

## Citizen Schools

# Closing Inspiration and Achievement Gaps in STEM with Volunteer-Led Apprenticeships

### DID PARTICIPATION IN STEM-FOCUSED APPRENTICESHIPS LEAD TO IMPROVED 21<sup>ST</sup> CENTURY SKILLS IN STEM AND STEM ENGAGEMENT?

## Project Overview

#### **THE PROBLEM: What Challenge Did the Program Try to Address?**

Most American students are neither prepared for nor engaged in the study of science, technology, engineering, and mathematics (STEM).<sup>1</sup> The challenge of developing a STEM professional pipeline in the U.S. has led to various public investments in STEM education. In addition to improving academic achievement in STEM, increasing interest in science among students is key to bolstering the growth of STEM education and careers in the US. In particular, lack of exposure to those working in STEM fields and understanding of their work is seen as a critical gap, particularly among girls and minorities.

#### **THE PROJECT: What Strategies Did the Program Employ?**

Citizen Schools received an i3 development grant<sup>2</sup> (2012–2017) to implement a volunteer-led afterschool apprenticeship program to expose students to STEM subjects, as part of its Extended Learning Time (ELT) model. Apprenticeships are one of two core components of the Citizen Schools' ELT, along with Academic Support. The project compared outcomes between students enrolled in at least one STEM-focused apprenticeship to those enrolled in non-STEM apprenticeships in Citizen Schools across the country. The study used a pre-post quasi experimental design (QED), controlling for school characteristics and time-varying effects. It included 21 schools implementing ELT during the 2015-16 school year, serving 2,835 students. The analytic sample was smaller as four schools which could not provide survey data and five which could not provide achievement data were all removed from the analysis.

<sup>1</sup> Citizens Schools received an i3 development grant supported by the U.S. Department of Education's Investing in Innovation program through Grant Number U411C120082.

<sup>2</sup> Development grants provide funding to support the development or testing of novel or substantially more effective practices that address widely shared education challenges. All i3 grantees are required to conduct rigorous evaluations of their projects. The quality of evidence required to demonstrate a project's effectiveness depends on a project's level of scale or grant type.

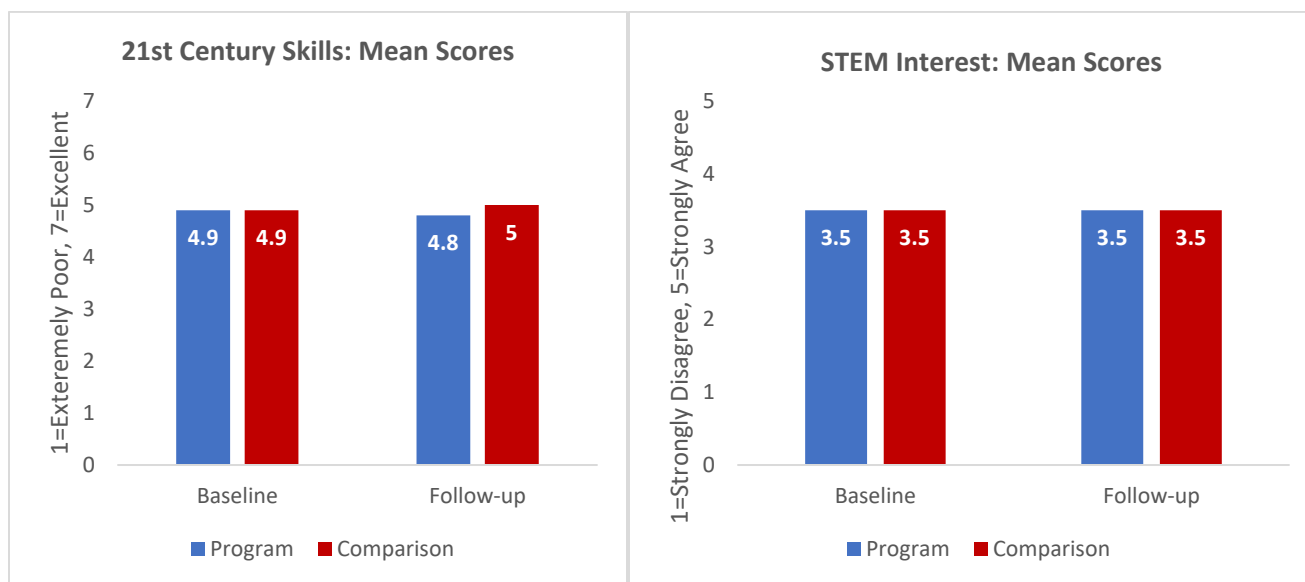
## THE VOLUNTEER-LED APPRENTICESHIP MODEL

- **Students chose their own topics of interest.**  
Students ranked their preferred apprenticeship options. They were assigned to an apprenticeship by a combination of stated preferences and availability.
- **Instruction was co-delivered by “second shift” educators and community volunteers.**  
Apprenticeships were co-taught by Citizen Fellows, who were Teaching Fellows generally working full time, funded by AmeriCorps, and who were expected to serve for two years, as well as Citizen Teachers, who were community volunteers. This “second shift” of educators supported Citizen Schools’ extended day, which typically started at 3pm and ended at 6pm.
- **Apprenticeship curricula were developed by the Citizens School National Program Team.**  
An apprenticeship typically consisted of 10 90-minute sessions during a semester. In some cases, Citizen Teachers relied on their own material or materials/syllabi. At the end of the semester, students participated in a showcase called the WOW!, in which they taught friends, family, and community members.
- **Training.** Citizen Schools trained new Citizen Teachers before each semester started and required all new Citizen Fellows to take part in a summer institute to become familiar with Citizen Schools.

## Summary of Results

### DID PARTICIPATION IN STEM-FOCUSED APPRENTICESHIPS LEAD TO IMPROVED 21<sup>ST</sup> CENTURY SKILLS IN STEM AND STEM ENGAGEMENT?

Students completed an Apprenticeship survey which included items about 21<sup>st</sup> Century Skills (7-point scales) and STEM Interest (5-point scales). The mean scores for items in each of those outcome categories is presented below.



Participation in at least one volunteer-led STEM-focused apprenticeship had no statistically significant effect on the confirmatory outcomes of 21<sup>st</sup> Century Skills and STEM interest when compared to the comparison group which participated in non-STEM-focused apprenticeships.

- **21<sup>ST</sup> CENTURY SKILLS.** There was no statistically significant difference in the level of 21<sup>st</sup> Century Skills between treatment and comparison group students at follow up.
- **STEM INTEREST.** Differences in STEM interest between treatment and comparison group students at follow up were not statistically significant.

Please see Appendices B and C for information about the evaluation's design and the quality of the evidence, respectively.

## SECONDARY FINDINGS

Analysis of the confirmatory outcomes by gender and grade indicated no statistically significant difference between the intervention and comparison groups on 21<sup>st</sup> Century Skills, STEM interest, and overall math achievement. Participation in the STEM apprenticeships did have significant impacts on math achievement for 6<sup>th</sup> graders and male students.

- **MATH ACHIEVEMENT.** There were no statistically significant differences between intervention and comparison group students in math achievement.
- **GRADE LEVEL.** The STEM-focused apprenticeships had a statistically significant positive impact on 6<sup>th</sup> grade students' math achievement. The effect was approximately equal to four months of math growth in one school year. Participation in the apprenticeships had no statistically significant impact on 6<sup>th</sup>, 7<sup>th</sup>, or 8<sup>th</sup> grade students' 21<sup>st</sup> Century Skills or STEM interest.
- **GENDER.** Participation in at least one STEM-focused apprenticeship had no statistically significant impact on either male or female students' 21<sup>st</sup> Century Skills or STEM interest. However, the apprenticeships had a marginally significant positive impact on male students' math achievement. This effect was approximately equal to three months of math growth in a school year.

## OTHER CONSIDERATIONS

The evaluators reported on the program's implementation results as well as some limitations to the study.

- **STUDY SAMPLES FOR STEM INTEREST AND MATH ACHIEVEMENT DID NOT OVERLAP DIRECTLY.** As a result, findings on these two domains are not directly comparable as they cover slightly different student groups.
- **AMBIGUITY OF IDENTIFYING STEM AND NON-STEM APPRENTICESHIPS.** Determination of what counted as a STEM and a non-STEM apprenticeship was not always clear. The study team used Citizen Schools' brief description of each apprenticeship, but the descriptions could be vague. Additionally, STEM apprenticeship options varied between districts and even between schools.
- **FIDELITY OF IMPLEMENTATION.** Evaluators set standards across five aspects of apprenticeships: core STEM curriculum development, volunteer recruitment, staff training, staff monitoring, and student participation in hands-on activities. Fidelity thresholds were not met for volunteer recruitment, school staff training, and student participation in hands-on activities.
- **LOWER THAN EXPECTED STUDENT ATTENDANCE.** Attendance records show 72% of students attended at least nine weeks of all apprenticeships they participated in.

## For More Information

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### Evaluation Reports

[Evaluation Report \(Full Report\)](#) (Abt Associates, September 2018)<sup>3</sup>

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<sup>3</sup> The information and data for this result summary was collected from the most recent report as of 01/22/2020: Abt Associates. (2018, June). Closing Inspiration and Achievement Gaps in STEM with Volunteer-Led Apprenticeships Retrieved from <https://static1.squarespace.com/static/57542d1b0442628dccd81967/t/5bd09d198165f5cc5f889805/1540398447561/Closing+Gaps+in+STEM.pdf>

## Appendix A: Students Served by the Project<sup>4</sup>

GRADE(S)													
PK	K	1	2	3	4	5	6	7	8	9	10	11	12

### GENDER



### RACE/ETHNICITY

Not Reported

### COMMUNITY

Not Reported

### HIGH-NEED STUDENTS<sup>i</sup>

Free/Reduced-Price Lunch	English Learner	Students with Disabilities
N/A	N/A	N/A

<sup>4</sup>These data reflect the entire student population served by the intervention, not just the evaluation sample used in the impact study.

## Appendix B: Impact Evaluation Methodology<sup>5</sup>

### RESEARCH DESIGN:

<b>Design:</b>	Quasi-Experimental Design (QED)
<b>Approach:</b>	<ul style="list-style-type: none"> <li>Twenty-one schools implementing ELT during the 2015-16 school year, serving 2,835 6<sup>th</sup>-8<sup>th</sup> grade students. The analytic sample was smaller as four schools were not able to provide survey data and five were not able to provide achievement data. These schools were removed from the analysis. The study compared outcomes for students who took at least one STEM-focused apprenticeship to those that took non-STEM focused apprenticeships.</li> </ul>
<b>Study Length:</b>	Two years

### DATA COLLECTION AND ANALYSIS

<b>Study Setting:</b>	21 schools serving 6 <sup>th</sup> -8 <sup>th</sup> grade students, drawn from Citizen Schools across the U.S.
<b>Final Sample Sizes:</b>	<ul style="list-style-type: none"> <li><i>Intervention Group</i>: 891 students</li> <li><i>Comparison Group</i>: 185 students</li> </ul>
<b>Intervention Group Characteristics:</b>	<ul style="list-style-type: none"> <li>Male: 54.3%</li> <li>6<sup>th</sup> grade: 65.1%</li> <li>7<sup>th</sup> grade: 28.8%</li> <li>8<sup>th</sup> grade: 6.1%</li> </ul>
<b>Comparison Group Characteristics</b>	<ul style="list-style-type: none"> <li>Male: 37.8%</li> <li>6<sup>th</sup> grade: 57.3%</li> <li>7<sup>th</sup> grade: 18.9%</li> <li>8<sup>th</sup> grade: 23.8%</li> </ul>
<b>Data Sources:</b>	<ul style="list-style-type: none"> <li>Surveys: Students (21<sup>st</sup> Century Skills and STEM interest questions)</li> <li>Student records: Standardized test scores</li> </ul>
<b>Key Measures:</b>	<ul style="list-style-type: none"> <li>21<sup>st</sup> Century Skills (using the 21<sup>st</sup> Century and Inquiry Skill Assessment, a 12-item Likert-scale instrument)</li> <li>STEM Interest (using the Modified Attitudes Towards Science Inventory (mATSI), a 25-item Likert-scale instrument designed specifically for middle school students)</li> <li>Math achievement (measured by math standardized test scores from Spring 2015 and 2016)</li> </ul>

<sup>5</sup> These data reflect only the evaluation sample in the impact study, not the entire population served.



## Appendix C: Quality of the Evidence

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### WHAT WORKS CLEARINGHOUSE REVIEW<sup>6</sup>

STUDY	RATING
Not reviewed as of 01/22/2020	N/A

### EVIDENCE FOR ESSA REVIEW<sup>7</sup>

STUDY	RATING
Not reviewed as of 01/22/2020	N/A

### NATIONAL CENTER ON INTENSIVE INTERVENTIONS REVIEW<sup>8</sup>

STUDY	RATING
Not reviewed as of 01/22/2020	N/A

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<sup>6</sup> <https://ies.ed.gov/ncee/wwc/FWW>

<sup>7</sup> <https://www.evidenceforessa.org/>

<sup>8</sup> <https://intensiveintervention.org/>



The [\*Investing in Innovation Fund \(i3\)\*](#), established under section 14007 of the American Recovery and Reinvestment Act of 2009, is a Federal discretionary grant program at the U.S. Department of Education within the Office of Elementary and Secondary Education (OESE). i3 grants help schools and local education agencies work in partnership with the private sector and the philanthropic community to develop and expand innovative practices that improve student achievement or student growth, close achievement gaps, decrease dropout rates, increase high school graduation rates, and/or increase college enrollment and completion rates for high-need students.

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<sup>i</sup> “High-need student” refers to a student at risk of academic failure or otherwise in need of special assistance and support, such as students who are living in poverty, attend high-minority schools, are far below grade level, who have left school before receiving a regular high school diploma, at risk of not graduating with a diploma on time, who are homeless, in foster care, have been incarcerated, have disabilities, or who are English learners. For more information see: [\*Applications for New Awards; Investing in Innovation Fund-Development Grants, 81 FR 24070 \(April 25, 2016\)\*](#).