

# ***STEMTECH ALLIANCE: PILOT REPORT***

Funded by the Massachusetts  
Department of Higher Education  
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Pilot Evaluation Report  
March 2009 - August 2009

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***E***VALUATION ***A***nalysis ***S***olutions, Inc.

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**STEMTech Alliance  
Pilot Evaluation Report**

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## EXECUTIVE SUMMARY

This evaluation report covers the period from April 2009 through August 2009 of the STEMTech Alliance project. The report documents the activities of the Project's School Pilot (June 2009) and presents findings in relation to the pilot's goals. It begins with findings related to the pilot activities, follows with findings related to the STEMTech Ambassadors, and finally focuses on the impact of the project as perceived by classroom teachers and as reported by students who participated in the STEMTech Ambassador visit.

In sum, the evaluation found that for the pilot, the StemTech Alliance project:

- Successfully implemented planned pilot activities
- Met the target number of recruited classrooms and teachers
- Trained and supported StemTech Ambassadors in their visits
- Encouraged all StemTech Ambassadors to successfully focus on key messages
- Yielded positive evaluations from STEM Ambassadors, teachers, and students
- Improved student interest in and understanding of STEM careers

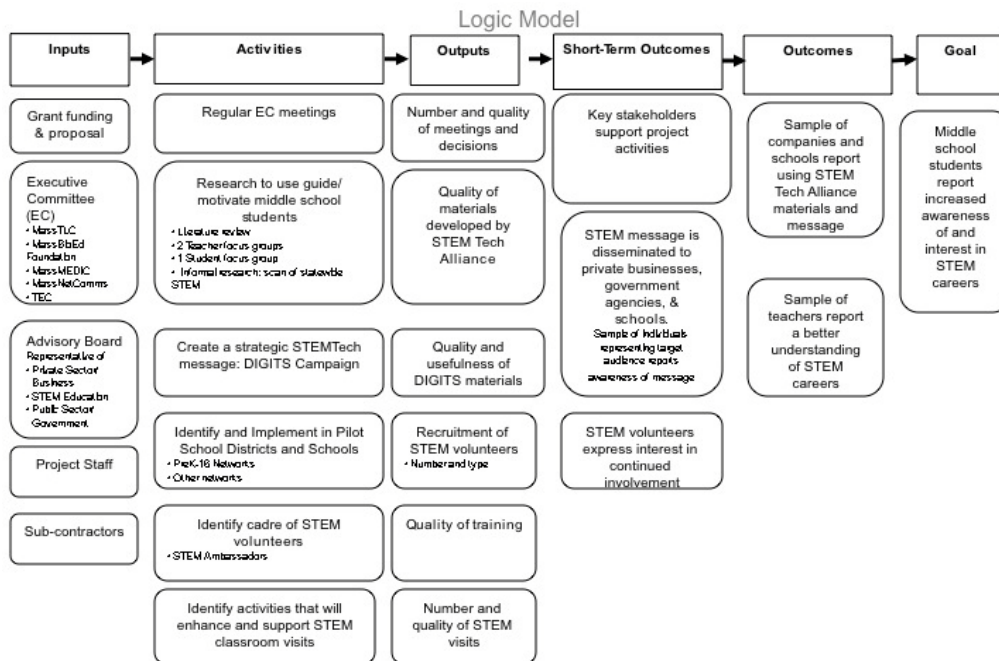
The full report follows.

# PROJECT DESCRIPTION OVERVIEW

The STEMTech Alliance project, funded by the Massachusetts Department of Higher Education’s STEM Pipeline Fund, is designed to increase middle school students’ interest in and understanding of STEM careers.

The project’s theory of change, illustrated in the project “logic model” below is that the project inputs, such as the grant funding, executive committee, and project staff, would enable the STEMTech Alliance to engage in specific activities including the development of a public education campaign regarding STEM awareness, which in turn would lead to specific outputs such as the DIGITS campaign materials and short-term outcomes. Ultimately, the project is designed to achieve the goal of increasing middle school students’ awareness and interest in STEM careers.<sup>1</sup>

**Graphic 1. Project Logic Model**



The logic model succinctly presents the links between activities and outcomes. It also guided the development of the evaluation questions, analyses and reporting framework, which are presented in the next section.

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# EVALUATION DESIGN

## INTRODUCTION

The STEMTech Alliance contracted with Dr. Diane Schilder at Evaluation Analysis Solutions to conduct an external evaluation of the STEMTech Alliance project. In order to provide formative data—feedback about project activities—to guide decision-making for future activities, the evaluator collected and reported findings to the project directors. The evaluator also collected summative data—to document the impact of the project on participating students. This report represents an interim report summarizing formative findings and project progress from April 2009 through July 2009.

The independent evaluator engaged in wide-ranging activities to collect the data discussed in this report. Different types of data were collected in order to:

- Document baseline conditions in pilot test sites
- Describe project activities, strategies, and pilot site contexts
- Provide formative feedback to the project
- Report preliminary impacts of project activities

## QUESTIONS, DATA COLLECTION, AND ANALYSIS

The logic model presented earlier guided the refinement of evaluation questions and methods.

The evaluation questions that guided the data collection and analysis for the pilot phase linked with the logic model are as follows:

- 1) Did the project complete planned activities? Did the project produce desired outputs?
- 2) How did teachers, Ambassadors, independent observers, and students view the project activities such as the DIGITS campaign materials? What conditions in each pilot test site supported implementation? What barriers were reported?
- 3) Did the project result in desired interim outcomes? What conditions are related to desired interim outcomes?

The evaluator engaged in the following specific activities to guide the evaluation. (Each evaluation activity is only listed in one place, even though there is some overlap in categories.)

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### Project Chair and Director

- › Refinement of logic model
- › Observation of and participation in selected project team meetings and conference calls
- › Facilitation of formative evaluation feedback meetings
- › Informal conversations with project leaders
- › Reviews of documents produced by project leaders
- STEM Ambassadors
  - › Informal conversations during training
  - › Training of 10 STEM Ambassadors via conference call
  - › Surveys of STEM Ambassadors
  - › Observations using structured protocols
  - › Direct observation of STEM Ambassador visits
- Target pilot test teachers
  - › Surveys (baseline and follow-up)
  - › Observations using structured protocols
  - › Informal interviews with teachers
- Students
  - › Observations
  - › Surveys (baseline and follow-up)

**Table 1. Data Collection Activities**

<b>Evaluation Activity</b>	<b>Description</b>	<b>Number</b>
<b>Observations</b>	Project chair and director meetings/conference calls	5
	STEM Ambassadors, teachers and students in classrooms*	19
<b>Surveys</b>	Teacher surveys	10
	STEM Ambassador surveys	10
	Baseline and post student surveys	289
<b>Document review</b>	Project communications DIGITS materials STEM Ambassador materials	

\* Classroom observation data from 17 classrooms supplied by other observers recruited by STEMTech Alliance; 2 observations conducted by the evaluator.

The evaluator used varied qualitative and quantitative methods to examine and describe project activities and associated impacts on teachers and their students. Our quantitative methods consisted of inferential statistical methods using paired-samples t-tests of means to examine sample differences and pre-post gains. Our qualitative methods were guided by Miles & Huberman's framework of creating an initial coding schema, refining the codes after preliminary analysis, and exploring emerging themes and trends. Qualitative data were coded based on a schema that examined the relationship between actors (such as project director and teachers), activities (such as the STEM Ambassador training, recruitment of schools within each Congressional district, etc.), outputs (such as number of visits and number of students), and outcomes (changes in participating teachers and their students).

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## FINDINGS

The findings are organized into 3 sections. We begin with a description of activities and their implementation, and suggestions for future changes. We follow by summarizing the perceptions of the project as reported by participating teachers and Ambassadors and then present findings regarding the project's impact on students.

### ACTIVITIES

#### DESCRIPTION OF PLANNED ACTIVITIES

The project created an ambitious plan of activities to be carried out in the spring 2009. Specifically, the project planned to:

- Recruit pilot test schools
- Recruit teachers to participate in the pilot test
- Recruit volunteers to serve as STEM Ambassadors
- Develop guide to be used by STEM Ambassadors
- Conduct training of STEM Ambassadors
- Provide support to STEM Ambassadors through regular communication and through coordination of communication with schools and teachers
- Collect and use formative data collected from the pilot test to revise activities with the aim of ensuring field test activities are successful

#### SUCCESSFUL COMPLETION OF OBJECTIVES

##### Recruitment of Sites and Teachers

During the pilot test phase of the project, the project successfully completed all planned project activities and met output targets. The project successfully recruited 10 schools representing the 10 Congressional Districts throughout the Commonwealth. The cities/towns were as follows:

Andover  
Beverly  
Boston  
Brockton  
Chicopee  
Fall River  
Malden

Mashpee  
North Adams  
Worcester

Moreover, schools were selected to ensure representation across geographic and socio-economic contexts in order to improve the transferability of the findings.

The schools and districts that volunteered to participate in the pilot test represented a mix of urban, suburban, and rural settings. Moreover, schools served children with a range of socio-economic backgrounds with some schools serving high percentages of children living in poverty and others serving children from high-income families.

The teachers who were recruited reported teaching a total of more than 600 students. All teachers who were originally recruited successfully hosted STEM Ambassador visits.

### **Recruitment of Ambassadors**

STEMTech Alliance engaged in steps to recruit STEM Ambassadors. A total of 10 STEM Ambassadors were successfully recruited who represented the each STEM sector represented by STEMTech Alliance:

- Biotechnology
- Medical Device
- Engineering
- Software and Internet
- Telecommunications

### **Steps to Enhance Fidelity of Implementation**

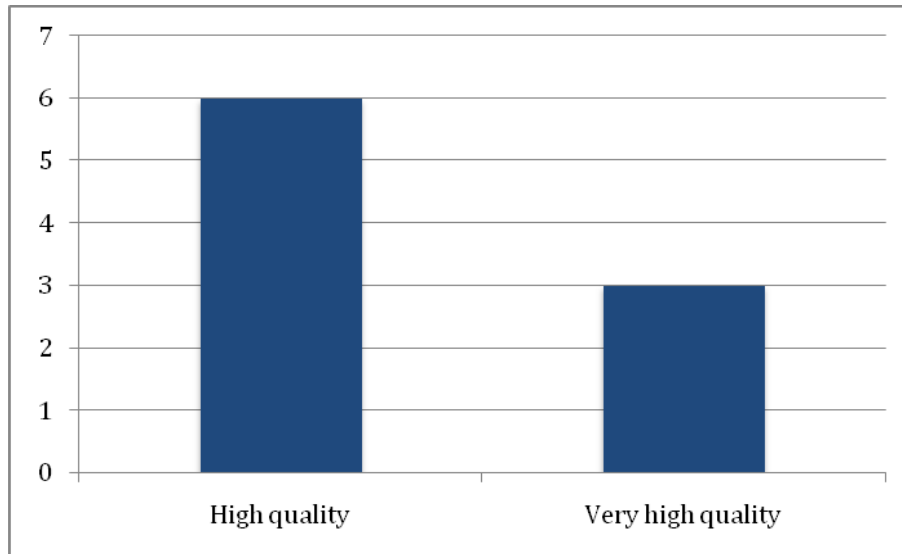
To increase the likelihood that the pilot visits would be implemented with fidelity, project leaders developed a detailed guide for STEM Ambassadors. Each STEM Ambassador received the Guide, highlighting key messages and campaign materials, and each was required to participate in training via conference call. A total of 3 telephone conference call training sessions were provided to ensure that each Ambassador had the chance to participate in one training session. During the training key messages were explored and volunteers were given information about successful best practices for middle school visits. Moreover, volunteers had opportunities to ask questions.

### **PARTICIPATING TEACHER REPORTS FAVORABLE**

Teacher responses to the STEM Ambassador visits were overwhelmingly favorable. Graphic 2 below shows that all of the teachers who responded indicated that the DIGITS

presentation was either high quality or very high quality. Respondents were asked to rate the quality of the presentations on a 4-point scale with options including “low quality” and “very low quality.”

**Graphic 2. Teacher Perceptions of Quality of DIGITS**



\* 10 teachers responded to the survey but 1 skipped this question.

Teachers provided comments that:

*“The DIGITS sticker activity and poster were creative, colorful, and fun.”*

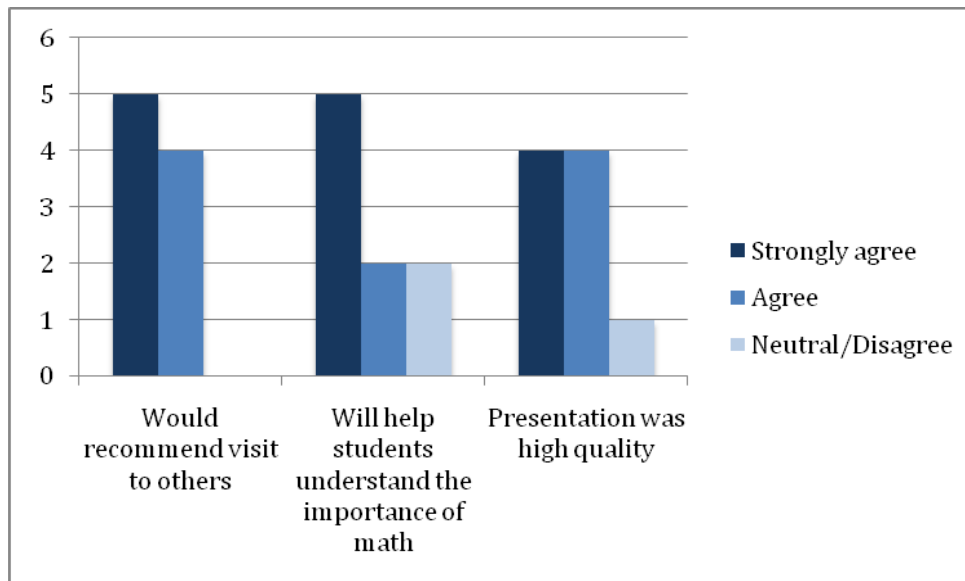
*“The presentation and material used was top quality and fun for the students.”*

*“The presentation engaged the students, allowed the students to work in groups, and move around. Real life situations were presented to the students. The presenter was well prepared and was constantly asking questions.”*

Moreover, most teachers either agreed or strongly agreed that the visits were positive. (See Graphic 3 below.) Teachers were asked to rate their level of agreement with statements regarding different aspects of the STEM Ambassador visits. As Graphic 3 shows, all teachers strongly agreed or agreed that they would recommend visits in the future. While most teachers agreed or strongly agreed that the presentation would help students understand the importance of mathematics, comments indicated that some Ambassadors did not explicitly make the connection between their jobs and middle school mathematics; 1 respondent disagreed with this statement and 1 respondent gave a

neutral response. Most of the respondents strongly agreed or agreed that the presentation was high quality with one respondent responding neutral to this question.

**Graphic 3. Teacher Perceptions of Different Aspects of DIGITS Presentations**



\* 10 teachers responded to the survey but 1 skipped this question.

As noted above, all teachers indicated they would recommend STEM Ambassador visits to others. Moreover, many indicated they were interested in a repeat STEM Ambassador visit:

*“I would enjoy having an ambassador coming into my class again I think it is a wonderful way to introduce the students to a possible future career and at the same time help them to see how important math and science is in the world and in their future.”*

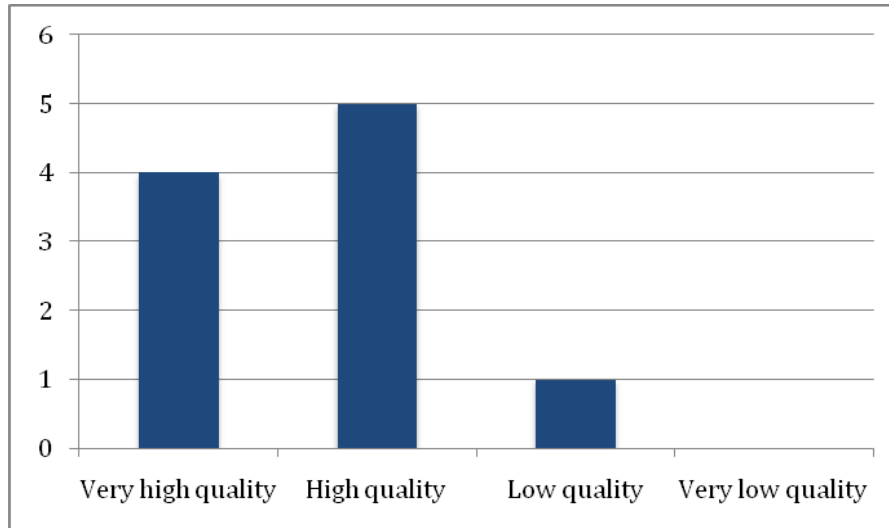
*“I would be interested in another visit from a STEM Ambassador. I feel it is extremely important to open the eyes of our children to what is available to them in the future. We need to constantly expose them...some of our students will never receive this exposure unless it happens in the classroom.”*

## IMPACTS

### STEM AMBASSADOR REPORTS MOSTLY POSITIVE

STEM Ambassadors were asked to complete a post-visit survey. Nine of the 10 STEM Ambassadors provided favorable reports regarding the DIGITS materials they received prior to the visits (See Graphic 4 below.)

**Graphic 4. Ambassador Perceptions of DIGITS Materials**



Similarly, 9 of the 10 STEM Ambassadors reported that the training was very high quality or high quality. All of the Ambassadors reported that they felt prepared for their site visits. Specific comments about the training and preparation are presented below.

*The training gave others and me a chance to ask questions... and it was nice to get a phone introduction to the other people involved.*

*I was relieved that I didn't have to go anywhere to participate in the training.*

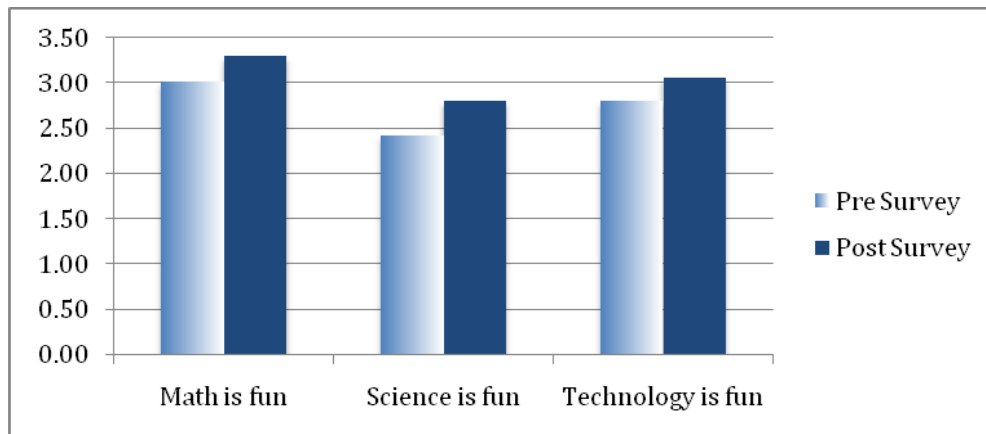
*[The STEMTech Alliance leaders] provided (the) necessary checklist that helped to ensure that each of the ambassadors appropriately prepared for each of the visits.*

### STUDENTS REPORT BENEFITS OF VISITS

Students participating in the STEM Ambassador visits were asked to complete a pre-visit survey and a post-visit survey. Seventy-two per cent (289 of 400) of students completed both the pre and post visit surveys. The results of analyses on student survey data are summarized below.

Students reported improvements in attitudes and knowledge of STEM careers after the Ambassador visits. As noted in graphic 5 below, on the post survey, students were more likely to report that mathematics, science, and technology were “fun” when compared to answers on the pre-survey.

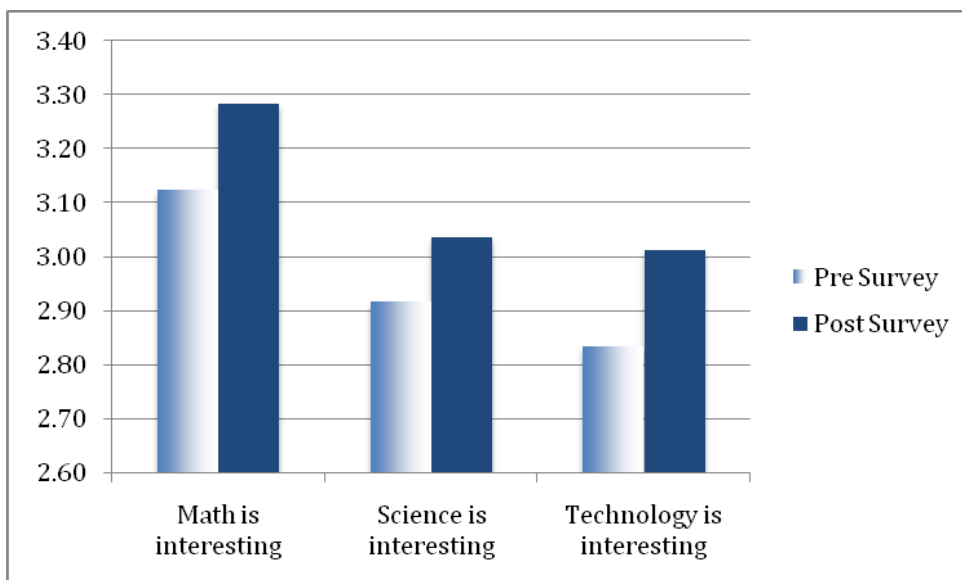
**Graphic 5. Students’ More Likely to View STEM as “Fun”**



On the survey 1=strongly disagree and 4=strongly agree.

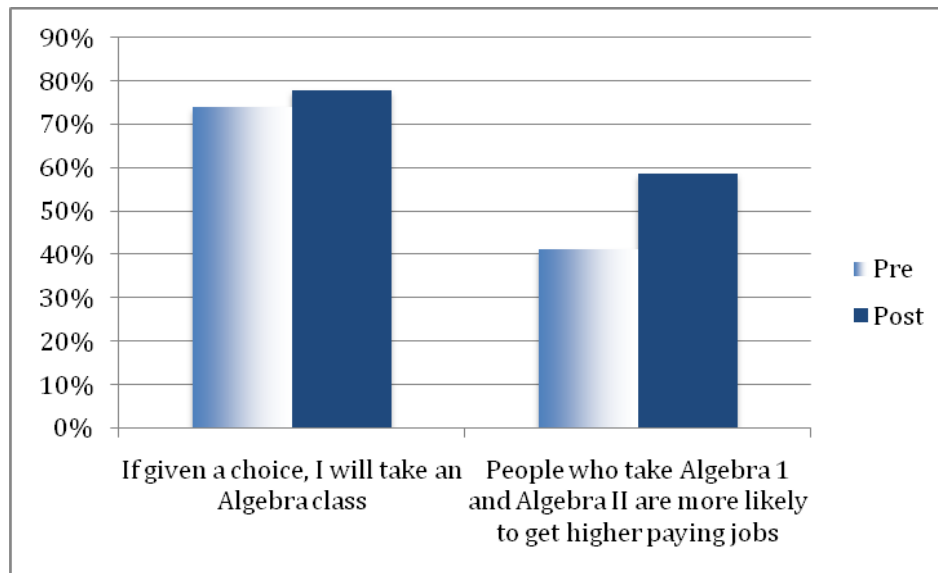
Students’ attitudes increased more dramatically when asked to report their attitudes regarding how “interesting” STEM careers are. As shown in Graphic 6, students reported increased interest in math, science, and technology on the post survey

**Graphic 6. Students’ More Likely to View STEM as “Interesting”**

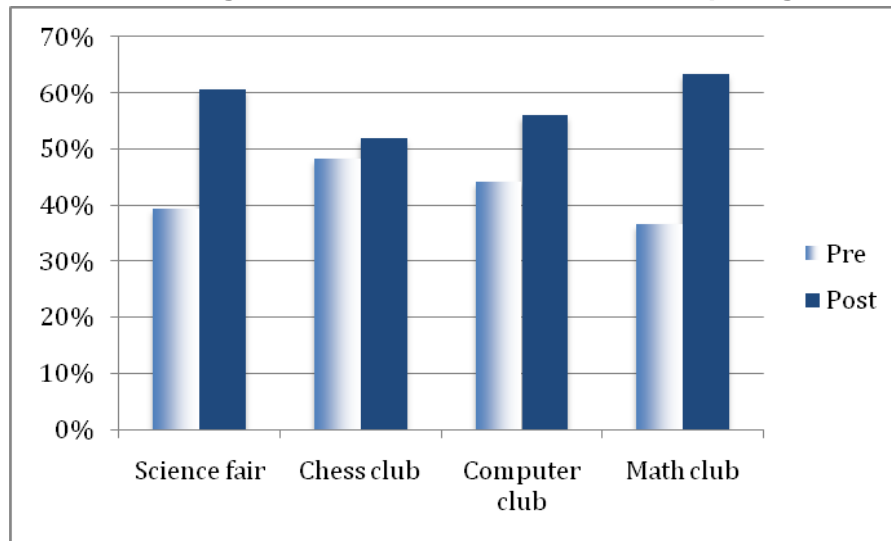


Students' knowledge increased as well. Students reported gains in understanding the types of STEM careers available to them and the steps needed to pursue STEM careers. For example, Graphic 7 illustrates that students were more knowledgeable about the importance of Algebra and were slightly more likely to report they would take algebra in the future.

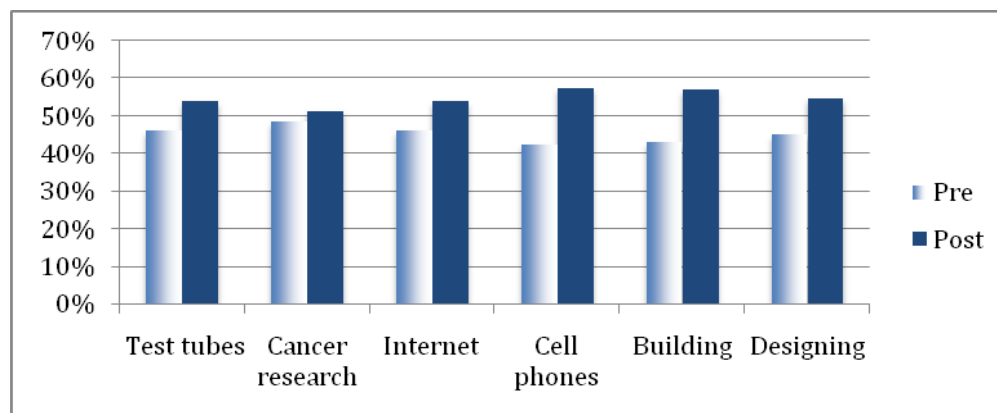
**Graphic 7. Students' Attitudes and Knowledge about Algebra**



Students' attitudes toward science, technology, engineering, and mathematics also changed after the Ambassador visits. Students reported an increased interest in mathematics, science, and technology clubs and activities after the STEM Ambassador visit when compared with their attitudes prior to the visit (see Graphic 8). Students were more likely to view these topics favorably after the visits than before the visits.

**Graphic 8. Percentage of Students Interested in Participating in Activities**

Students were more likely to view science, technology and mathematics careers favorably after the Ambassador visit. Specifically, they were more likely to view words such as Internet, cell phones, building and designing as related to mathematics and science after the Ambassador visit. See Graphic 9 below.

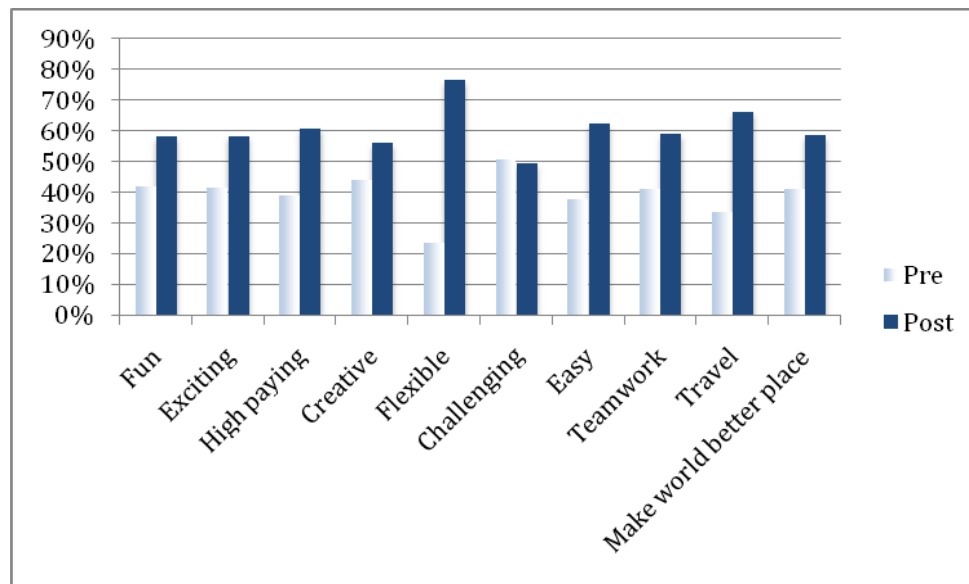
**Graphic 9. Percentage of Students Viewing Jobs As Involving...**

Qualitative analysis of open-ended questions reveals that students' awareness of careers that involve mathematics, science, and technology expanded after the STEM Ambassador visits. For example, when asked on the pre-survey to list jobs that involve mathematics numerous students listed the following occupations: teacher, cashier, and banker. Following the visit, examples of students' responses include: mechanical engineer, Comcast worker, and computer analyst. When asked to list jobs that involve science,

examples of responses on the pre-survey include: scientist, teacher, and astronaut. Post-visit science jobs listed by students include: pediatrician, meteorologist, and video game developer. Example pre-survey technology jobs listed by students include: teacher, manager, and secretary. Finally, example post-survey technology jobs listed include: satellite designer, website creator, and computer programmer.

In addition, after the STEM Ambassador visit, students were more likely to view STEM jobs as fun and exciting. See Graphic 10 below.

**Graphic 10. Percentage of Students Viewing STEM Jobs As . . .**



Students viewed the visits favorably. The overall rating was high and their comments revealed that they gained knowledge from the visit and that their attitudes toward STEM careers improved. On a 4-point scale with 4 being the highest and 1 being the lowest, the average score was 3.65. In addition, over 70 percent of students who completed both the pre and post surveys gave the visits the highest rating. Selected comments from students are presented below.

Students reported that they learned from the STEM Ambassador visits. Illustrative comments follow:

*I learned a bunch of cool jobs related to math, science, and technology.*

*I could have a life of science.*

*[I learned] . . . what job I can do after learning math and science and about different technologies there are for helping people.*

*[I learned] . . . what I will do in the future.*

*[I] learned that math and science can be fun and you will need it in the future.*

While the majority of comments about the quality of the visits were positive, some students' comments revealed some changes that can be made for the full implementation. For example, one student said he felt the Ambassador was not sensitive to working-class families. The STEMTech Alliance leaders plan to incorporate additional information in the training materials to ensure Ambassadors are aware that they need to address students from a range of backgrounds.

However, the majority of students provided favorably comments about the quality of the visits. Illustrative comments follow:

*It was interesting; now I want to become an engineer.*

*It was really interesting. I learned new interesting facts.*

*I got to understand through activities.*

*I loved hearing things that includes science and math.*

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## CONCLUSION AND RECOMMENDATIONS

### CONCLUSION

During the pilot test, the STEMTech Alliance met or exceeded the project goals and benchmarks. In sum, the project:

- Successfully implemented all planned activities
- Met the target number of visits for the pilot test
- Supported STEM Ambassadors, thereby enhancing fidelity of implementation
- Received positive reports from Ambassadors, teachers and students
- Improved student outcomes

### RECOMMENDATIONS FOR THE FUTURE

As the project team plans to move from the pilot phase to full implementation, the Project Chair and Director are refining plans for the upcoming year. Based on an analysis of pilot phase data, the external evaluator has a number of suggestions for the future.

- Consistent with the Project Chair and Directors' plans, the evaluator suggests that the project replicate the training for all newly recruited STEMTech Ambassadors. Moreover, the evaluator suggests that future trainings incorporate lessons from the pilot phase. For example, future training should emphasize the link between mathematics and specific jobs and should emphasize the importance of following the script even if Ambassadors have their own pre-developed presentations.
- Based on analyses of the observation notes and information provided by Ambassadors, the evaluator recommends that if possible Ambassadors consider conducting visits to multiple schools and classrooms. During the pilot phase nine of the 10 Ambassadors visited two classes at each school and one Ambassador visited a single classroom. Some of the Ambassadors who conducted multiple visits reported feeling more comfortable with the second visit than the first. Moreover, numerous teachers said they were interested in follow up visits. While it is outside the scope of the original project and funding, the project might consider ways of supporting follow up Ambassador visits.

- Continue to provide specific instructions regarding the importance of fidelity of implementation of the DIGITS Campaign and continue to emphasize the DIGITS scripts. When recruiting individuals who have a standard presentation, it is especially important to ensure these individuals are aware of the unique aspects of DIGITS that need to be emphasized. While most Ambassadors followed the scripts with fidelity, there were instances in which key components were not emphasized appropriately. Therefore, future trainings should include specific instructions for Ambassadors that have existing standard presentations.
- Refine training materials to offer examples of ways to link jobs explicitly to mathematics. While analyses of observer, teacher, and student data reveals that most Ambassadors emphasized the importance of mathematics, some observers and Ambassadors reported that additional details about jobs that are related to mathematics would be beneficial. For example, one individual recommended that scripts include specific ways in which engineers use mathematics or how video game developers actually use mathematics in their jobs.
- Since the results of the pilot were consistently positive, consider collecting data from a sample of students rather than from the universe of students who participate. The pilot report includes only descriptive statistics as the sample was not randomly selected and the sample is somewhat small. For the full implementation it is possible to perform inferential statistical analyses of a randomly selected sample of students, thereby generalizing to the population. Nonetheless, it will be important for the evaluator to collect data on activities, such as the numbers of classroom visits completed. Nonetheless, data from a sample of students should provide adequate statistical power to generalize to the population.