

The talkSTEM nonprofit organization is dedicated to broadening participation in STEM activities by all people. Our walkSTEM initiative, launched in 2017, is aimed at engaging girls and low income youth in meaningful STEM activities and thereby closing the opportunity gap that exists for them.

Mission:

To foster development of STEM identity for girls and low income youth by designing engaging, real-world experiences.

Vision:

A world where every person is a STEM person and every space is a STEM space.

To achieve our vision, we are partnering with private and public institutions and other nonprofits to build a network. This network provides opportunities for underrepresented groups in STEM to participate in unique learning experiences.

The walkSTEM network includes:

- Customized, standards-aligned walking tours of specific sites based on methodology developed by Dr. Glen Whitney, Founder of the National Museum of Mathematics
- Open-access, online platform of short videos
- Downloadable, standards-aligned educator guides accompanying all walkSTEM stops for K-12 students
- Support and resources for walkSTEM after-school clubs and summer camps
- Professional development for teachers and other educators

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 trajectories¹, 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.² 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”.³

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”.⁴

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.² 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.⁵ 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.⁶ 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.⁷ 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

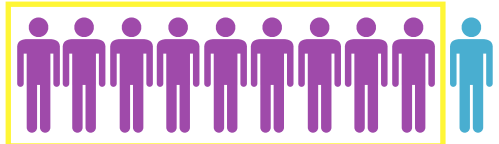
FIGURE 1: DISD STUDENTS STRUGGLE TO REACH PROFICIENCY IN MATH AND SCIENCE



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 ⁸:

- 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.⁹ 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.¹⁰

 [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.¹¹ walkSTEM provides educators with tools to help their students build STEM skills beyond completing rote classroom assignments.

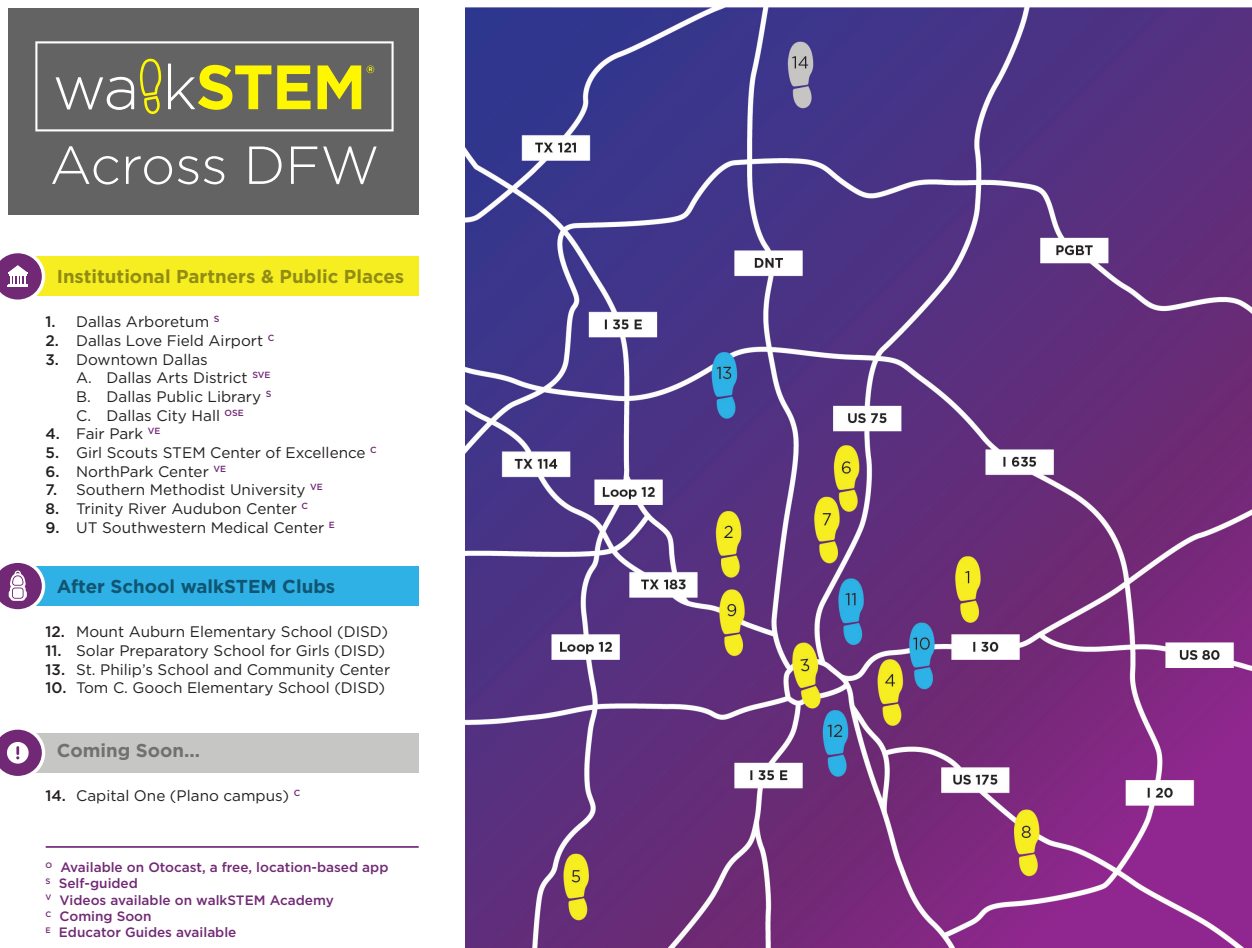
The walkSTEM initiative purposefully integrates formal and informal learning experiences by aligning state and common core standards with all walkSTEM experiences. We provide guidance through detailed educator guides for teacher use, and educator professional development for formal and informal settings. 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.¹² 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).¹³ 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



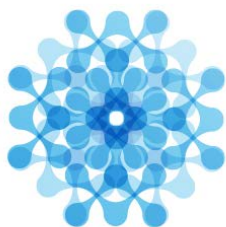
In creating an ecosystem of STEM, walkSTEM also aims to create a network of institutions, cities, neighborhoods, and schools that utilize walkSTEM programming. Network partners will gain access to knowledge sharing, collaboration, recognition via walkSTEM Academy and social media. This network will augment 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.



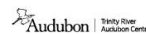
The Dallas Morning News

PRESENTS

Science
in the City



SCIENCE SATURDAY Community Partners



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

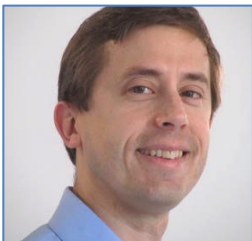
Dr. Koshi Dhingra, Founder and Executive Director



Koshi Dhingra received an undergraduate degree from the National University of Singapore and a Doctorate in Science Education from Teachers College, Columbia University. Her research focused on connecting formal and informal educational opportunities for over 20 years. She has years of experience

teaching at the middle and high school levels, and in teacher education programs. She previously served as a director of the Science and Engineering Education Center at the University of Texas at Dallas. Following this, she founded talkSTEM in Spring, 2015.

Dr. Glen Whitney, walkSTEM Advisor and Founder, National Museum of Mathematics



Glen Whitney received an undergraduate Math degree from Harvard University and a Ph.D. in Mathematical Logic from UCLA. He began his career teaching at the University of Michigan, then worked as a hedge fund quantitative analyst with Renaissance Technologies. In

2012, Whitney founded the National Museum of Mathematics in New York, NY, which aims to change public perceptions of mathematics and improve the way youth are educated in the United States. Whitney presents interactive math talks all over the country. He is a Visiting Professor in the Mathematics Department at Harvard University during the 2018-19 academic year.

Jonathan Edquid, Program Manager



Jonathan Edquid holds an undergraduate degree in Biology from the University of Texas at Austin. A science educator with experience in various school districts, Jonathan is also formerly of the National Math + Science Initiative, where he developed

and presented science and math teacher training. Jonathan also served as STEM Curriculum Designer for the Dallas Arboretum.

Mary Cary Peterson, Education Coordinator



Mary Cary Peterson holds a B.A. in Religious Studies from the University of Virginia, and spent several years working in the nonprofit sector before returning to school for education. She completed a field-based residency program with the

Friends' School of Boulder Teacher Preparation Program and taught in Colorado and Tennessee prior to moving to Dallas, where she worked as the STEAM Coordinator at Dallas ISD.



Brea Ratliff, Curriculum Consultant

Brea Ratliff holds a bachelors degree in Mathematics Education from Baylor University and a masters in Educational Leadership and Policy Studies from the University of Texas at Arlington.

Brea has taught mathematics at the elementary, middle and high school levels and has written mathematics curricula for Dallas ISD, the State Fair of Texas and the Dallas Cowboys organization. She is the founder and owner of Me to the Power of Three, LLC, a consulting company which creates tools and resources for K-12 learning.

Jenn Savage, Web and Graphic Design



Jenn Savage holds a B.F.A. in Advertising Design from the Art Institute of Dallas, where she also worked as a mathematics tutor to encourage students to understand and enjoy the intersections of math and art. She began work as a freelance graphic designer in

2010, and has worked with many clients in the non-profit sector over the course of her career. Jenn owns Awkward Robot, a visual design studio.

Malini Ratnam, Social Media Strategist



Malini Ratnam is a digital marketing professional with over 20 years of experience in marketing, advertising and digital media. Malini holds Masters degrees in Life Sciences and Advertising from University of Hyderabad in India and University of Illinois Urbana-Champaign, respectively. Her

experience spans the United States, Europe and Asia and she has worked across multiple cultures, languages and industries. Malini owns Mantram Digital Media, a digital consulting firm.

Community Contributors

Teaching Fellows

talkSTEM Fellows are Doctoral Candidates from area universities who assist with content creation. The Fellows program is a deliberate gathering of individuals with varied and relevant backgrounds ranging from architecture and urban design to math and science. talkSTEM Fellows work with the core team to generate new content for the walkSTEM initiative. These individuals are helping walkSTEM scale and expand while maintaining high-quality content.

Professional Contributors

We are grateful for the assistance of our expert community members, who help us generate new walkSTEM content.

Docents

Educators and other professionals from public and private schools, universities, informal learning spaces, and industry and corporate settings participate in the walkSTEM docent program. Docents lead groups through live walkSTEM experiences, including walkSTEM@Dallas Arts District and walkSTEM@NorthPark Center.

Junior Docents

walkSTEM Junior Docents are young men and women from various public and private high schools in the Dallas area. Junior Docents volunteer their time to assist docents during walks and at special events, such as the Dallas ISD STEM Expo.

PROFESSIONAL CONTRIBUTORS



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Dr. Fredrick Olness,
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TEACHING FELLOWS



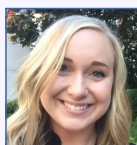
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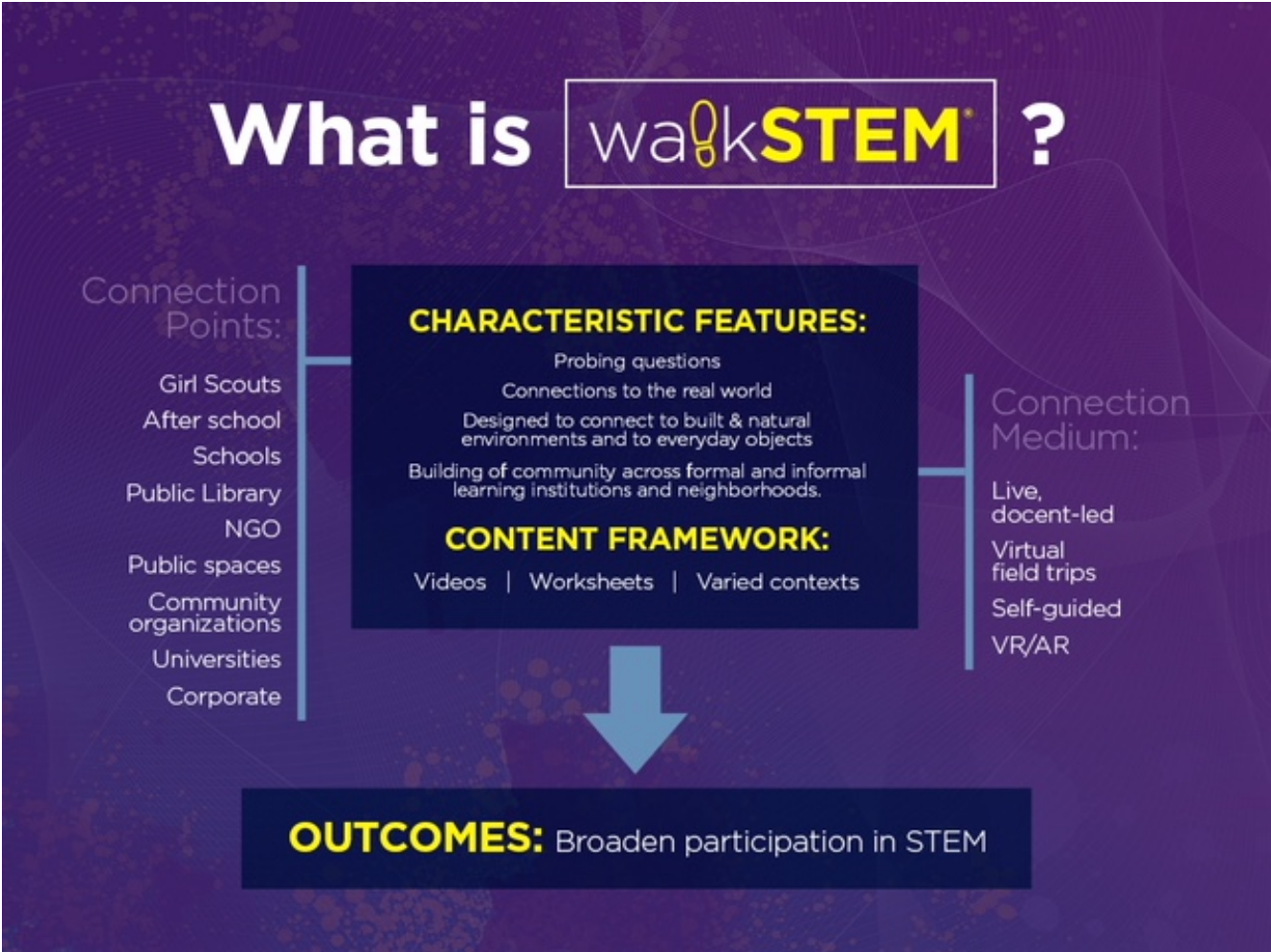
Brittany Stewart, Biological
Sciences at UT Southwestern
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What is walkSTEM?

The walkSTEM initiative was created by talkSTEM, a 501(c)3 non-profit based in Dallas, Texas, in 2017. talkSTEM aims to build a community of scientists by bringing together individuals across a variety of disciplines and encouraging them to share how they interact with STEM on a regular basis.

walkSTEM is a learning methodology that encourages STEM engagement and literacy among preK-12 students. By highlighting STEM experiences in everyday life, walkSTEM enables students to interact with math outside of the traditional classroom setting but also provides ample opportunities to connect to standards-aligned curriculum. walkSTEM connects formal and informal education, encouraging educators to utilize the methodology to create custom walkSTEM experiences in their schools and communities. The initiative meets students where they are by providing captivating occasions to engage with math in highly-accessible settings, including online and in underserved schools.

FIGURE 3: WHAT IS WALKSTEM?



walkSTEM broadens the traditional definition of STEM and encourages interdisciplinary connections. The overall goals of the program are broadening participation in STEM through development of STEM literacy and STEM identity. All walkSTEM content is created by the Executive Director, Program Manager, and talkSTEM Fellows, in consultation with Dr. Glen Whitney, walkSTEM Advisor.

The walkSTEM initiative is made up of three interconnected sets of activities: designing walkSTEM experiences, walkSTEM Academy, and after-school walkSTEM clubs.

1. Designing walkSTEM experiences

Program

- A walkSTEM experience introduces students and their families to STEM encounters in their surroundings. Walks consist of several “stops” and may be self-guided or docent-led. Participants can access videos of each stop via walkSTEM Academy and/or may be given a walkSTEM guide on-site.

Current Status

- Current walk sites include:
 - ▶ Dallas Arts District
 - ▶ NorthPark Center
 - ▶ Dallas City Hall Plaza
 - ▶ SMU campus
 - ▶ Fair Park ([watch "walkSTEM: Texas Star" on Youtube to see the walkSTEM experience at Fair Park in Dallas, Texas](#))
 - ▶ Dallas Public Library
 - ▶ Dallas Arboretum
 - ▶ Trinity River Audubon Center
 - ▶ Girl Scouts STEM Center of Excellence
 - ▶ UT Southwestern Medical Center
- Upcoming walk sites include:
 - ▶ Texas Discovery Gardens at Fair Park
 - ▶ Dallas Zoo
 - ▶ Dallas Love Field Airport

Our Vision for the Future

- walkSTEM experiences will exist in cities and surrounding communities throughout the United States.
- All walks will be recorded with high-quality video and uploaded to the walkSTEM Academy site.
- Engaging guides for all walkSTEM tours will be available through a location-based app.

FIGURE 4: WALKSTEM TOUCHPOINTS

PUBLIC TOUCHPOINTS

- Docent-led, **guided tours**.
- **Self-guided tours**.
- walkSTEM **Academy videos**.
- **Educational materials**, including artist-created maps that facilitate self-guided exploration of walkSTEM sites and activity sheets that accompany walkSTEM stops. Educational materials can be used with walkSTEM Academy Videos or on live tours.
- Otocast **audio guides** (Otocast is a location-based app hosting audio guides to over 3500 points of interest throughout the United States. The app is used by the City of Dallas Public Arts Program).
- **Volunteering** as a docent.
- Additional touchpoints, including an **augmented reality** experience, are currently in development.

PREK-12 TOUCHPOINTS

- After-school **walkSTEM Clubs**.
- **Professional development** workshops for teachers.
- **In-class** walkSTEM activities.
- **Field trips** featuring teacher- or docent-led walkSTEM tours.
- **Volunteering** as a junior docent.

#IwalkSTEM



"Because STEM knowledge is a great tool for understanding the world and solving problems...it's a foundational element to success."

Torrence Robinson
President,
The Fluor Foundation

2. walkSTEM Academy

Program

- walkSTEM Academy is an open-source, highly accessible, online video library where people can find engaging examples of math, science and related concepts from diverse fields of study. All videos can be accessed via YouTube.
- Examples of STEM in the real world are recorded and uploaded to the walkSTEM Academy site. Short videos allow students to visit or revisit walkSTEM experiences virtually, thus removing limitations caused by transportation.
- walkSTEM Academy cultivates an alliance of students and educators who share interests and intellectual curiosity towards STEM learning.
- The open-source site also includes educator trainings; walkSTEM Academy builds educator competence and confidence in applying walkSTEM principles in their own teaching practices. Free access to a continuously growing, standards-aligned, video collection allows for transformative practice in schools.

Current Status

- 32 videos are available on the walkSTEM academy site. More will be added in the next few months from walkSTEM experiences at SMU, Girls Scouts STEM Center of Excellence, Dallas Zoo, and Dallas Love Field Airport.
- walkSTEM educator guides will be available for each video thanks to a grant from the City of Dallas Office of Cultural Affairs.

Our Vision for the Future

- walkSTEM Academy will become a platform for innovative thought leadership about the walkSTEM methodology and informal STEM learning practices.
- The Academy will be in part curated by walkSTEM program designers and in part by partners across the country, who will be encouraged to submit their own videos following the walkSTEM methodology. This encourages students and educators to take ownership and engage with STEM experiences in the world around them.
- walkSTEM Academy will be hosted through an updated walkSTEM website. Videos will be complemented by robust educator guides. All material will be tagged and organized into categories for ease of use by educators.
- All walkSTEM Academy videos will be accessible on computers and mobile devices through the walkSTEM app. Participants will be able to utilize academy content while engaging in live walkSTEM experiences.

FIGURE 5: DISSEMINATION PARTNERS

PARTNER ORGANIZATION	REACH
ATTPAC	500,000 visitors served each year
KERA Education Newsletters	2,100 individuals reached
City of Dallas Office of Cultural Affairs	Promotes walkSTEM and disseminates walkSTEM content via Social Media
Dallas Afterschool	180 partner sites
	14,000 children served each year
Dallas ISD STEM Department	Presented walkSTEM materials to 700 STEM team members representing all DISD schools
Dallas Museum of Art	80,000 visitors served in 2017
Dallas Zoo	1.2 million visitors served each year
	120,000 students served each year
Nasher Sculpture Center	100,000 visitors served each year
	12,000 students served each year
Dallas Symphony Orchestra	Disseminates walkSTEM educator guides to 150 schools each year
	Features walkSTEM on DSO kids website

3. Afterschool walkSTEM clubs

Program

- walkSTEM clubs bring engaging STEM learning opportunities to students in their neighborhoods and schools. Students develop walkSTEM tours of their own with teachers and peers whom they are familiar with.
- walkSTEM academy videos provide models for teacher and students so they can build their own walkSTEM experiences with these models in mind. Educators are encouraged to upload the walkSTEM experiences they create with their students to the Academy site.

Current Status

- walkSTEM piloted a free Afterschool Club in Spring 2017 at Mount Auburn STEAM Academy, a Title 1 school in DISD. In January 2018, walkSTEM clubs were initiated at two additional DISD schools, Gooch Elementary and Solar Preparatory School for Girls. St. Philips School and Community Center, Wesley Rankin Community Center and others plan on launching walkSTEM clubs in Fall 2018.
- An in-class experience using similar methodologies was piloted at a DISD elementary school in Spring 2018.

Our Vision for the Future

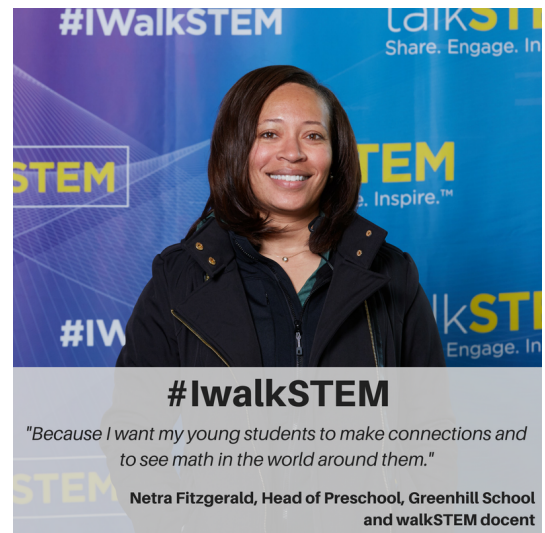
- Clubs will exist at schools and community centers throughout the United States.
- Best practices in engaging preK-12 students in informal STEM experiences will continually be published and updated on an expanded walkSTEM website.
- walkSTEM practices will be incorporated during the school day through in-class informal learning occurrences.
- walkSTEM will host educator conferences to foster collaboration and community in the STEM learning space.

Audience and Impact

walkSTEM's programming serves a wide audience including preK-12 students, educators, and families throughout Dallas, with a focus on disadvantaged communities and girls.

walkSTEM is uniquely poised to make an impact in STEM education because of the flexibility and access that its model provides. By cutting across formal and informal education models, walkSTEM works outside the traditional preK-12 pipeline to provide touchpoints online, in the community, and through afterschool programs. The multiple media and connection points offered by walkSTEM result in broad participation with the potential to reach many populations.

walkSTEM expands its reach collaboratively with its strategic partners, including the Girl Scouts, Southern Methodist University, and the Dallas Museum of Art. Moreover, we see social media as a critical tool in building our community; we invite all walkSTEM participants to continue the conversation by engaging with our channels.



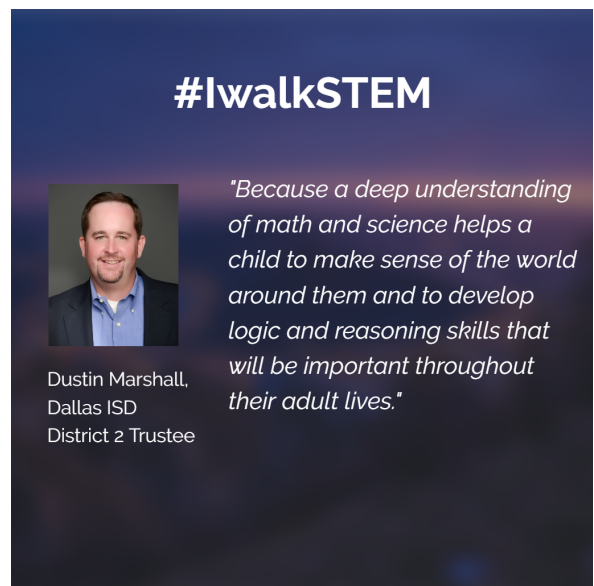
walkSTEM has made an incredible impact in its first year. Our approach has been validated by community and education partners throughout the City of Dallas. The next step to building our vision is to increase the number of people served through all connection points (walkSTEM experiences, Afterschool Clubs, online through walkSTEM Academy, and consulting services for educational sites). walkSTEM has and will continue to grow through strategic partnerships with stakeholders who see the value of real-world STEM experiences. We look for partners who have established relationships with key constituencies (including underserved communities and girls) and can bring the walkSTEM methodology to these groups.

The walkSTEM program aims to make it easy for cities, schools and institutions, to create their own walkSTEM experiences. Our goal is to create a framework and tools that are free and easily accessible through the walkSTEM website. By disseminating best practices, walkSTEM methodologies can be easily utilized by interested parties. We encourage institutions to create their own walks and provide paid consulting services for groups who want customized walkSTEM experiences or professional development. This model permits walkSTEM partners to achieve maximum impact with minimal internal resources.


walkSTEM has already been approached by communities outside of Dallas who are interested in developing walkSTEM experiences in their cities, but our current capacity is insufficient to meet these needs. In order to successfully implement this model, we need strategic investments in the areas of human capital and technology.

Our Current Needs

- To create a sustainable and scalable organization, we need a full-time, paid staff. Currently, we rely heavily on volunteer support and cannot provide the level of service necessary to to scale our initiative. We need to hire a full-time Program Director and part-time Marketing and Communications Director within the next year.
- In order to increase our reach, we must make strategic investments in technological solutions. Resources for media and content creation, website and mobile app development are necessary to expand walkSTEM's impact.
 - ▶ In order to achieve our goal of creating an online space for thought leadership in informal STEM learning, walkSTEM needs a updated, high-quality website. The website will serve as a functional tool for students and educators and will include categorized, searchable content.
 - ▶ A walkSTEM mobile app will make it easy for

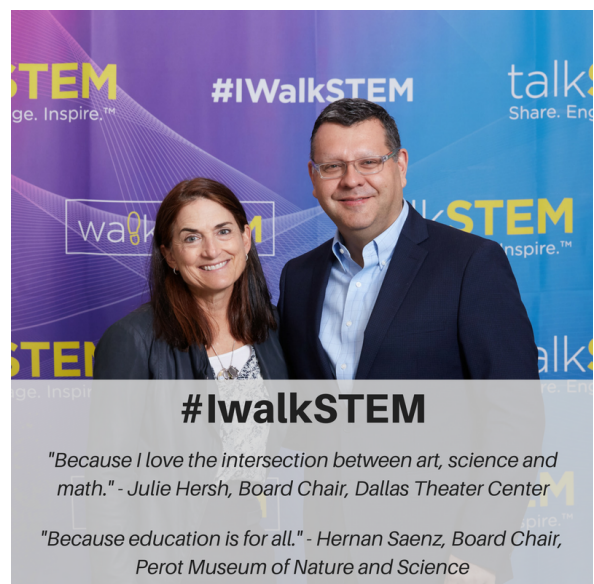


#IwalkSTEM




"Because a deep understanding of math and science helps a child to make sense of the world around them and to develop logic and reasoning skills that will be important throughout their adult lives."

Dustin Marshall,
Dallas ISD
District 2 Trustee



#IwalkSTEM



"Because I love the intersection between art, science and math." - Julie Hersh, Board Chair, Dallas Theater Center

"Because education is for all." - Hernan Saenz, Board Chair, Perot Museum of Nature and Science



JUDY ALVARENGA, DALLAS ISD TEACHER, AND OSWALDO ALVARENGA, DIRECTOR OF STEM, DALLAS ISD.



WALKSTEM FOUNDER AND EXECUTIVE DIRECTOR, DR. KOSHI DHINGRA, AND ADVISOR DR. GLEN WHITNEY.

people to engage in walkSTEM experiences throughout the metroplex, and eventually throughout the United States. A location-enabled app will show users nearby walkSTEM stops and provide them with text and video guides from walkSTEM academy in order to enhance their experience.

- ▶ Estimated one-time costs for website reorganization and app development are \$25,000 and \$100,000 respectively. Due to the high financial burden, walkSTEM will only be able to pursue these vital initiatives if they are sponsored through in-kind or monetary support.

To effectively reach the next level of service, we developed a strategic growth plan for the next three years:

- 2019 - hire full-time Program Director, hire part-time Development and Communications Manager, Reorganize walkSTEM website, launch many additional walkSTEM Clubs, create additional community walks in the Dallas-area.
- 2020 - hire a second Program Director, hire full-time Development and Communications Manager, development of walkSTEM mobile app, lease designated walkSTEM office space, launch additional walkSTEM Clubs, create additional community walks in DFW Metroplex and greater Texas.
- 2021 – launch additional walkSTEM Clubs, create additional community walks in Texas and nationally.

In order to fund these strategic initiatives while also keeping walkSTEM experiences accessible to all, walkSTEM must significantly increase contributed income. We will also aim to increase earned income by providing staff development training, walkSTEM implementation consulting services, and content creation services.

In 2017, talkSTEM debuted two [walkSTEM experiences in the Dallas Arts District](#) that center around elementary and middle school math concepts. The walks are free of charge and take place in public spaces so that all people can take advantage of the experience. Both walks were designed by Dr. Glen Whitney, Founder and then President of the National Museum of Mathematics in New York City, and experts in the STEM education field. Stops in the Arts District include Booker T. Washington High School for the Performing and Visual Arts, the Morton H. Meyerson Symphony Center, and the Hunt Oil Building. As a resource-rich neighborhood, the Dallas Arts District contains a wealth of community partners with missions that work in synergy with the mission of walkSTEM.

walkSTEM in the Dallas Arts District was launched in conjunction with talkSTEM's Pi Day Math festival. walkSTEM's community partner, AT&T Performing Arts Center (ATTPAC) assisted by providing free parking to all walkSTEM participants. Given the great success of the Pi Day Math Festival in 2017, walkSTEM was approached by ATTPAC with a partnership request for the Pi Day Math Festival in 2018. ATTPAC was a full partner in the 2018 festival.

walkSTEM organized ten docent-led walkSTEM@Dallas Arts District walks to take place during the festival; each walk was at capacity and there was a waitlist. walkSTEM docents are educators from area schools, universities, and informal learning spaces. Docents received training from Dr. Whitney and a stipend for their time spent in training and leading walks. Following the launch, guided walks were offered on the first Saturday of each month throughout 2017.

All stops in the Dallas Arts District walk were professionally filmed and uploaded to the walkSTEM Academy YouTube page. walkSTEM Academy videos allow individuals to take self-guided walkSTEM tours of the district whenever guided-tours are not offered. Moreover, videos enable students, educators, and parents to experience the entire walk virtually. Support for the creation of these videos came from the City of Dallas Office of Cultural Affairs.

walkSTEM provided docent-led experiences for several school and nonprofit groups, including the Urban League of Greater Dallas, who then went on to visit one of the Arts Districts museums. Moreover, over 895 schools scheduled field trips to the DMA in 2017, where they were able to experience walkSTEM as part of their tour. Students are able to view the walkSTEM Academy video based on an artwork located right outside the museum's doors.

 [Watch Miguel Covarrubias' Genesis, The Gift of Life through a mathematical lens.](#)

Similarly, visitors to the Nasher Sculpture Center, Wyle Theater, Margot and Bill Winspear Opera House, Meyerson Symphony Center, and Klyde Warren Park can take advantage of the walkSTEM stops situated at each of these sites.

HOW WALKSTEM@DALLAS ARTS DISTRICT HAS IMPACTED THE COMMUNITY

walkSTEM docent-led walks:

- **750 people served** at Pi Day Festivals in 2017 and 2018.
- **250 people served** during free first Saturday walks in 2017 (April - December).

Tours for nonprofit organizations and schools:

- Urban League of Greater Dallas
- So SMAART Program of Trinity Chapter of The Links, Incorporated
- Girl Scouts of Northeast Texas
- Family Gateway
- Irma Lerma Rangel Young Women's Leadership School
- Family Gateway (A Day to Play community event)
- Dallas Theater Center (Family Day event)

Educator training:

- 60 Dallas Museum of Art docents
- Region 10 teachers (for credit, professional development workshop)
- Teach for America Education team at Trinity River Audubon Center, Dallas
- STEM Academy for Dallas ISD Science teachers at SMU Simmons

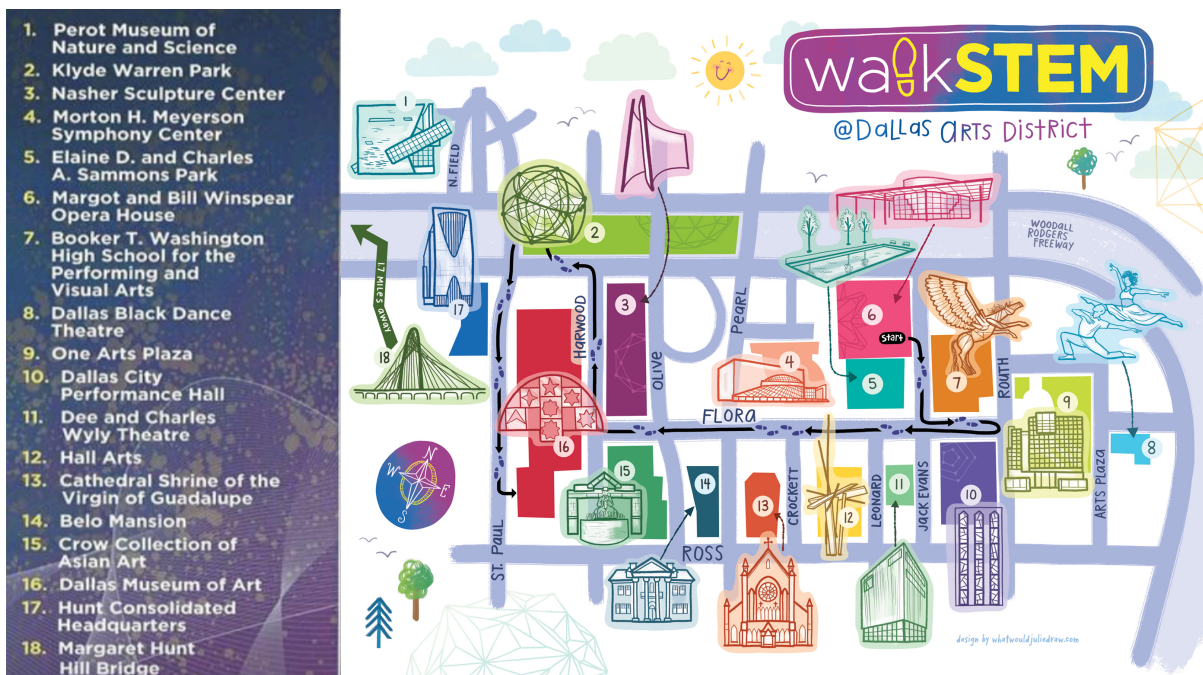
walkSTEM@Dallas Arts District led to many valuable partnerships and opportunities to expand the walkSTEM mission. walkSTEM received a second grant from the City of Dallas Office of Cultural Affairs in 2018 to create detailed educator guides for each stop in the Arts District. This grant was focused on the goal of providing equitable educational opportunities in Dallas. These guides contain activity sheets that educators can use before, during, and after the walk or virtual field trip, and are available as free downloads on the talkSTEM website. The Dallas ISD STEM department is actively encouraging all teachers to utilize these resources. The talkSTEM team presented these and other resources to about 700 Dallas ISD STEM campus leadership personnel (PreK-12) in September, 2018 by invitation of the Dallas ISD STEM leadership team.

Additional educator development experiences at the Dallas Arts District included a workshop for 50 Teach for America teachers who will be teaching at DISD and at Fort Worth ISD schools during the 2018-2019 school year. Held at walkSTEM’s community partner space, Dallas Museum of Art, the workshop allowed teachers to experience walkSTEM methodologies and learn how to apply it to their classrooms. walkSTEM also collaborated with Texas Region 10 schools to deliver a teacher workshop in September, 2018. Region 10 is comprised of 80 public school districts and 35 public charter schools across Kaufman, Rockwell, Hunt, Fannin, Grayson, Dallas, Collin, Ellis and a portion of Van Zandt counties. Moreover, high school girls from Irma Lerma Rangel Young Girls Leadership School, an all-girls school in Southern Dallas, participated in summer activities in the arts district through walkSTEM.

At the request of the DMA Education Department, DMA docents participated in a walkSTEM workshop in the fall of 2017. A walkSTEM guide for the *Cult of the Machine*, a new exhibition that opened at the museum in September 2018, will be designed in collaboration with museum staff for use in their family and homeschool programming.

The walkSTEM methodology not only provides a valuable experience for students to engage in mathematics in the real world, but it also works in union with museums and cultural institutions.

[View the walkSTEM Academy “Dallas Arts District” playlist to see the 18 stops designed for this public space.](#)



WALKSTEM@DALLAS ARTS DISTRICT HANDOUT FOR SELF-GUIDED AND DOCENT-LED TOURS.

walkSTEM recognizes that many communities face barriers to engaging with live walkSTEM experiences. In order to counter this disadvantage, walkSTEM established its first after-school club in 2017 at Mount Auburn STEAM Academy, a DISD Title 1 School. This school will continue operating walkSTEM clubs lead by teachers in fall, 2018. By bringing walkSTEM methodologies to local campuses, disadvantaged students will not only have access to engaging STEM opportunities, but they will also recognize that learning opportunities exist everywhere - not only in resource-rich areas.

walkSTEM clubs create an opportunity for multiple touchpoints with the walkSTEM methodology. Clubs reinforce ideas learned in community walks. Moreover, walkSTEM Clubs, coupled with the walkSTEM Academy, allow students to interact with the walkSTEM methodology in a familiar setting, with teachers and peers whom they are comfortable with.

walkSTEM expanded their after-school club model to Solar Preparatory School for Girls, a DISD all-girls school, and Gooch Elementary, a DISD Title 1 School. Young Women’s STEAM Academy at Balch Springs, St. Philips School and Community Center and Wesley Rankin Community Center in West Dallas are some of the other sites interested in having their students participate in walkSTEM activities.

walkSTEM has received positive feedback from educators. Teachers noted that kids who normally do not engage in class activities were active and engaged in the walkSTEM club programming. It was apparent that children felt a sense of pride and accomplishment when leading their parents through the STEM walk they created. Moreover, watching the walkSTEM videos gave the children a sense of belonging to the greater walkSTEM movement.



The walkSTEM club model is actively being promoted by Big Thought and Dallas Afterschool, two umbrella organizations for hundreds of afterschool programs in Dallas. Both organizations are disseminating information about walkSTEM clubs to their academic and community partners.

Mount Auburn STEAM Academy is also participating in a research study conducted by SMU Simmons School of Education and Human Development, in partnership with Dallas ISD, to assess impact of the walkSTEM club experience on both student learning and teacher practice.

“People of all ages learn science in an increasingly wide variety of ways. Formal schooling is only one part of a larger ecosystem of science, technology, engineering and math (STEM) learning that also occurs throughout one’s lifetime.” – InformalScience.org (website operated by Center for Advancement of Informal Science Education, a National Science Foundation-funded resource center for the Advancing Informal STEM Learning program)

While adults often underestimate the developmental capabilities of young children, studies have found that children begin systematically and intentionally exploring their environment even as infants. Young children have an enormous capacity for STEM learning and early STEM engagement is critical for a child’s future development. Informalscience.org, a National Science Foundation initiative, suggests that early learning outcomes can have long-term effects on a child’s interest in and engagement with STEM later in life. Moreover, engagement with STEM at a young age may form the foundation of differences in science participation across genders.

The importance of early childhood education was underscored by recent study of kindergarten readiness by Dallas Independent School District. The research found that students who who attended Pre-K were twice as likely to be Kindergarten Ready than eligible students who did not attend Pre-K; students who are Kindergarten Ready are three times as likely to be reading on grade level in 3rd grade than their peers who were not Kindergarten Ready.¹⁵




With this research in mind, walkSTEM piloted an early childhood education program in a pre-kindergarten classroom at Gooch Elementary (DISD) in Spring 2018. Through this pilot we developed a collection of best practices that engage young learners while remaining developmentally appropriate. We have received extremely positive feedback from educators and plan to expand the program to additional schools and early childhood centers. As always, walkSTEM wants to make it easy for educators to utilize the walkSTEM methodology in the classroom. Proposals for incorporating walkSTEM into early childhood education include “walkSTEM in a box” – a kit that gives early childhood educators all the tools they need to engage their students in STEM activities. Moreover, conversations with DISD schools about instituting walkSTEM programming throughout the school day for K-12 students are ongoing.

¹⁵ [2017 The Commit Partnership Community Achievement Scorecard](#), The Commit Partnership.

walkSTEM has focused its outreach efforts on elementary, middle, and high school-aged girls. Current programs designed to increase interest in math among young women include a walkSTEM project at the Girl Scouts of Northeast Texas STEM Center of Excellence, walkSTEM clubs at schools and community organizations for girls, and field trips for all-girls schools to engage with live walks in Dallas.

The Girl Scouts STEM Center of Excellence is located in southwest Dallas and is positioned with easy access to southern Dallas residents and schools whose communities have been traditionally under-resourced, thus easing access for historically marginalized communities. The STEM Center of Excellence anticipates serving over 10,000 Girl Scouts in 2018-2019. This project was made possible by a grant from High Tech High Heels, a non profit organization whose vision is to close the gender gap in STEM professions in the United States. Moreover, the Girl Scouts of Northeast Texas offer a walkSTEM badge to Girl Scouts who participate in walkSTEM experiences.

HOW WALKSTEM ENGAGES GIRLS	
○	Customized walkSTEM@Girl Scouts STEM Center of Excellence
○	walkSTEM is a Girl Scouts STEM Patch
○	Field trips for So SMAART of Trinity Chapter of The Links, Incorporated and Irma Lerma Rangel Young Girls Leadership School
○	Partnership with newly formed social impact institute at Hockaday
○	Partnership with Young Women's STEAM Academy in Balch Springs
○	Role models through talkSTEM Fellows, junior docents (most of whom are women)



#IwalkSTEM

"Because we believe all girls can succeed through STEM education."

Young Women's Preparatory Network

walkSTEM is partnering with a number of girls' institutions including Solar Preparatory School for Girls, Young Women's Preparatory Network (consisting of 7 schools across Texas), Young Women's STEAM Academy in Balch Springs, and the newly formed Social Impact Institute at Hockaday School. We hope to create a coalition of girls' schools across the socioeconomic spectrum and foster the development of a formal or informal girls in STEM network.

walkSTEM has also coordinated field trips to the Arts District for several underserved, girls' schools and community organizations, including the So SMAART of Trinity Chapter of The Links, Incorporated (a nonprofit group that works with middle school aged girls from Southern Dallas on STEM topics) and Irma Lerma Rangel Young Girls Leadership School.

WALKSTEM

Koshi Dhingra
817.366.6194
koshi@talkstem.org

talkSTEM.org

walkSTEM offers free math walks designed in partnership with Dr. Glen Whitney, founder of MOMATH in NYC. These walks engage kids in learning how math is a dynamic part of our surroundings. We offer guided walks in the Arts District on select Saturdays and self-guided walks via the Otocast app.

Awards Offered: Math STEM Seal of Approval patch

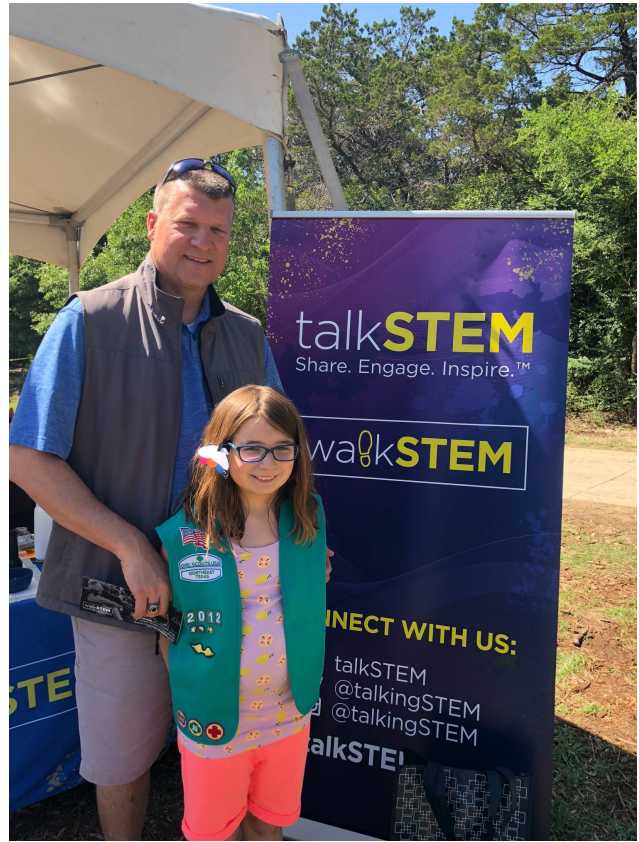


Walk with us and learn how to make connections between math and the real world for girls of all ages.

A variety of free guided and self-guided walks are available. Learn more at www.walkstem.org

Photo credit: Sarah Bradbury

WALKSTEM IS LISTED AS PROGRAM PARTNER FOR GIRL SCOUTS OF NORTHEAST TEXAS IN THE 2017-2018 GIRL SCOUT PROGRAM SUPPLEMENT.



walkSTEM is an initiative under talkSTEM, a 501(c)3 non-profit organization. talkSTEM was founded in 2015 by Dr. Koshi Dhingra. She created talkSTEM to serve as an ecosystem of science and math learning opportunities both inside and outside of the traditional school setting, with the goal of engaging students in STEM experiences “beyond the textbook”. In addition to the walkSTEM initiative, talkSTEM offers a variety of other programs.

talkSTEM Digital Forum

talkSTEM aims to create a community of scientists by inviting traditional and unexpected STEM leaders to share their perspectives via the talkSTEM Digital Forum. The Forum consists of over 100 original articles and videos created by local, national, and international experts in STEM education. The Forum is a place for sharing best practices from a diverse set of people, all engaged in STEM in varied ways. Forum contributors include:

- Ali Benjamin, young adult author and finalist for national book award
- David Chard, President of Wheelock College, previously Dean of SMU Simmons School of Education
- Tim Chartier, Professor of mathematics at Davidson College in Davidson, North Carolina
- Shilpi Jain, chemist and entrepreneur
- Michael Mayhew and Michelle Hall, founders of a teen science cafe network
- Cathy O'Neil, author of Weapons of Math Destruction
- James Tanton, Mathematician-at-Large for the Mathematical Association of America, cofounder of the Global Math Project
- Kent Rathbun, Chef
- Aura Satz, artist
- Conrad Wolfram, strategic director of Wolfram Worldwide Group, founder of the nonprofit Computer Based Math

Growing Lab Girls

Growing Lab Girls is a curriculum toolkit created by talkSTEM for grades 7-12 teachers in Language Arts, Science, Engineering, and Mathematics. The curriculum is available online on the talkSTEM website and is inspired by Dr. Hope Jahren's book, *Lab Girl*. The toolkit provides powerful messages about the universal relevance of science to each and every one of us. Publishers of Lab Girl, Penguin Random House, are helping to disseminate the curriculum through social media and at national conferences. Collaborators include Dallas Arboretum, Design Connect Create, UT Southwestern, and Southern Methodist University. Dallas ISD has listed *Growing Lab Girls* as a recommended resource for all middle and high school science teachers



GROWING LAB GIRLS
 A Free Curriculum Supplement for ELA, Science, Engineering and Math Teachers (grades 7-12)
 CREATED BY talkSTEM™

inspired by Dr Hope Jahren's 2016 memoir *Lab Girl*, a National Bestseller and *A New York Times* Notable Book

AUTHENTIC ACTIVITIES • STANDARDS-ALIGNED • GIRL-CENTERED

Designed in collaboration with Dallas Arboretum; Design, Connect, Create; SMU; UT Southwestern Medical Center.

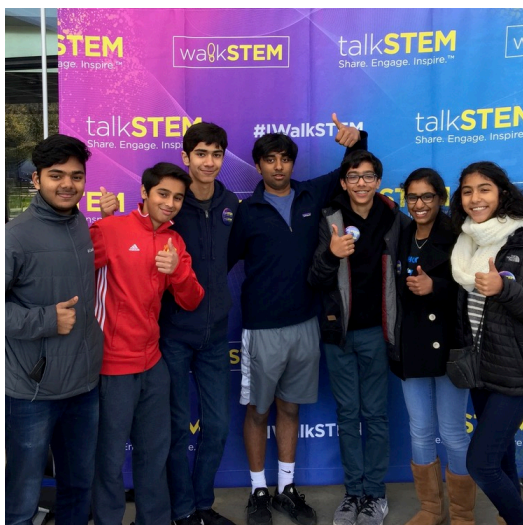
Contains Student Writing and Photography Contests

Visit talkSTEM.org to view and download this free resource.

All excerpts from LAB GIRL by Hope Jahren. Copyright © 2016 by Hope Jahren. Used by permission of Alfred A. Knopf, an imprint of The Knopf Doubleday Publishing Group, a division of Penguin Random House LLC

Special Events - Pi Day Math Festival

talkSTEM hosted its second annual Pi Day Math Festival in partnership with ATPAC in the Dallas Arts District on March 14, 2018. The Festival was attended by over 400 students and parents. The event featured guided walkSTEM tours of the Dallas Arts District, and interactive booths sponsored by 20 varied organizations, including EARTHx, the Dallas Zoo, KERA, the Dallas Museum of Art, and Dallas Love Field Airport. A key goal was for visitors to engage with real world math concepts embedded in these varied spaces and spheres of activity.



AT&T
PERFORMING
ARTS
CENTER

talkSTEM and
present

<p>AT&T PERFORMING ARTS CENTER Tours of Winspear</p> <p>BOLD IDEA Binary Number Challenge!</p> <p>DALLAS ARBORETUM Natural Tessellations</p> <p>DISD STEM ENVIRONMENTAL RESOURCE CENTER Field Measurements</p> <p>DALLAS MUSEUM OF ART Andean Number Systems</p> <p>DALLAS SYMPHONY ORCHESTRA Instrument Petting Zoo</p>	<p>DALLAS ZOO How Much Should Animals Eat?</p> <p>SMU A Recipe for Orange Pi?</p> <p>TEXAS DISCOVERY GARDENS A Butterfly's Life</p> <p>TEXAS LEGENDS Science in Sports</p> <p>DALLAS PUBLIC LIBRARY Graphical Displays</p> <p>DALLAS LOVE FIELD Will it Fly?</p> <p>DCCCD STEM INSTITUTE Pi and Other Math Friends</p>	<p>CROW COLLECTION OF ASIAN ART Beautiful Geometry of Islamic Patterns</p> <p>EARTHx Virtual Reality</p> <p>KERA Digital Resources</p> <p>UT SOUTHWESTERN MEDICAL CENTER Math in the Lab</p> <p>MICROSOFT STORE NORTH PARK What Happens During an Earthquake?</p> <p>TALKSTEM walkSTEM@Dallas Arts District</p>
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#ATTPACTalkSTEM

Exhibit 1: Strategic Initiatives

walkSTEM must make strategic investments in human capital, office space, and technology in order to scale our model and expand our impact.

Strategic Growth Initiatives	2018	2019	2020	2021
Executive Director	\$ 72,100	\$ 74,263	\$ 76,491	\$ 78,786
Full-time Program Director ¹	13,333	40,000	41,200	42,436
Full-time Program Director ²	-	-	40,000	41,200
Part-time Development and Marketing Coordinator	-	25,000	-	-
Full-time Development and Marketing Coordinator	-	-	40,000	41,200
Lease Office Space	-	11,550	12,128	12,734
Total	13,333	76,550	133,328	137,570

In addition to the strategic initiatives listed above, walkSTEM needs significant investments in technology in order to scale the movement. We are seeking in-kind as well as financial support for a high-quality, redesigned website and a location-enabled mobile app. Estimated one-time costs for website organization and app development are \$100,000 and \$25,000 respectively. Due to the high financial burden, walkSTEM will only be able to pursue these vital initiatives if they are sponsored through in-kind or monetary support.

Exhibit 2: Income Statement

In order to fund our strategic initiatives, walkSTEM must more than double our current contributed income by 2021. walkSTEM will also increase earned income over the next several years by offering customized educator trainings, implementation advice, and content creation services. Over 70% of our expenses will be allocated to programs each year.

	Actual	Projected			
	2017	2018	2019	2020	2021
Revenue					
Individual Donations	\$ 41,576	\$ 6,500	\$ 26,000	\$ 40,000	\$ 41,500
Corporate and Institutional Donations	11,000	11,000	63,000	77,000	78,000
In-kind Donations	85,000	100,883	7,500	9,000	8,000
Government Grants	5,000	16,500	25,000	31,500	30,000
Earned Income	4,260	35,000	56,500	76,450	110,150
Total	146,840	169,883	246,000	319,450	354,650

Expenses					
Program	\$ 124,760	\$ 155,393	\$ 193,624	\$ 246,249	\$ 263,107
General and Administrative	9,630	7,056	20,017	22,288	25,871
Marketing and Development	10,900	4,608	30,991	49,585	63,100
Total	145,290	167,057	244,632	318,122	352,077

NET INCOME	1,550	2,826	1,370	1,330	2,570
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Exhibit 3: Income Detail

	Actual	Projected			
	2017	2018	2019	2020	2021
Contributed Income					
Individual Donations	\$ 41,580	\$ 6,500	\$ 26,000	\$ 40,000	\$ 41,500
Corporate and Institutional Donations	11,000	11,000	63,000	77,000	78,000
In-kind Contributions ¹	85,000	100,883	7,500	9,000	8,000
Community Grants			68,000	85,500	87,000
Government Grants	5,000	16,500	25,000	31,500	30,000
Total Contributed Income	142,580	134,883	189,500	243,000	244,500
Earned Income					
Educator Workshops	-	-	12,500	19,250	33,000
Implementation Consulting	-	-	4,000	7,200	12,150
Content Creation	4,260	35,000	40,000	50,000	65,000
Total Earned Income	4,260	35,000	56,500	76,450	110,150
Total	\$ 146,840	\$ 169,883	\$ 246,000	\$ 319,450	\$ 354,650

¹ 2017 and 2018 budgets includes in-kind personnel contributions of \$85,000 and \$100,883. In order to transition to a sustainable business model, these expenses will be paid as salaries and supported by monetary contributions from 2019 onward.

Exhibit 4: Expense Detail

	Actual	Projected			
	2017	2018	2019	2020	2021
Program					
Executive Director ¹	70,000	72,100	74,263	76,491	78,786
Advisor ²	15,000	15,450	15,914	16,391	16,883
Part time Program Manager	11,175	12,500	-	-	-
Full-time Program Manager 1 ³	-	13,333	40,000	41,200	42,436
Full-time Program Manager 2	-	-	-	40,000	41,200
Professional Services (docents, teaching fellows, etc.)	3,300	11,000	26,925	28,437	30,095
Event Expenses	5,100	2,000	2,060	2,122	2,185
Otocast app	-	2,000	2,200	2,420	2,904
Academy Content	-	6,500	7,150	7,865	9,438
Website Maintenance	2,100	3,150	3,780	4,536	5,443
Social Media	3,500	5,250	6,300	7,245	8,332
Printing	2,381	5,000	6,500	8,451	10,986
Materials/ Supplies	5,469	7,110	8,532	11,091	14,419
Photography and Video ⁴	8,509	-	-	-	-
National Museum of Mathematics ⁵	9,900	-	-	-	-
Total, Program	118,025	155,393	193,624	246,249	263,107
General and Administrative					
Legal	3,915	4,697	5,637	6,764	8,794
Insurance	1,549	1,859	2,230	2,676	3,479
Office Space	-	-	11,550	12,128	12,734
Miscellaneous	305	500	600	720	864
Total, General and Administrative	5,768	7,056	20,017	22,288	25,871
Marketing and Development					
Part-time Development and Marketing Coordinator	-	-	25,000	-	-
Full-time Development and Marketing Coordinator	-	-	-	40,000	41,200
Grant writing	1,587	1,983	2,578	4,125	8,250
Marketing	1,500	2,625	3,413	5,460	13,650
Total, Marketing and Development	3,087	4,608	30,991	49,585	63,100
Total	126,880	167,057	244,632	318,122	352,077

¹ Executive Director is currently a volunteer position. 2017 and 2018 salaries are considered in-kind donations.

² walkSTEM Advisor is currently a volunteer position. 2017 and 2018 salaries are considered in-kind donations.

³ Program Director 1 was hired in September 2018; 2018 salary of \$40,000 is pro-rated.

⁴ One-time costs associated with walkSTEM launch.

⁵ One-time costs associated with walkSTEM launch.

Dallas Morning News, [At Science in the City, learn why science matters \(and that it's not scary\)](#), Leslie Barker, April 9, 2018.

National Math and Science Initiative, [Math in the Living World: walkSTEM Guides the Way](#), Jessie Riley, September 25, 2017.

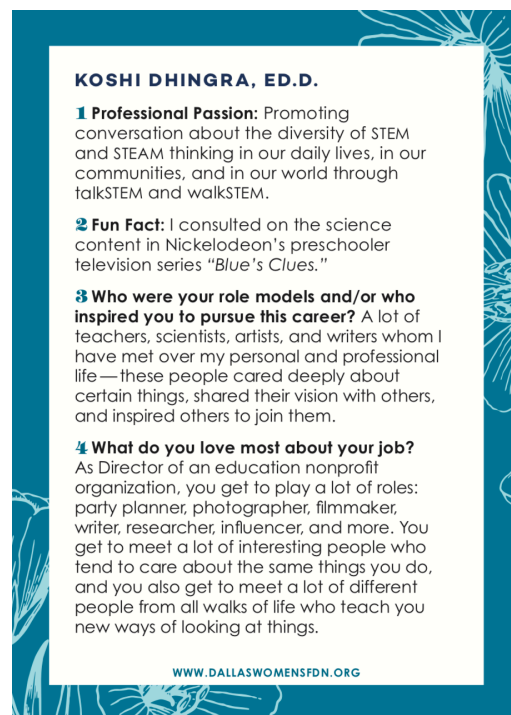
Dallas Innovates, [STEM-focused Walking Tours Pick Up Stride in Dallas Area](#), Meredith McGrath, June 18, 2018.

Dallas Innovates, [Walkers See STEM Concepts in Dallas Arts District](#), Julia Falcon, April 4, 2017.

SMU video, [Math is All Around Us](#), March 22, 2017.

Fox4 News, [Dallas Pi Day Math Festival](#), March 10, 2017.

KERA News, [Want To Teach Kids About Math And Science? Take A Stroll Through The Dallas Arts District](#), Stella M. Chavez, November 1, 2016.



walkSTEM founder and Executive Director Dr. Koshi Dhingra was honored in 2018 by the Dallas Women's Foundation for her work promoting STEM in the community. Each of the women honored is featured as a trading card. Complete sets of trading cards featuring women in STEM were distributed amongst Dallas-area schools in an effort to spark conversations by providing diverse role models.



Walk, Don't Run

Koshi Dhingra, founder of Arts District-based program talkSTEM, is taking math to the streets. STEM is an acronym for science, technology, engineering and mathematics, and the former director of the Science and Engineering Education Center at the University of Texas at Dallas is passionate about communicating the breadth of STEM education—in and out of school. “I founded the nonprofit in

order to create a platform for [the] sharing of perspectives and best practices by diverse groups of people wanting to inspire youth,” she explains. “These people include all different types of educators (pre-K through 12th grade teachers, university professors, parents, school administrators) and other professionals who are active in the science, technology, engineering, art, and mathematics learning, teaching and doing ecosystem.” This includes everyone from famed chef Kent Rathbun (after all, cooking is engineering) to the docents at the Dallas Museum of Art. These are the people who participate in Dhingra’s much lauded walkSTEM program, in which families, schools, teachers and even adults explore the Arts District through a mathematical lens during 50-minute strolls where they are encouraged to ask questions about the world around them. Questions addressed during a walkSTEM experience might include: What’s the most symmetrical solid in the Arts District and why? What was Renzo Piano’s favorite ratio? Why are there two different ramps with different slopes in front of the Wily Theater? How many patterns can we see in the louvers of the AT&T Performing Arts Center? Join a class or go on a self-guided walkSTEM tour by visiting talkSTEM.org.

walkSTEM founder and Executive Director Koshi Dhingra is featured in the 2018-2019 *Dallas Arts District Visitors Guide*.

The talkSTEM organization actively fosters engagement through social media. We create content, curate content, and invite people to join us in creating their own walkSTEM content. In doing so we are building a growing community of likeminded individuals who are connecting science, technology, engineering, arts, and mathematics to their lived experiences.

Facebook	<ul style="list-style-type: none"> Total reach of 460,000 (includes reach by partner organizations) engagement rate of 6-10% per post
Twitter	<ul style="list-style-type: none"> Total reach 380,000 (includes reach by partner organizations) engagement rate of 2-5%
Instagram	<ul style="list-style-type: none"> Total reach of 220,000 (includes reach by partner organizations)
Digital Forum	<ul style="list-style-type: none"> 418 subscribers
talkstem.org	<ul style="list-style-type: none"> 700 - 1000 visitors per month 70% are new visitors between 18-44 years of age 31% of visits come from organic search 15% of visits come from social media
STEAM Challenges	<ul style="list-style-type: none"> 250 Fall and Summer STEAM Challenge subscribers



6

WAYS YOU CAN #TALKSTEM

1

READ OUR BLOG

www.talkstem.org

2

CONNECT WITH US ON SOCIAL

Facebook: talkstem

Twitter : @talkingstem

Instagram: @talkingstem

3

SHARE OUR CONTEST

Share the How #IwalkSTEM contest with your friends via social media

4

JOIN OUR CLOSED FACEBOOK GROUP

By invite only - walkSTEM Docents.

5

USE #ILEADWALKSTEM IN YOUR POSTS

And share on social media

6

SUBSCRIBE TO OUR NEWSLETTER

Via our website talkstem.org to stay updated with the latest in talkSTEM and walkSTEM.

TALKSTEM UTILIZES SOCIAL MEDIA TO EXPAND THE TALKSTEM COMMUNITY.

“Shapes and math isn’t just on a piece of paper. It is all around you.” - *Participating walkSTEM student*

“We are excited for the possibilities for our schools to have opportunities to experience walkSTEM activities throughout the school day and in the broader community. These experiences will greatly enhance and deepen the education of our students.” - *Oswaldo Alvarenga, Director of STEM Dallas Independent School District*

“In October 2017, Trinity (TX) Chapter of The Links, Incorporated partnered with the walkSTEM team to take approximately 50 So SMAART program students from Thomas L. Marsalis Elementary School and William Hawley Atwell Law Academy to participate in the walkSTEM tour. Our So SMAART students, Site Coordinators, Parents and Volunteers thoroughly enjoyed the Arts District and while participating in the walkSTEM tour, the So SMAART students had an opportunity to engage in different activities and visit an art museum in the Arts District. Our So SMAART students gained valuable perspectives as a result of the walkSTEM tour of the Arts District.” - *Sonya D. Hoskins President, Trinity (TX) Chapter of The Links, Incorporated*

“After completing the walkSTEM docent training in February 2017, I was excited to take back to our students and others the ideas I had learned regarding a view of the world through a STEAM lens. Whether looking at nature, art, or architecture, a STEAM lens opens up pathways of seeing and questioning that deepen understanding and inspire creative thinking. The reason I signed up to be a walkSTEM docent and the reason I led a group of students from my school on a walkSTEM tour in December 2017 is because I believe it is critical that students gain integrated understandings of the arts and sciences. walkSTEM inspires this type of understanding. This is what will fuel potential innovation.” - *Gwendolyn F. Satterfield-Barjon, walkSTEM Docent and Director of Innovation and Science*

“The Office of Cultural Affairs is proud to support the innovative work talkSTEM does in Dallas. They have engaged a wide and diverse variety of community and educational partners. And their programs highlight a completely new dimension of the Arts District - engaging families and educators in thinking about the STEM facets which are integral throughout these spaces.” - *Jennifer Scripps, Director, City of Dallas Office of Cultural Affairs*

“TRAC is so excited to work with the walkSTEM team to develop a custom walk at the center. There are so many interesting math and nature connections, and then of course math and our architecture connections. This type of experience gives an opportunity for people to come to the center with fresh eyes and minds. And for folks who maybe aren't nature-ey type people, it provides an experience that might speak to their interests and then hopefully they will realize "oh hey, this nature thing is actually pretty cool!" Our goal is to always inspire people to care about their native environments; connecting with them in a different way will help foster that deep connection to and interest in nature and will inspire them to learn and conserve these important ecosystems.” - *Lucy Hale, Director, Trinity River Audubon Center*

“walkSTEM has been a wonderful addition to our Girl Scouts of Northeast Texas Program partner list. The program delivers STEM concepts in an engaging and easy to understand format. What truly stands out is how the docents make STEM come to life with examples of math and science in their everyday environments. After participating, girls see the relevance of STEM in their lives and are interested in applying the lessons learned. We are thrilled to be working with walkSTEM and having them deliver value-add STEM curriculum to our Girl Scouts!” - *Stacy Cushing Director of Programs, Girl Scouts of Northeast Texas*

walkSTEM Network

- Capital One Corporate Headquarters
- Dallas Arboretum
- The Dallas Arts District
- Dallas City Hall
- Dallas Independent School District
- Dallas Love Field Airport
- Dallas Public Library
- Dallas Zoo
- Fair Park
- Girl Scouts of Northeast Texas
- NorthPark Center
- Southern Methodist University
- Texas Discovery Gardens at Fair Park
- Trinity River Audubon Center
- UT Southwestern Medical Center

Supporters

- High-Tech High Heels
- Catherine and Will Rose
- City of Dallas Office of Cultural Affairs
- Lisa K. Simmons
- Fluor
- Texas Instruments
- Young Women’s Preparatory Network
- NorthPark Center
- Hall Arts
- Baylor Jack and Jane Hamilton Heart and Vascular Hospital
- Top Pot

Community Partners

- AT&T Performing Arts Center
- Corner Bakery Cafe
- The Dallas Arts District
- Dallas Independent School District STEM Department
- Dallas Museum of Art
- Southern Methodist University Simmons School of Education and Human Development



walkSTEM has established a strong relationship with the SMU Simmons School of Education, as well as the greater SMU community. Professors Wilhelm and Walkington of the Research in Mathematics Education Group



Dr. Annie Wilhem

Assistant Professor of Mathematics Education in the Department of Teaching and Learning at Southern Methodist University



Dr. Candace Walkington

Associate Professor in Teaching and Learning at Southern Methodist University, specializing in mathematics education

at SMU Simmons co-authored the attached study regarding the impact of walkSTEM during its launch year. Highlights include:

- Research and math education professors applied and received an internal grant to support a yearlong study of walkSTEM in 2017; their research was presented in April 2018 at a national educational research conference in New York City
- walkSTEM@SMU was created at the request of the community outreach office at SMU; walkSTEM@SMU will be made available to over 1,000 middle school students who visit the campus for field trips every year.
- Koshi Dhingra, Director of talkSTEM, was invited to speak to groups of teachers about walkSTEM initiatives at SMU.
- Conversations about joint funding at the national level are ongoing.



Finding mathematics in art, architecture, and landscape in urban areas: The walkSTEM movement

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This research was funded through a University Research Council Grant at Southern Methodist University.

Objectives

Students' interest in learning mathematics can decline as they reach adolescence (Fredericks & Eccles, 2002; Frenzel, Goetz, Pekrun, & Watt, 2010), as the mathematics they are learning in school typically becomes less concrete and immediately relatable to everyday activity.

Mathematics educators face a challenging question: How can we engage students and to allow them to see that mathematics is a rich and dynamic subject that is useful for describing and understanding the world?

Urban areas are dense with architectural and artistic attractions, as well as planned natural areas. Such community sites can be an avenue for children and families to explore how mathematical concepts occur in the world around them. Students who are residents of urban areas often have familiarity with the major landmarks, environments, and areas in the downtown. This familiarity can be used as a resource to support their learning of mathematics (Civil, 2007). Indeed, students come into school with key resources or *funds of knowledge* (FOK), from their homes and communities that have been historically-accumulated and culturally-developed (Moll, Amanti, Neff, & Gonzalez, 1992).

In the present paper, we describe a research study conducted on the *walkSTEM* initiative. In this initiative, children and their families can sign up for free "math walks" in the Dallas Arts district on weekends. Walks are led by trained docents who engage families in discussions around how mathematics appears in the world. We conducted surveys with families who participated in the walks, as well as with docents who led walks.

Theoretical Framework

The FOK perspective accentuates that students often engage in situated quantitative reasoning in out-of-school contexts (Civil, 2007), and these resources can be brought into the classroom to support student engagement and learning. Utilizing FOK shows students that their communities are valued and that the things they do in their everyday life are relevant to school learning. Researchers have examined how the "everyday math" that students use in their homes, communities, and day-to-day activities. Research has explored the creation of instructional school units around children's experience playing games (Civil, 1994), with different types of money, and with home-based knowledge of gardening and construction (Civil, 2007). Interviews with families have revealed that they use mathematical practices while cooking, sewing, engaging in construction, and scheduling (Gonzalez, Andrade, Civil, and Moll, 2006).

While using community-based resources to draw upon funds of knowledge and enhance interest has promise, research has documented the incredible difficulty of students making connections between math and the real world (Inoue, 2005; Lave & Wenger, 1991; Masingila et al., 1996; Saxe, 1988). Research is needed on programs like walkSTEM that can serve as models for other communities, and for other programs that seek to connect math to everyday life. Our first research question is: *What do families learn from participating in an urban math walk experience?*

Math educators also need to understand how connections are made between math and the community. Turner et al. (2012; 2016) conducted studies in which pre-service teachers engaged in “community walks” where they visited students’ neighborhoods, and wrote activities connected to students’ home and community lives. They found that teachers tend to make connections to students’ lives at a variety of depths – some teachers used general, overarching assumptions about an age group (e.g., liking swings), while others used knowledge about student preferences that was not necessarily quantitative. The strongest connections included mathematization of family practices and mathematical activities that children actually engaged in (e.g., scoring points in basketball; Turner et al., 2016).

While this research is important, it does not examine how educators go about enacting these approaches, and it occurs within the relatively artificial “school math” realm. In the present study, we operate within a community-based informal learning space where educators guide children and their families to think together about mathematics. Our second research question is: *After leading an urban math walk, what reactions to docents have relating to the experience?*

Methods and Data Sources

The walks involved two trained docents (STEM educators) working together to lead up to 25 participants around various sites in the Dallas Arts District (Figure 1, end of document). The walks lasted 45 minutes, and there were two different versions of the walk for elementary versus middle school. Parents would sign up for one of these versions in advance online. The walks would stop at sites like a Pegasus sculpture composed of geometric shapes, a park with a large jungle gym in the shape of an icosahedron, a tessellation of floor tiles in front of a symphony, and a growth of bamboo around a sculpture center.

Two surveys were designed on Qualtrics. The first was for walk participants, designed to be taken on a cell phone. Participants would be given a link and barcode to access the survey at the end of the walk. This survey included demographic questions and three open-response questions: (1) What did you learn from the walk? (2) Describe how math appears in downtown Dallas. (3) Describe how math appears in your neighborhood. The second survey was distributed to docents via email after they led their first walk. The survey contained demographic items and a variety of open-response items, but in the present summary we focus only on two: (1) What was your favorite aspect of the walk? (2) What was challenging about this walk? Docents were offered \$25 gift cards to take the survey.

The participants survey was taken by $n=40$ parents and children, although not all participants responded to all questions. Twenty-one identified as caregivers, teachers, or community

members over 18 years of age, while 18 identified as K-12 students. For the students, the average age was 11.5 ($SD=2.6$), and there were 11 males and 6 females. For those over 18, one reported being aged 18-24, 13 reported 25-44, and 1 reported 45-64, with 4 males and 11 females.

The docents survey was taken by $n=18$ docents (15 females, 3 males). Thirteen reported typically working with elementary students, 6 with middle school students, 6 with high school students, and 2 with university students. Their average amount of experience as an educator was 11.2 years ($SD=6.1$). Nine docents reported a race/ethnicity of Caucasian non-Hispanic, 2 reported African-American, 2 reported Asian, and 2 reported Other. Five reported Hispanic ethnicity.

Open-ended responses were coded using emergent themes (Glaser & Strauss, 1967) by two coders working collaboratively.

Results

RQ1: What do families learn from participating in an urban math walk experience?

We looked at walk participant responses to three open ended questions on the participant survey (Tables 1 and 2, end of document). Responses were subdivided depending on whether the respondent was a child or adult. When asked what they learned from the walk, 6 children discussed geometry concepts and terms they learned about. A 12-year-old female described how “I enjoyed seeing shapes and symmetry in nature and the real world.” In addition, 6 children discussed algebraic concepts they learned. A 10-year-old female said she learned “How to find a slope.” Six children also expressed the sentiment that math was all around them, and part of their everyday life: “Shapes and math isn't just on a piece of paper. It is all around you.” Finally, 5 children mentioned math in architecture, nature, or art: “... Lots about shapes in buildings. Also, how math can affect architecture.”

The adults were similar, although fewer discussed concepts they learned from algebra and geometry. Some adults cited the STEM (Science, Technology, Engineering, and Mathematics) connections in the walks. One adult described how: “I enjoyed observing how STEM components were highlighted utilizing the various buildings and other structures throughout the Dallas Arts District. Watching the kids engage their current level of knowledge to solve challenges was exciting.”

We also looked at participants' responses to two additional questions “Describe how math appears in downtown Dallas.” and “Describe how math appears in your neighborhood” (Table 2). For the downtown Dallas question, responses were similar for adults and children. Both groups were most likely to describe architectural sites. A female caregiver described how “Everywhere! In the walkways, the buildings, the signage-- you can't miss it once your eyes are opened!” A 12-year-old female described how “It appears in shapes of the buildings and the slopes, ratios are also used.” Connections to nature were the next most often-cited answer, given by 4 children and 7 adults. A 12-year old male describes how “It appears in many things. From the structures and buildings, the circumference of plant stems, and the area of structures.” Three children and 2 adults also expressed how math was found in art like statues: “Statues with

shapes. Area on tile. Fractal geometry in magnolias leaves. Linear equations on bamboo sticks.” Finally, 4 children and 5 adults again expressed that math is everywhere.

For the questions about math in their neighborhood, the most common response among children (7/15) and adults (5/11) was to describe how math occurs in houses. A 15-year old male describes how math is in “basic construction of my house” while a female caregiver stated “The designs of the street, the perimeters and areas of the homes.” Respondents also mentioned the sidewalk or street in their neighborhood, as well as the signage, gardens and yards, parks and playgrounds, and their local school building: “We would need to know the area of a yard for new grass, or the perimeter for a new fence.”

RQ2: After leading an urban math walk, what reactions to docents have relating to the experience?

Table 3 shows docents’ responses to questions asking them what was their favorite and most challenging aspect of the walk. All 18 docents said that interacting with families was their favorite part of the walk. In addition, 9 mentioned the enthusiasm they saw from participants, while 8 discussed how participants contributed their own mathematical ideas. One docent described how their favorite was “Being able to explain how art and math go hand in hand in some of the amazing infrastructures and art pieces in the arts district. The students faces light up when they discover this.” Another described how “I loved seeing the kids engaged and looking for more things to measure/observe at each stop than just the ones we showed them.” A third docent said “My favorite aspect of the walk was being able to interact with the kids, especially at the *REALLY Big Number* stop. The kids were really engaged and spent several blocks discussing other objects or shapes we could count.”

When asked what was challenging about the walk, most docents (13/16) mentioned issues with being limited to just 45 minutes. One docent described how “My walk was about 55 minutes instead of the recommended 40-45 minutes. I think this was due to the discussions the walkers engaged me in, increased traffic around lunch time.” Another described how “The walk was very interactive and children were engaged which made is difficult to keep track of time so we couldn't do the last stop.” Three docents also mentioned issues with age-appropriateness for children: “We were leading a middle school walk; however, a majority of the students who came on the walk were elementary.” Finally, two docents mentioned wanted more time to practice with their partner, while 2 cited issues with participants being unable to hear them.

Significance

Here we explored a novel approach to connecting mathematics to the community, and to engaging families together in mathematical reasoning. We describe an informal learning experience where docents lead free math walks in an urban area. Our results suggest that both children and adult walkers benefitted from this experience, and that docents also enjoyed interacting with families around mathematics in an informal setting. WalkSTEM is not intended to be a static math walk specific to downtown Dallas; rather it is conceptualized as a grassroots movement where people design and create and lead their own math walks for their schools, neighborhoods, and communities. Indeed, several of our docents have been expanding

walkSTEM in this way. By communicating this research, we hope to add to the proliferation of community-based mathematical experiences for families.

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1. Perot Museum of Nature and Science
2. Klyde Warren Park
3. Nasher Sculpture Center
4. Morton H. Meyerson Symphony Center
5. Elaine D. and Charles A. Sammons Park
6. Margot and Bill Winspear Opera House
7. Booker T. Washington High School for the Performing and Visual Arts
8. Dallas Black Dance Theatre
9. One Arts Plaza
10. Dallas City Performance Hall
11. Dee and Charles Wylie Theatre
12. Hall Arts
13. Cathedral Shrine of the Virgin of Guadalupe
14. Belo Mansion
15. Crow Collection of Asian Art
16. Dallas Museum of Art
17. Hunt Consolidated Headquarters
18. Margaret Hunt Hill Bridge

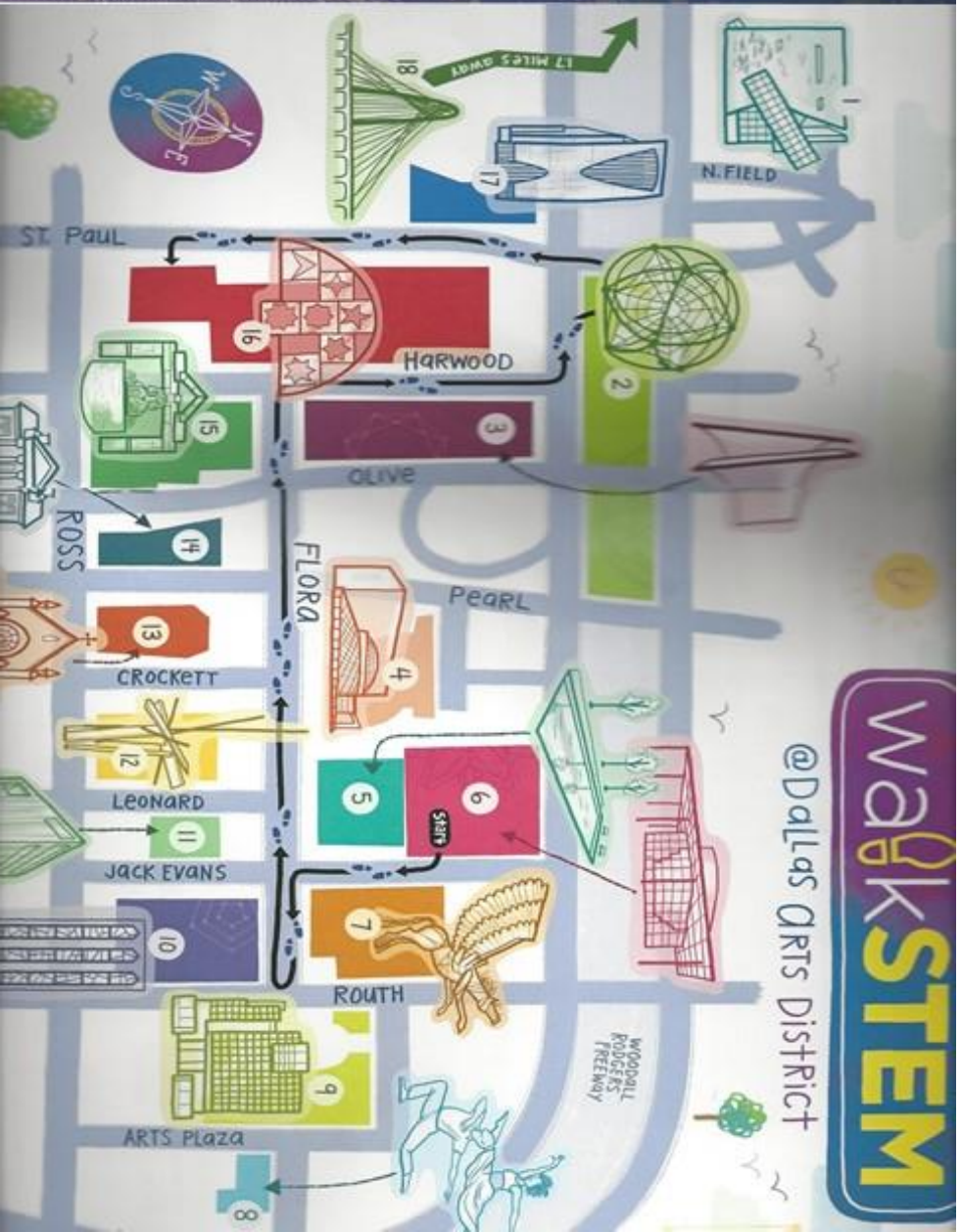


Figure 1. walkSTEM route in Dallas Arts District

Table 1.

Responses to question “What did you learn from the walk?” on participant walk survey

Children (n=18)	Adults (n=14)
Geometry concepts and terms (6)	Math is everywhere (7)
Math is everywhere (6)	Architecture/nature/art (4)
Algebraic concepts and terms (6)	STEM integration (4)
Architecture/nature/art (5)	Algebraic concepts and terms (2)
	Geometry concepts and terms (2)

Note. One participant’s response can be coded with multiple codes.

Table 2.

Responses to two questions on participant walk survey

Q2. Describe how math appears in downtown Dallas.		Q3. Describe how math appears in your neighborhood.	
Children (n=16)	Adults (n=13)	Children (n=15)	Adults (n=11)
Architecture (11)	Architecture (11)	Houses (7)	Houses (5)
Nature (4)	Nature (7)	Sidewalk/street (3)	Sidewalk/street (4)
Art (3)	Art (2)	Gardens/yards/leaves (3)	Signs (2)
Math is everywhere (4)	Math is everywhere (5)	School building (2)	Park/playground (2)

Note. One participant’s response can be coded with multiple codes.

Table 3.

Responses to two questions on docent survey

Q1. What was your favorite aspect of the walk? (n=18)	Q2. What was challenging about this walk? (n=16)
Interacting with families and children (18)	Time management (13)
Seeing participants excited/enthusiastic/engaged (9)	Age-level appropriate content (3)
Having participants contribute mathematical ideas (8)	Partnering with another docent (2)
	Communicating with participants (2)

Note. One docent’s response can be coded with multiple codes.