

There is an opportunity gap between groups who are underrepresented in STEM careers and those who are not. We need to close this gap for girls and low-income youth not only for the sake of the students left behind, but for future growth and well-being of our country. Technology and engineering literacy scores from NAEP (National Assessment of Educational Progress) Nation's Report Card – which measures whether students are able to apply technology and engineering skills to real-life situations – revealed a 28-point gap between students from low-income families and their more affluent peers, and a 38-point gap between black and white students. Additional data in NAEP's Nation's Report card show that only 34% of 8th graders across public and private schools are proficient in math as well as in science. This discrepancy must be addressed – not merely for the sake of the students left behind, but for the prosperity of our country and the health of our planet.

Further, according to The National Science Board, the disparity between the number of men and women in STEM jobs has only moderately narrowed over the last two decades, despite focused efforts to attract and retain more women in STEM fields. The National Girls Collaborative Project reports that while women took home 57% of bachelor's degrees in all fields in 2013, women earned just 43% of the degrees in math, and just 19% and 18% of the degrees in engineering and computer science respectively. Research-based evidence points to a need to engage girls early, well before high school, in meaningful STEM experiences. A large body of research supported by the National Science Foundation also indicates that informal STEM opportunities can materially increase girls' interest in these areas. Memories of informal STEM encounters can become critical resources in shaping personal identities and life trajectories<sup>1</sup>, which in turn lead to development of knowledge, comfort and confidence (or literacy) in STEM areas.

## The Need

### Mathematical and Scientific Literacy

walkSTEM aims to to increase mathematical and scientific literacy among all people so that there is equity in access to STEM learning opportunities for all our youth, regardless of gender and socioeconomic background.

Mathematical literacy and scientific literacy refer to the individual's capacity for employing and interpreting mathematics and science in many contexts. According to the Programme for International Student Assessment, mathematical literacy helps people to identify and understand the role that mathematics plays in the world, and to make the sound judgements required in life by constructive and engaged citizens.<sup>2</sup> The United States National Research Council defines scientific literacy as “the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity”.<sup>3</sup>

The statements above highlight that scientific and mathematical literacy are necessary in order to engage in everyday life as a well-informed citizen. In the United States, STEM fields are the key to continued economic competitiveness and national security going forward. Over the next five years, American companies will

will need to add an estimated 1.6 million STEM-skilled employees. Moreover, STEM literacy cuts across traditional subject matter boundaries; in the twenty-first century, all Americans need to be literate in STEM disciplines. Data shows that “the set of core cognitive knowledge, skills and abilities that are associated with a STEM education are now in demand not only in traditional STEM occupations, but in nearly all job sectors and types of positions”.<sup>4</sup>

Unfortunately, current data indicates that we have much work to do in order to achieve high rates of STEM literacy. The United States lags behind other developed nations in math and science education. Despite the wealth of resources available in the United States, a recent Programme for International Student Assessment test ranked the United States 38th in math literacy and 24th in science literacy.<sup>2</sup> Further, according to data from the Nation’s Report Card, less than 45% of 4th graders in four of Texas’ largest cities – Dallas, Ft. Worth, Houston and Austin – scored at or above proficiency level in math.<sup>5</sup> For 8th graders the number is even more stark, with less than 39% scoring at or above proficiency. Of the twenty-one large urban school districts assessed, none exceeded 41% (8th grade math) or 49% (4th grade math).

Only 41% of Dallas Independent School District (Dallas ISD) fourth graders met the standard set by the State of Texas on their math standardized test, compared with 45% in the greater State of Texas. Moreover, only 40% of Dallas ISD eighth graders met the standard of proficiency on their science standardized exam, compared with 46% in the State of Texas. 77% of Dallas ISD high school graduates are not “college-ready”, and only 22% complete a two- or four-year degree within six years of high school graduation.<sup>6</sup> While these statistics are not encouraging, test scores alone cannot reveal the full story. There are significant pockets of excellence, innovation, and improvement within Dallas ISD, as well as within other urban school districts. Partnerships with these schools and other organizations are critical as we collaborate to address the complex problems at play in our society, which are frequently reflected in our schools.

In order for all students become literate in math and science, they must see STEM disciplines as relevant to their lived experiences, which in turn requires that they develop a personal STEM identity.<sup>7</sup> STEM identity is the ability to see oneself as a legitimate participant in STEM through the lens of one’s personal interests, abilities, race, gender and culture. Research shows that development of STEM identity increases the likelihood that students continue to develop math and science literacies over the long term, or follow a pathway towards a science career or profession; STEM identity is what makes lifelong STEM engagement possible. Thus, development of student’s STEM identities must be a deliberate goal in STEM education.

## How walkSTEM Addresses this Need

walkSTEM aims to address the challenges highlighted above. The walkSTEM network brings together a wide range of community based organizations and spaces in alignment with several of the recommendations listed in

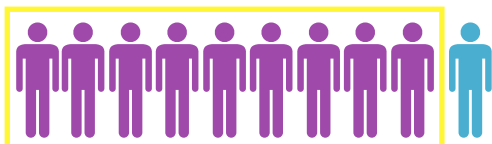
**FIGURE 1: DISD STUDENTS STRUGGLE TO REACH PROFICIENCY IN MATH AND SCIENCE**



**59% OF DISD 4TH GRADERS DID NOT MEET THE STANDARD OF PROFICIENCY** ESTABLISHED BY THE STATE OF TEXAS ON THE **4TH GRADE MATH STAAR EXAM.**



**60% OF DISD 8TH GRADERS DID NOT MEET THE STANDARD OF PROFICIENCY** ESTABLISHED BY THE STATE OF TEXAS ON THE **8TH GRADE SCIENCE STAAR EXAM.**



**87% OF 2016 DISD HIGH SCHOOL GRADUATES WHO TOOK THE SAT OR ACT SCORED BELOW 1110 OR 24, RESPECTIVELY.** THESE SCORES ARE CONSIDERED PROXIES FOR COLLEGE-READINESS.



**78% OF 2011 DISD HIGH SCHOOL GRADUATES DID NOT COMPLETE A TWO OR FOUR YEAR DEGREE** WITHIN SIX YEARS OF GRADUATION.

United States Department of Education's STEM 2026 vision for innovation in STEM education <sup>8</sup>:

- The walkSTEM network is a growing networked community of practice that uses walkSTEM methodologies in varied settings, both formal and informal.
- walkSTEM activities involve low barriers to entry, encourage creative expression of ideas, and utilizes interdisciplinary approaches to exploring one's surroundings.
- walkSTEM is a flexible methodology that partners with varied institutions to create place-based experiences.

Jo Boaler, Stanford professor of mathematics education, reports that many undergraduates, especially women, express that the reason behind their abandonment of STEM programs is because of their performance in math.<sup>9</sup> walkSTEM is committed to making inquiry-based mathematics a significant part of each experience. We foreground use of a mathematical lens in our programming because math is a gateway to the other sciences, and because math-related anxiety is a key reason undergraduates leave STEM programs. walkSTEM participants use math to explore the real-world in low stakes situations, thereby building confidence and appreciation of the relevance of math to their lived experiences. We also utilize science, engineering, art, and architecture lenses to examine real world environments.

 Watch "Welcome to walkSTEM!" on Youtube to see Dr. Glen Whitney introduce the walkSTEM methodology.

## Purposeful integration of Formal and Informal Learning

*"STEM education stands to be greatly improved by taking advantage of the complementary nature of formal and informal learning opportunities...Settings like afterschool and summer learning programs can be thought of as pollination points in a wider STEM ecosystem, where having multiple locations to learn reinforces students' developing mastery of science, technology, engineering and mathematics skills."* - STEM Education Coalition Policy Forum, 2016

Dallas Independent School District's (DISD) Executive Director of STEM, Oswaldo Alvarenga, recognizes the importance of incorporating STEM experiences outside the classroom into DISD's curricular development. Alvarenga and others have demonstrated the city's commitment to these principles by partnering with walkSTEM to bring informal STEM experiences to DISD schools. Such experiences are critically important to building the next generation of leaders in STEM fields and beyond. The 2010 Lemelson-MIT Invention Index survey found that teens consider access to STEM activities outside of the classroom as the most effective way to get them interested in science-related topics.<sup>10</sup>

 Watch "talkSTEM DMA Coffee and Conversation" on Youtube to see Oswaldo Alvarenga's discussion of walkSTEM.

Many efforts to increase interest in STEM have been directed at students. Yet as the gatekeepers of what is shared in classroom settings, teachers should also be targeted as agents of change. The 2010 Lemelson-MIT Invention Index survey also found that 55% of teens reported they would be more interested in STEM if their teachers were excited about such subjects.<sup>11</sup> walkSTEM provides educators with tools to help their students build STEM skills beyond completing rote classroom assignments.

The walkSTEM initiative purposefully integrates formal and informal learning experiences by aligning state and common core standards with all walkSTEM experiences. We provide guidance through detailed educator guides for teacher use, and educator professional development for formal and informal settings. We are committed to providing free, easily accessible resources that can be easily integrated to create valuable educational experiences in all learning environments.

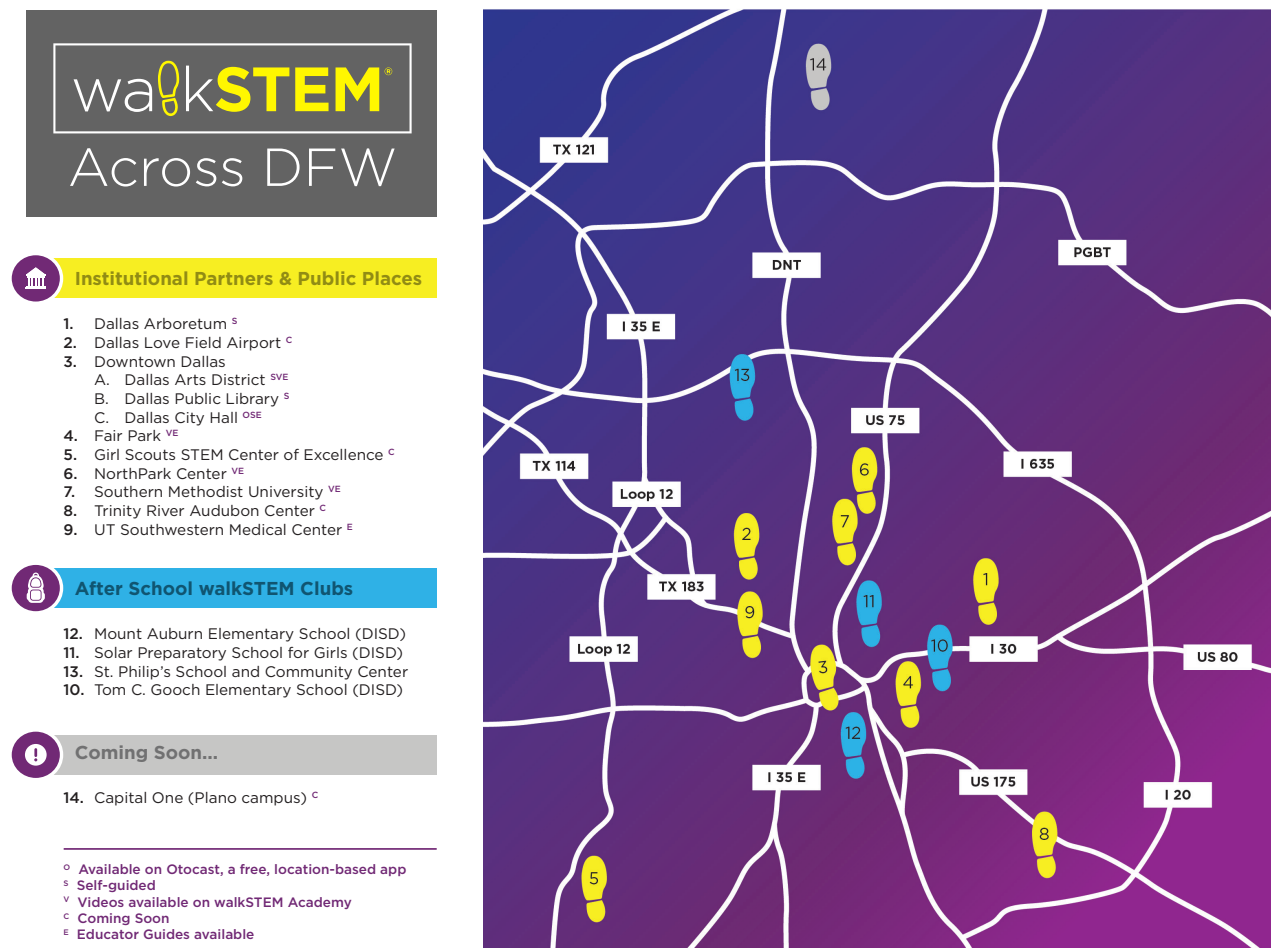


# Building a City of STEM

*“The engagement of the full range of stakeholders and community members in improving STEM education in particular contexts can help mitigate the behavioral, structural, and organizational factors that affect STEM teaching and learning practices that play a role in engaging or turning certain groups of learners away from STEM pathways.” - US Department of Education, Office Innovation and Improvement (2016)*

Dallas has the third highest rate of childhood poverty of all major United States cities.<sup>12</sup> 72% of DISD Students are economically disadvantaged (defined as students who are on free or reduced priced lunch) and 28.3% of children live in poverty (defined as households who live on less than \$25,000 per year for a family of four).<sup>13</sup> In order to break the cycle of poverty and access high-paying jobs, children must have both competence and confidence in STEM skills. walkSTEM is aligning collaborators to create an ecosystem of STEM in Dallas. In securing a grant from the City of Dallas Office of Cultural Affairs, walkSTEM has effectively broadened the definition of culture in Dallas to include STEM. The organization is strategically partnering with groups throughout the city to further educational equity by creating access to high quality STEM experiences in all parts of Dallas. By creating STEM opportunities throughout the city, walkSTEM eliminates the barriers to access caused by extreme socioeconomic differences, transportation needs, and other factors.

**FIGURE 2: WALKSTEM ACROSS DFW**

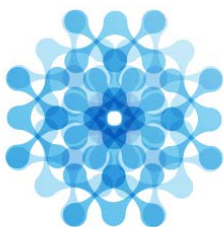


In creating an ecosystem of STEM, walkSTEM also aims to create a network of institutions, cities, neighborhoods, and schools that utilize walkSTEM programming. Network partners will gain access to knowledge sharing, collaboration, recognition via walkSTEM Academy and social media. This network will augment walkSTEM programming and empower partners to think creatively about informal STEM learning. walkSTEM has partnered with likeminded organizations and participated in special events, such as *Science in the City*, organized by Dallas Morning News, EarthX Event, and Science Saturday, organized by UT Southwestern Medical Center.



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- <sup>1</sup> [“Cascading Influences: Long-Term Impact of Informal STEM experiences for Girls”](#), Franklin Institute, 2013
- <sup>2</sup> [“Mathematical Literacy”](#), OECD Programme for International Student Assessment (PISA).
- <sup>3</sup> National Research Council. 1996. *National Science Education Standards*. Washington, DC: The National Academies Press.
- <sup>4</sup> [“Civil Rights Data Collection: Data Snapshot: College and Career Readiness”](#), U.S. Department of Education Office for Civil Rights, 03/2014.
- <sup>5</sup> [“District Profiles”](#), The Nation’s Report Card.
- <sup>6</sup> [“2017 The Commit Partnership Community Achievement Scorecard”](#), The Commit Partnership.
- <sup>7</sup> [“What is STEM Identity ”](#), Center for Advancement of Informal Science Education, National Science Foundation.
- <sup>8</sup> [“STEM 2026: A Vision for Innovation in STEM Education”](#), United States Department of Education, 09 2016.
- <sup>9</sup> [“The ‘boys are better at math’ mindset creates gender gap in sciences”](#), Kelly Wallace, CNN, 10/12/2016.
- <sup>10</sup> [“Survey reveals ways to enhance teens’ interest in science, technology, engineering and mathematics”](#), Science Daily, 1/29/2010.
- <sup>11</sup> [“Survey reveals ways to enhance teens’ interest in science, technology, engineering and mathematics”](#), Science Daily, 1/29/2010.
- <sup>12</sup> [“Dallas’ child poverty rate drops, but still high compared to other major U.S. cities”](#), Tristan Hallman, Dallas Morning News, 9/26/2017.
- <sup>13</sup> [“2017 The Commit Partnership Community Achievement Scorecard”](#), The Commit Partnership.