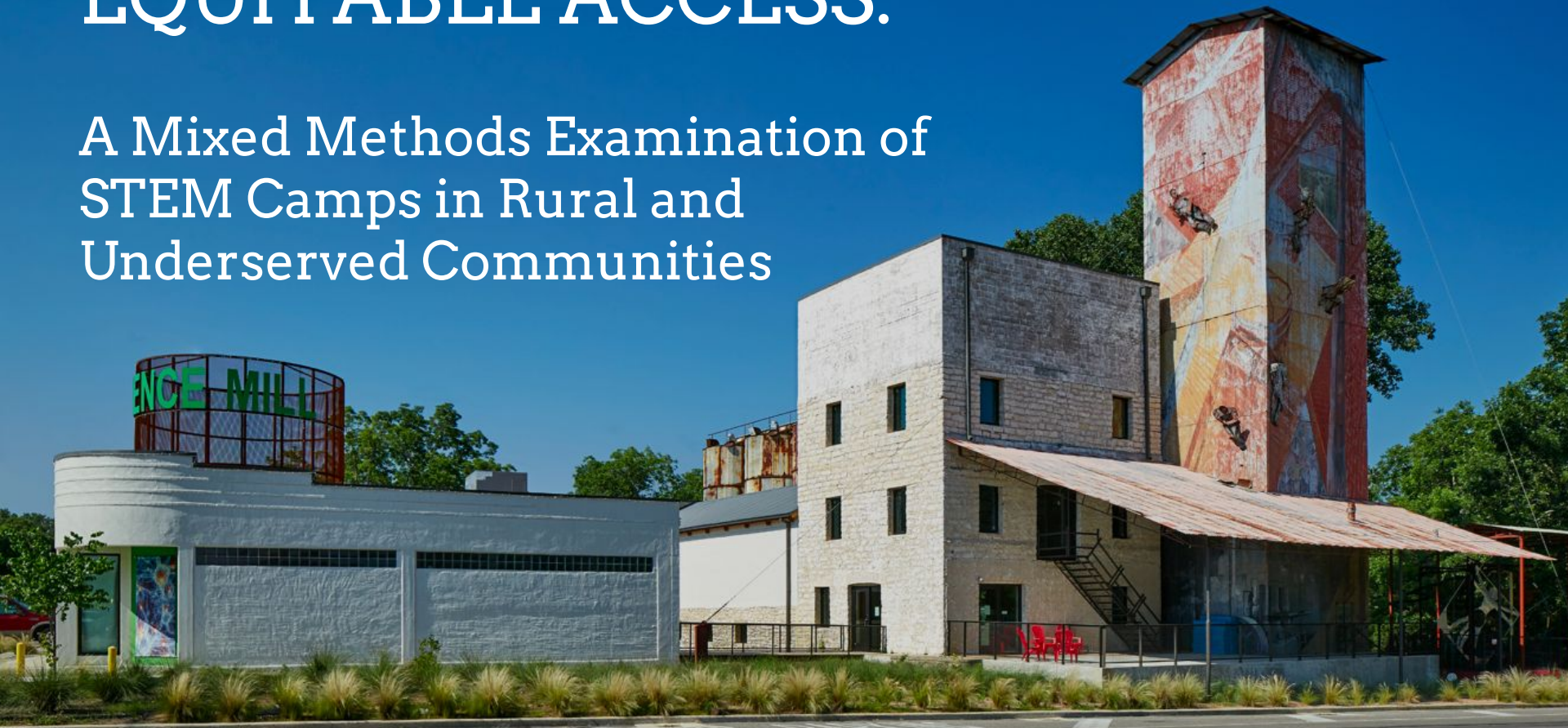# EQUITABLE ACCESS:

A Mixed Methods Examination of STEM Camps in Rural and Underserved Communities

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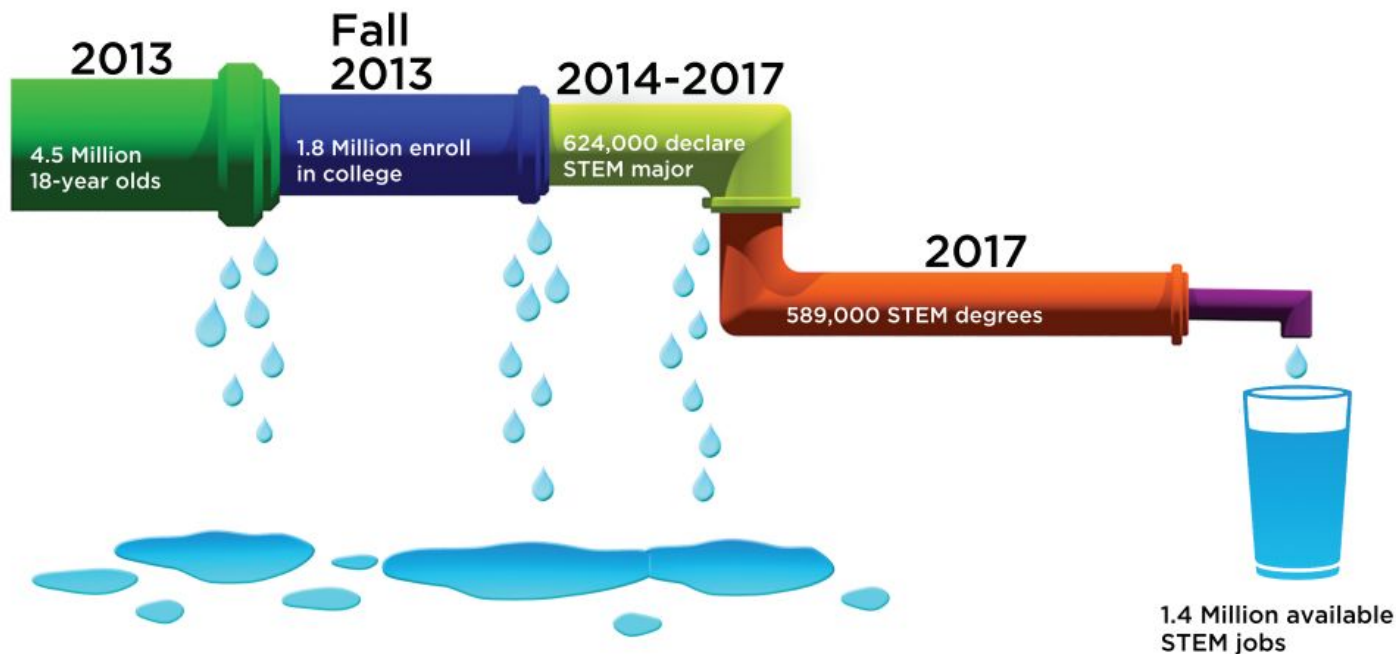**Mahek.Shaikh@sciencemill.org**

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What is the Current Landscape of Our STEM Fields?
A Leaking STEM Pipeline

2013 — 4.5 Million 18-year olds

Fall 2013 — 1.8 Million enroll in college

2014-2017 — 624,000 declare STEM major

2017 — 589,000 STEM degrees

1.4 Million available STEM jobs

Low-Income Students Fall 2.5 to 3 Years Behind by Fifth Grade

FAMILY READING TIME
WEEKEND DAY TRIPS
220 HOURS
245 HOURS
PRE-SCHOOL
1,395 HOURS

6,000 HOUR LEARNING GAP

AFTER-SCHOOL ACTIVITIES
3,060 HOURS

SUMMER CAMP
1,080 HOURS
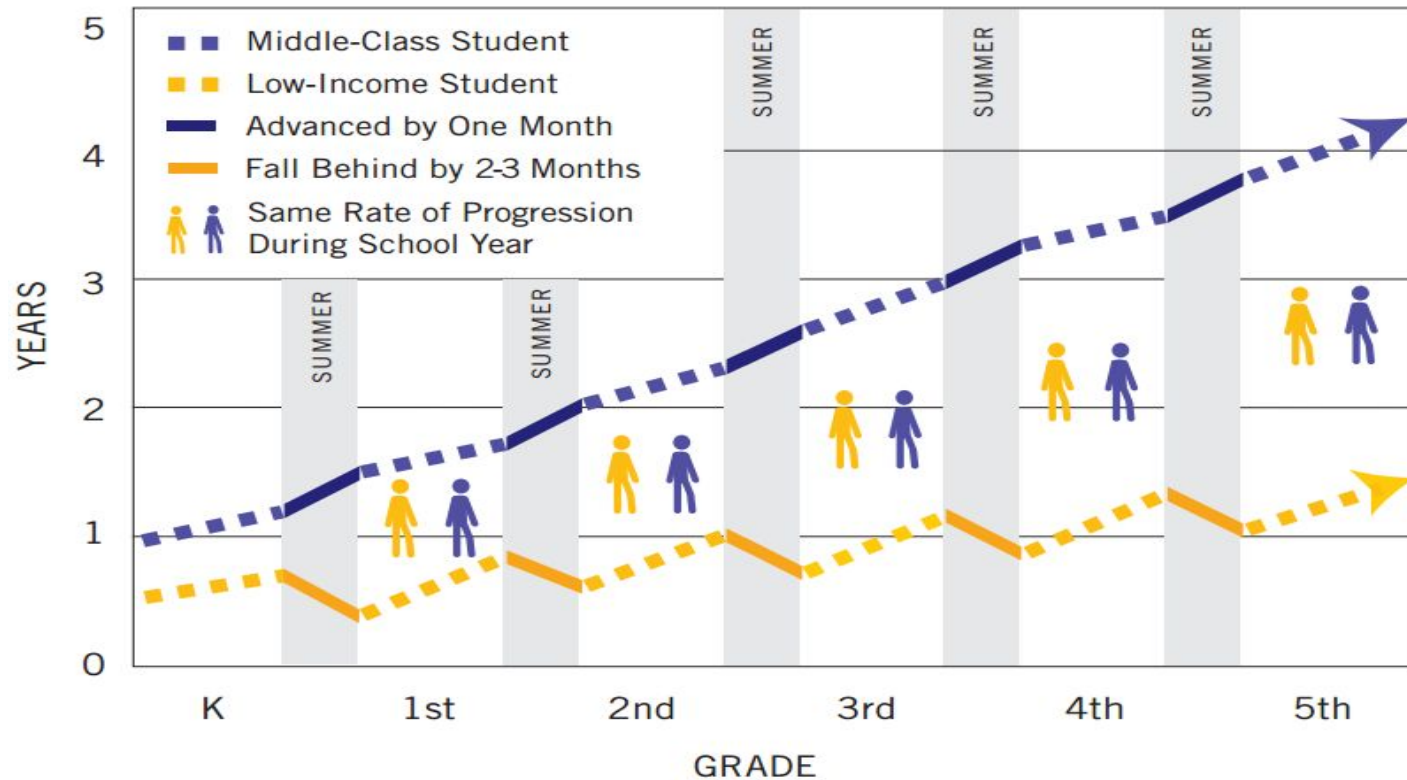
By 6th grade Kids born into poverty are likely to suffer a 6,000-hour learning gap compared with their middle-class peers.

Statement of the Problem

- **By 9th grade, 66% of the income-impacted achievement gap is attributed to summer learning loss**
- **Lack of access to quality STEM programming in underserved communities**
- **Limited geographic access to STEM learning resources their urban peers have, these programs build and support an interest in STEM**

Additional Challenges

- **Teacher retention: difficult to recruit and retain teachers especially in STEM, teachers often required to teach a variety of subjects that they may not be proficient in due to course need**
- **Lack of STEM enrichment courses for smaller, isolated school districts**
- **Limited STEM & Tech literacy: leads to students being less prepared to enter post-secondary and careers**
- **Limited knowledge of career pathways and opportunities.**
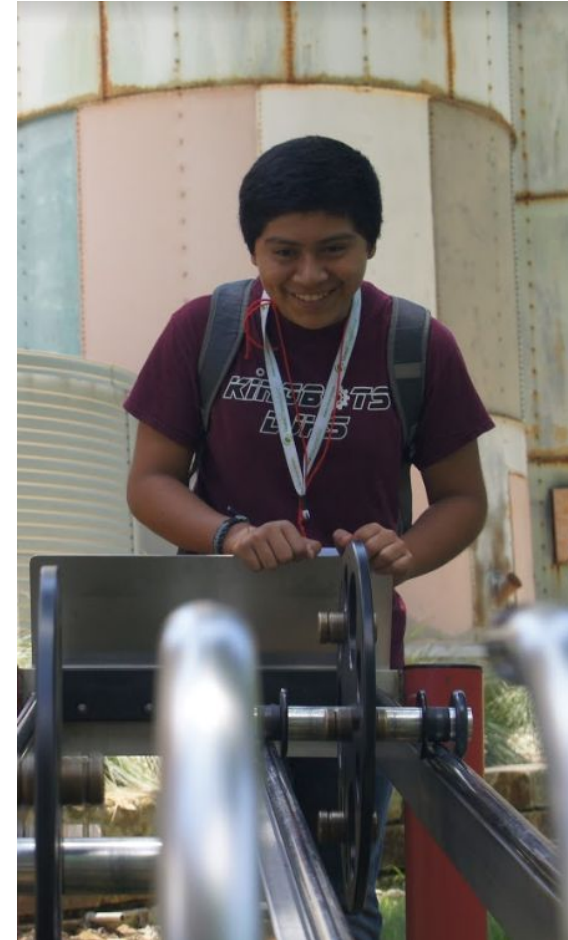
Review of the Literature

"Despite above-average salaries and very low unemployment in most STEM fields, far too few students are pursuing STEM majors in college- particularly girls, African Americans, Hispanics, and children from low socio-economic households" (Coxon, Dohrman, & Nadler, 2018, p. 87).

"When students are exposed to STEM like course earlier on in the grades, students tend to have a higher success rate later on in their career" (Yoon & Strobel, 2017).

"We recognize the ways in which other learning sites, such as libraries, after-school programs, and museums, can be effective partners, collaborators, and support networks when it comes to ensuring children's learning progress" (Carnegie Corporation, 2018).

"When it comes to STEM subjects, families can increase children's competencies by creating STEM-rich home environments, encouraging their children to think of themselves as STEM learners and consider careers in STEM fields, and supporting STEM interactions with their children in and out of school" (Caspe, Woods, & Kennedy, 2018).

"After-school participation is related to academic improvement, especially in math, and with closing achievement gaps in the elementary years" (K. M. Pierce, A. Auger, and D. L. Vandell, 2013).

Mission

Through impact-driven programs, the mission of the Science Mill, is to excite and engage students in science, technology, engineering and math (STEM), inspire them to pursue *post-secondary* education and allow them to envision themselves as part of a 21st century STEM workforce.

Opportunities

STEM Jobs Available and Qualified Talent by 2029

Jobs in Thousands

Jobs Available — Qualified Talent
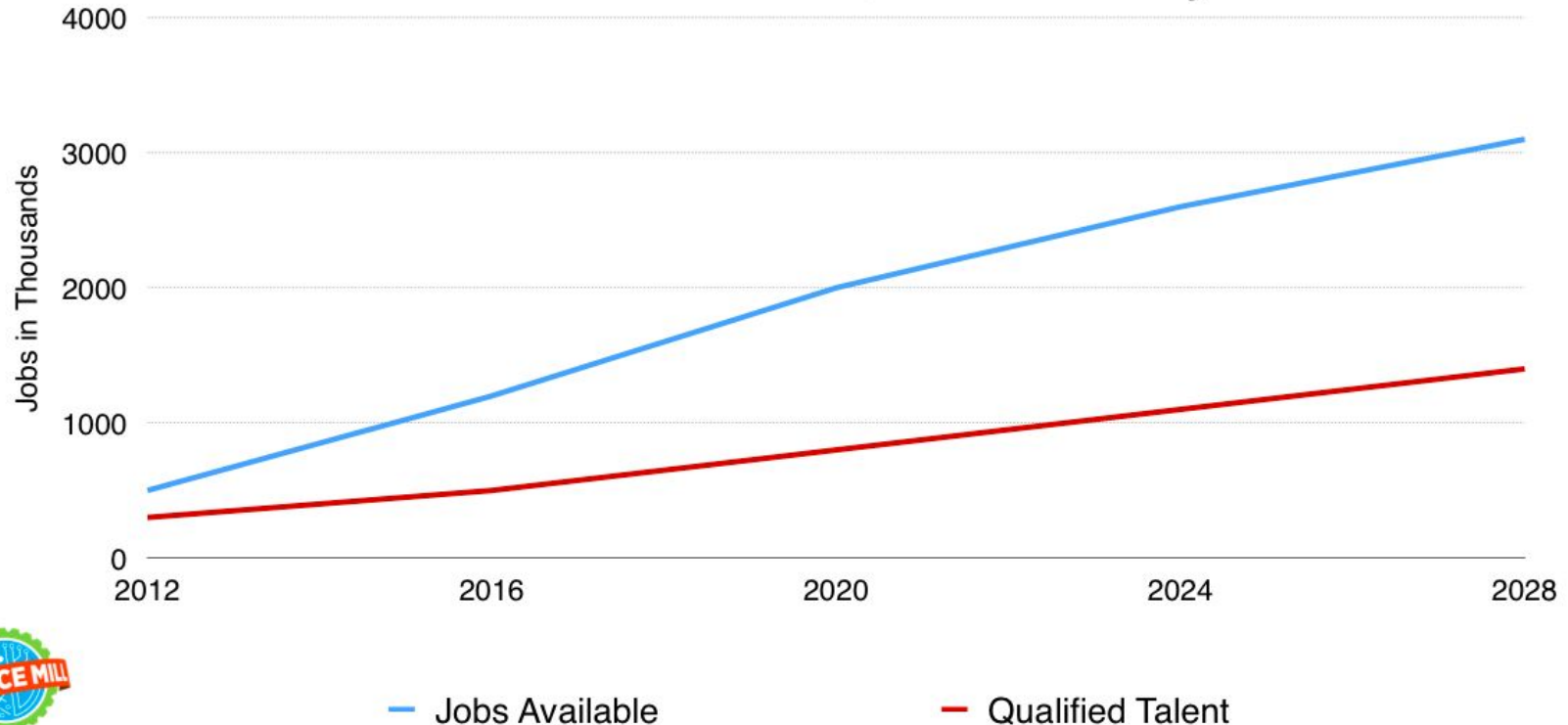
STEM EQUITY INITIATIVE

SUMMER SCI CAMPS

- STEM camps where campers live

- Ignite student curiosity and interest in STEM

- Fueling student excitement for the upcoming school year

SEI

STEM DISCOVERY CLUB

- During school-year clubs, focused exploration of STEM careers

- Delve deeper into various STEM themes from camp

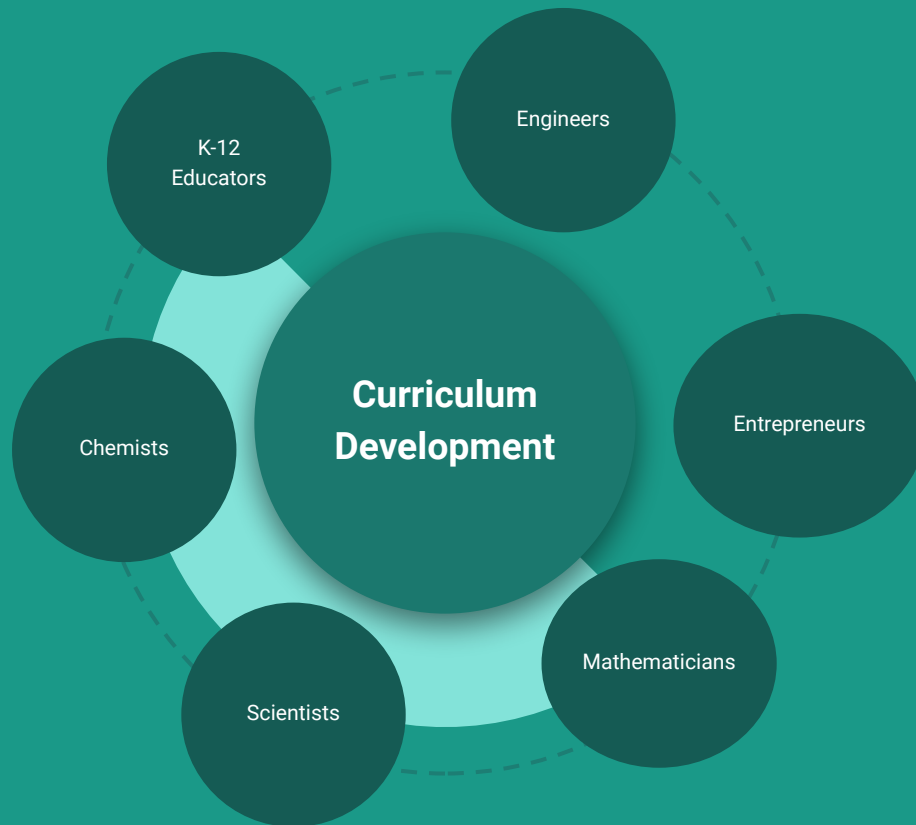- Build STEM identity through long-term, year-round experiences

COMMUNITY AT ITS CORE

Our Design

Our curriculum is designed with:

- Activities that build on each other, focused on developing innovative thinking and real-world problem solving embedded in STEM career scenarios
- Challenge driven learning, design and project based activities
- Emphasize team based collaboration, in depth reflection and connections to STEM career skills
- Linking STEM opportunities with STEM exposure through hands-on, minds-on activities to develop STEM expertise

Our Team of Content Experts

Engineers

K-12 Educators

Chemists

Curriculum Development

Entrepreneurs

Scientists

Mathematicians

Science Mill Summer STEM Camps:

- Provide portable, turnkey science- and technology-rich summer camps that are accessible and affordable to students, located right in their neighborhood, with a specific focus on reaching low income, underserved areas

- Allows these students to experience the same level of summer STEM enrichment as their higher income counterparts

- The opportunity for *all* students to learn through hands-on experiences and to feel the excitement of "doing science" can be the catalyst to in inspiring them to pursue an educational pathway towards a STEM career.

Learning by Doing

Research Questions

How does attending a STEM career-focused Summer Camp impact student self-efficacy, interest in STEM careers, and growth in STEM identity?

Methodology

Source: Texas Demographic Center
Map by: John Harden

Participants

- There are over 5 million students enrolled in Texas public and charter schools in grades K-12.
- On average, each grade level has 450,000 students, with 59% considered economically disadvantaged, with little or no access to STEM.
- The students in this study came from 40 school districts and 115 zip codes.
- The data included student responses and demographics from nearly 1,700 participants who completed a one-week STEM summer camp.
- The growth of this program has grown from 5 camps in 2015 to 27 camps in 2019. There are 46 summer camps scheduled for the summer of 2020.

Data Collection

- Student outcomes and impact were measured through analysis of surveys, observations, and video reflections to track a variety of metrics specific to camper experiences
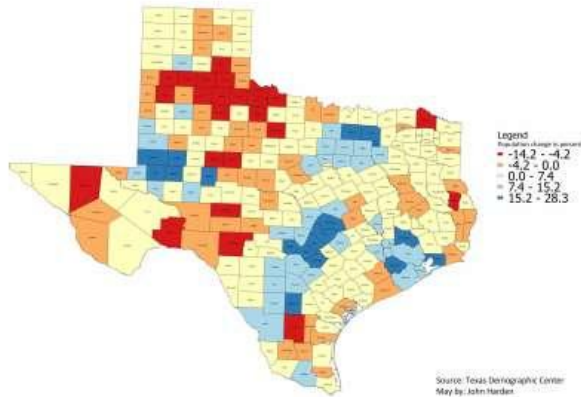
Findings

- 97% of students now believe they can succeed in STEM.
- 91% believe STEM skills are necessary to be successful.
- 94% want to learn more about STEM opportunities.
- 93% of campers like science, technology, engineering, or math (STEM).
- 88% report they are more interested in STEM.
- 76% of students are interested in having a STEM career or job in the future.
- 90% of campers articulate an increase in their knowledge of STEM careers
- 96% have a positive sense of self-efficacy in STEM

2019 CAMPER SURVEY RESULTS

■ Yes ■ No

I am more interested in STEM now than before I came to camp.	83%	17%
Would I attend another Science Mill STEM Career Camp if given the opportunity?	86%	14%
I made new friends this week.	93%	7%
After completing this camp, I am more interested in taking further STEM classes or joining STEM extracurricular activities such as clubs, camps, afterschool programs, or other similar activities.	81%	19%

0%   20%   40%   60%   80%   100%

Key Findings (RAND Corporation, 2011)

- Summer Learning Loss, Which Is Disproportionate and Cumulative, Contributes Substantially to the Achievement Gap
- Students Who Attend Summer Programs Have Better Outcomes Than Similar Peers Who Do Not Attend These Programs
- Strategies for Maximizing Quality, Enrollment, and Attendance Are Critical to Achieving Benefits
- Cost Is the Main Barrier to Implementing Summer Learning Programs
- Partnerships Can Strengthen Summer Learning Programs

What the Kids Have to Say

"I made a friend who likes science as much as I do!"

"I coded a program with my team."

"I can't believe I built a robot!"

"Our creation of a prosthetic leg for a dog could really be used to help animals."

"I feel smarter and more confident now."

"STEM Camp was a great experience! I would recommend it to my friends."

2020 Summer Camp Themes

Camps for rising 6th-8th graders

INNOVATION NATION
As a STEM secret agent, you'll take on daily challenges with high-tech tools of the trade. Investigate with a DIY microscope, program spy gadgets and engineer a remote-mission robot.

Technology Exposure: Arduino, mBot, K'Nex, Scratch, Makey Makey, Foldscope

CREATE TO ESCAPE
It's a zombie outbreak — can you lead the survivors to safety? Create a pneumatic tool to clear a path, program a robot for life-saving rescues and build working prosthetics.

Technology Exposure: Visual block-based coding, microBit, EZ Robots, app development, Lillypad wearable technology, K'Nex, 3D Pens

Science Outside
Make the great outdoors your science lab! Inspect specimens under a DIY microscope, program a portable weather station and use coding to crack a GPS scavenger hunt.

Technology Exposure: Arduino, mBot, K'Nex, Scratch, Makey Makey, Foldscope

INNOVATION UNLOCKED ENTREPRENEUR CAMP
Runs for 2 weeks, Mon-Fri, 9am-4pm
Design actual products with real customers and see what it takes to turn your ideas into a business. Use exciting technology, including artificial intelligence, app and web design, circuitry, e-textiles and robotics to solve a challenge.

Technology Exposure: Scratch 3, Construct 3 video game design, Circuit Playground Express, Rapid prototyping tools, Arduino based robotics, App and web development, E-textiles and sewable electronics

Camps for rising 3rd-5th graders

C.I.A. (Create, Innovate, Activate)
Your mission: create gadgets and design solutions that get agents out of sticky situations. Be ready to program robots, craft chemical concoctions and power up electrical creations.

Technology Exposure: Basic circuitry, Circuit Playground Express, Scratch 3 animation, Makey Makey, Arduino based mBot robotics with visual block programming, K'Nex building
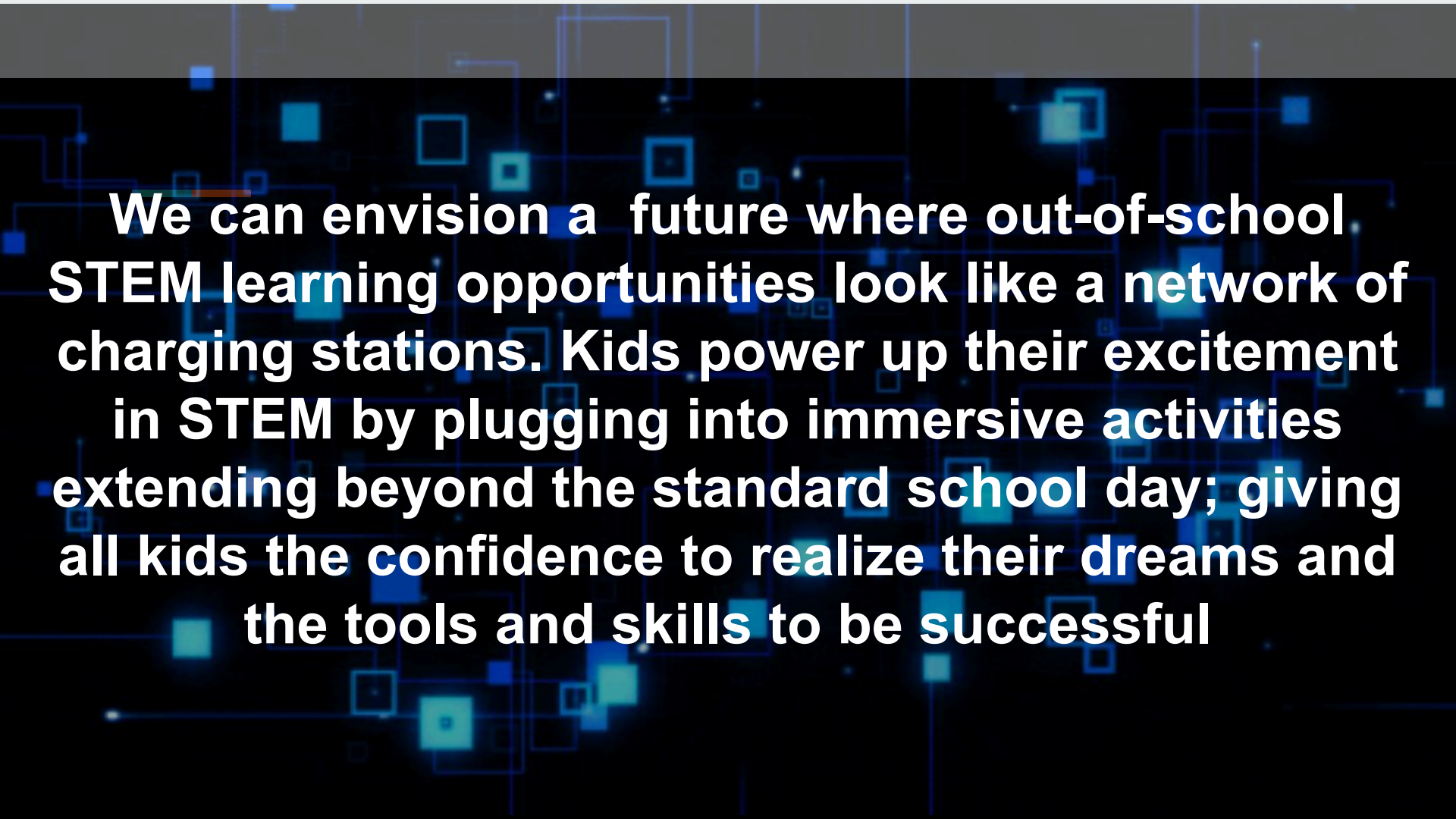
CAMP MAYDAY: STEM SAVES THE WORLD
In a post-apocalyptic world, your ingenuity is the key to the future. Construct mechanical claws to remove rubble, use chemistry to find new food sources and program safety devices to ward off danger.

Technology Exposure: Paper circuits, Circuit Playground Express, Micro:bit, Strawbee flow coding and robotics with servos and sensors, K'nex building

Camps run for 1 week, Mon-Fri, 9am-4pm (unless otherwise noted)

Scholarships available for all camps

We can envision a future where out-of-school STEM learning opportunities look like a network of charging stations. Kids power up their excitement in STEM by plugging into immersive activities extending beyond the standard school day; giving all kids the confidence to realize their dreams and the tools and skills to be successful

We are always looking for partners to ENHANCE, ENRICH, and EXPAND STEM Education for ALL Texas Students.

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www.youtube.com/channel/UCVmr7sbmwX_A_dgZfUIMkCg

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Introduction

- STEM has been part of education since NSF (National Science Foundation) created the term in the early 2000's.
- There are four parts to STEM, science, technology, engineering and math.
- "Increasing the science, technology, engineering, and mathematics (STEM) workforce is vital for future economic success on both individual and national levels" (Coxon, Dohrman, & Nadler, 2018, p. 86).
- Despite STEM education initiatives gaining traction across the country, rural and underserved areas have not been a major focus of these initiatives, and the untapped potential of these students is tremendous.
- "Despite above-average salaries and very low unemployment in most STEM fields, far too few students are pursuing STEM majors in college- particularly girls, African Americans, Hispanics, and children from low socio-economic households" (Coxon, Dohrman, & Nadler, 2018, p. 87).
- The STEM program in this study intentionally engages rural and underserved students to elevate their interest in STEM learning and inspire them to begin to see themselves as part of a future 21st century technical workforce.

STEM Equity Initiative: Timeline At a Glance

Spring 2019

Summer 2019

Late Summer 2019

Fall 2019 - Spring 2020

STEM Discovery Club Begins

Monthly meetings led by Science Mill to sustain and grow student engagement and interest in STEM fields.

Ignite recruitment efforts for Summer 2019 SCI Camps

Collect data on: STEM Identity, Self-efficacy, STEM Interest, evaluation of test scores, enrollment and participation in STEM-related courses

Summer STEM Camp 2019

Week-long STEM Career Immersion for rising 6th - 8th graders, emphasis on enrolling all STEM Discovery club youth.

Camp + Club Data Sharing

Sharing data on: STEM Identity, Self-efficacy,, STEM Interest, etc.

STEM Discovery Club Begins

Monthly meetings begin in Fall.

Eligible students: 5th - 7th grade. Cohort of 30 students.

SCIENCE MILL!