learn to write in JavaScript, functions with parameters, and design a video game character. **The Get Coding Program places 9 Dots instructors in public schools to co-teach with other teachers and provide professional development that is meant to help teachers and schools build their own computer science programs**. They offer their own unique platform and interface with curriculum that is built for teachers to use in the classroom, and comes completed with **lesson scripts, materials, and the ability to track their students' progress in real time**. All lessons are aligned to CCSS, NGSS, and K-12 California CS Learning Standards. Finally, **9 Dots** is in the process of completing grant-funded research for UCLA and UC Berkeley.

LA Makerspace

LA Makerspace is the primary STEAM partner for LA City and County public libraries. Founded in 2012, the organization is actually a branch of the Two Bit Circus Foundation, which "**cultivates the next generation of inventors…and spurs community engagement by providing students of all means with access to STEAM…education**." LA Makerspace is overseen by 8 board members and 4 paid staff. The organization also relies on the help of volunteers (particularly those who are multilingual) to facilitate its library programming. The organization highly values the celebration of community and unique talents (**which suggests their commitment to culturally responsive practices**), innovation, self-esteem, and experiential learning. The Maker Mindset emphasizes their belief in the ability to figure things out, persistence, risk-taking, collaboration, learning new thinks, solving problems, confidence, resilience, and creativity.

LA Makerspace offers professional development for library staff to help them incorporate Making (STEAM themed project-based learning) into their existing programming, as well as workshops that the libraries can purchase. For each $1500 workshop, libraries receive four 2-hour long workshops, with 20 kids accommodated per workshop (ages 7-high school). LA Makerspace supplies all of the materials, including computers. **Programs include robotics, e-textiles,**

coding with Scratch, and coding with Minecraft. They are currently working on expanding their programming into Title I schools.

Finally, **LA Makerspace** offers a unique program called Coding Crew, in which students ages 13-16 provide **near-peer mentoring and teaching in coding programs**. This program is currently taking place at churches across the city. **The program has even inspired young coders to start their own nonprofit organization that provides peer-to-peer coding workshops and classes (see: Korbins Kode)**.

Korbins Kode

Korbins Kode is a youth-driven nonprofit that teaches basic coding to students ages 8 to 16. The organization was established in 2017 by a 13-year-old participant in LA Makerspace's Coding Crew who enjoyed teaching other kids to code so much that he decided to start teaching on his own. The organization is primarily focused on using the program **Scratch, however, they have plans to begin teaching HTML, CSS, and JavaScript**.

Each session of a **Korbins Kode** workshop engages about 8-10 students, completely taught by other kids. The founder of the organization has said that "kids listen to kids", and that **near-peer mentoring has been the key to their success**. Workshops are held in-person, often at small to medium-sized venues with access to computer labs and high-speed internet.

SoLa I CAN Foundation: SURGE Technology and Entrepreneurship Center

SURGE is a project that is a part of the SoLa Foundation, which was established in 2017 to **end intergenerational poverty in South Los Angeles through community development and economic opportunity**. The organization specifically serves Black and Latinx community members by providing career development, technology education, financial literacy education, and college readiness and scholarship opportunities. The **SURGE** program seeks to directly address the digital divide facing residents of the area by offering free youth programming in areas such as **robotics, Esports and game development, virtual/augmented reality, coding, animation/digital effects, digital media, music production, app development, podcast production, and financial technology**.

SURGE has not yet started its in-person programming, but will be hosting its free youth programs at the Beehive, a 100,000 square foot warehouse space in the South LA Opportunity Zone (OZ). This campus houses several Black-owned businesses, including galleries, and will serve the main center for **SURGE's** programs by offering a safe space for kids (the Technology and Entrepreneurship Center).

SURGE has a clear passion for the South LA community, and highly values the inherent power of the community to be resilient and innovative, and their main mission is to **provide access to education, job training, and placement opportunities that have not been accessible to youth in the community in the past**. Culturally responsive practices are at the heart of this project.

Teens Exploring Technology (TxT)

TxT primarily targets young men of color in grades 7 to 11 that live in low-income communities, particularly South Los Angeles. Established in 2019, **TxT** is overseen by 3 board members and 18 paid staff. Although **TxT** is a relatively young organization, they earned close to $1M in grants and contributions in fiscal year 2020, and are able to boast their reach of 1,500 students per year, 95% of which are attending 4-year universities, and 75% of which are majoring in computer science. **TxT's mission is to use coding and technology to teach young men of color about collaboration, ideation, and long-lasting life skills**.

Teens Exploring Technology offers several programs for students to learn the **Python coding language, HSML, CSS, JavaScript, 2D gaming concepts, design thinking skills, leadership skills, and project management skills**. These programs largely take place on the campus of the University of Southern California, and often offer opportunities to visit tech companies like Google and Snapchat. While many of their programs are workshops that last between 4 and 10 weeks, **TxT** is also partnering with schools by offering semester-long courses in coding and computer science. Students in the course learn to build a personal website with a specific focus on social justice.

TxT's cultural values are distinct and explicit. **The organization seeks to build a community of young men of color that see themselves as brothers in leadership and problem solving**. The organization has tied its programming to a "leadership creed" in which participants are taught to lead by example, act as a role model to other young men in the community, and continuously seek self-

improvement.

LA's Best

LA's Best i**s one of the largest and longest-standing afterschool programs in the city of Los Angeles**. The organization has been providing afterschool supervision and enrichment at 200 elementary schools for thirty years. They have reached over 25,000 students, and employ 2,000 staff. 90% of **LA's Best** participants qualify for free or reduced lunch, and 98% of parents have expressed that the program has provided them with the necessary support system that allows them to keep their jobs.
Programs last until 6 PM every day, and include meal service, academic tutoring, and enrichment activities in STEAM, literacy, sports, health, and wellness. All of **LA's Best** programs are guided by trauma-resilient informed practices, and aim to **provide evidence-based social and emotional learning to support positive youth development**.

While **LA's Best** programming is extensive, their STEM partnerships are worth noting in this review. Relevant partners include the Air Force Association, California Science Center, Girls Who Code, NASA/Jet Propulsion Laboratory, and the University of California Cooperative Extension. In particular, the NASA-JPL has brought in hundreds of engineers to meet and mentor students, and this partnership has helped to create the Celebrate Science Program. NASA-JPL also donated the Imagine Mars curriculum, which is a community-based technology project that culminates in a presentation to actual NASA engineers. This partnership has existed since 1999.

DIY Girls

DIY Girls' mission is to increase girls' interest and success in STEM through innovative experiences and mentor relationships. The organization primarily targets girls in 5th-12th grade in the Northeast San Fernando Valley, where 97% of participants are Latina. Programs include creative electronics, creative coding, virtual design and 3D printing, and woodworking. Programs take place on partner school campuses completely free of charge. The organization has been operating since 2011, and has served over 4,000 girls in the hopes of building their technical skills and confidence to pursue STEM education and careers.

The LA Promise Fund

The LA Promise Fund offers a variety of programs in South Los Angeles to prepare LA

students for success in college, career, and life. The organization is vocally anti-racist, and seeks to actively increase education equity and close the opportunity gap by fostering a diverse, inclusive, and equitable team; promoting anti-racist learning, incorporating African American and Latinx voices in curriculum and programming, and supporting South LA Black- and female-owned businesses.

In terms of STEM programming, the **Fund** facilitates a local chapter of Girls Build, in which **middle and high school girls are placed into teams to collaborate and implement community-based solutions**. The **Fund** also provides the Amgen Biotech Experience, which provides hands-on science and biotechnology education for high school students. The program has a full curriculum and state-of-the-art lab equipment to foster a fully immersive experience.

Conclusions & Direction

The provided research proves that there is a clear and present need for greater diversity in STEM careers. The overrepresentation of white and Asian populations in STEM careers can be traced back to the barriers uniquely facing K-12 Black/African-American and Latinx students, and STEM programming must directly address these barriers in order to promote greater inclusion and proportionate representation in the field. Culturally responsive pedagogy, mentorship, and representational role models are some of the ways that STEM programs may begin to design their programming.

Many of the organizations explored in this overview share common values for cultural responsiveness, which has been critical to building trust in the Los Angeles area. The challenges facing youth in South Los Angeles are fundamentally rooted in systemic racism and oppression of people of color, and many of the programs researched have put anti-racism, community, and resilience at the forefront of their key activities. Many of the programs researched also seek to build interest and confidence in the STEM field for youth, thereby seeking to positively impact self-efficacy. Programs specifically tailored for girls and young boys of color exist to combat stereotype threat that often disinclines students from pursuing further STEM opportunities and careers. It is also important to note that many of these programs seek to impact the lives of the students they serve by elevating the voices of historically marginalized groups, empowering them through team collaboration, and inviting in community voices to provide a greater sense of mentorship and belonging.

The following recommendations should inform the development of Future Forward Education's programming:

- **Invite community voices to design culturally responsive curriculum.**
- **Establish relationships and partnerships in the community that foster trust and respect.**
- **Foster near-peer mentorships and role model relationships with individuals that reflect the demographics of the school community/participants. This recommendation will help combat stereotype threat and help students feel welcome and seen in their learning environment.**
- **Structure programming in a way that emphasizes teamwork and offer ample opportunities for successful and positive experiences to increase self-efficacy.**
- **Conduct a school-specific assessment to gauge content interests, barriers, and present knowledge, attitudes, and behaviors in relation to STEM education.**