

BEC STEM Connect™ **Program Impact Report**

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Presented by:

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BEC *STEM Connect*™

2015 Program Impact Report

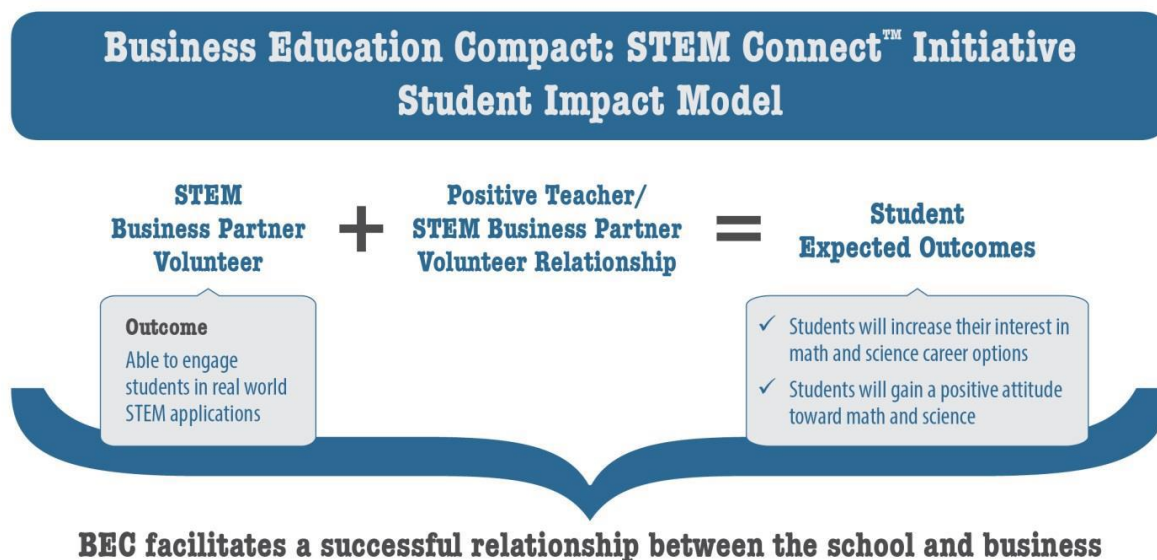
Acknowledgements

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Methodology

The BEC *STEM Connect*[™] Initiative brings together community business partners and underserved neighborhood schools to inspire interest in math and science. By generating interest, the program seeks to create a pathway to STEM careers. The focus is on 4th and 5th grade classrooms, where research reports declining interest in math and science.

The evaluation investigated the impact of the program in two key areas: career interest and attitude. The expectation is that the students will: (1) improve their attitude/behavior toward math and science and (2) increase their interest in pursuing a math or science career. The student impact model below illustrates the relationships between teachers, STEM business partner volunteers, BEC, and students, as well as the expected outcomes. It sets the foundation for the evaluation.



Three key methodologies were employed to measure key outcomes:

Fourth grade student pre/post student survey. The Attitude Toward Science in School Assessment (ATSSA) (Germann 1988) was administered to students in fall 2014 (pre) and spring 2015 (post). This instrument focused on science and was expanded to the topic of math for the purposes of this evaluation. Items added to the post-test captured students' thoughts on program components, as well as whether they felt their interest in math and science had changed as a result of the program. There were 608 fourth-grade students across ten schools that completed the pre/post surveys. The actual number of responses varied item to item.

Summative surveys. Both teachers and volunteers completed a summative survey that captured their thoughts about student engagement, overall student impact, as well as program implementation feedback.

This report highlights impact BEC *STEM Connect* made in the 2014-15 school year as well as how data will be used for program improvement.

Student Outcomes

STEM Connect Student pre-test scores were high, resulting in no marked improvement in aggregate scores from pre to post-tests. However, statistically significant positive shifts in attitudes toward science and math occurred among students who had limited interest or negative attitudes at the beginning of the year. In addition, post surveys included specific questions about program impact where we saw marked improvement. It is significant to note that *STEM Connect* was successful in inspiring some of these students to improve their attitude toward math, and to a lesser degree science.

Key student outcomes and survey results are as follows:

Outcome: Students will improve their attitudes/ behavior toward math and science.

Data show this outcome was met. While aggregate scores did not change much, this was likely due to the high pre-test scores. To dig deeper, the same tests were run on a subset of students who had a negative or neutral attitude toward math and science in the pre-test. For students who showed little interest in science and math in the pre-test, there were significantly positive changes on nearly every measure.

Post-test results also illustrate positive findings as follows:

✓ 66% (of 565 students) reported being more interested in science because of the STEM program	<p><i>"I feel more interested because you get to have more time experimenting."</i></p> <p><i>"I feel more interested in science because you get [to] see stuff inside a bug."</i></p> <p><i>"I love math way more now."</i></p> <p><i>"You made me love math 100%."</i></p>
✓ 33% (of 63 students) with neutral or negative attitude toward science in the pre-test were more interested in science because of the STEM program	
✓ 46% (out of 570) reported being more interested in math because of the STEM program	
✓ 23% (out of 110) with neutral or negative attitude toward math in the pre-test showed improved attitude in the post-test	

Outcome: Students will increase their interest in pursuing a math or science career.

Data show this outcome was met. Aggregate scores showed no marked improvement about their interest in jobs in science or math. As with measuring changes in attitude, this too is likely due to the high pre-test scores. Notably, tests run with a subset of students who had negative or neutral pre-test results showed increased interest.

Post-test results also illustrate positive changes as follows:

✓ 23% of students (out of 94) who had neutral or negative responses regarding jobs in science showed an increase in interest in the post-test	<p><i>"I would love to have a job in science when I grow up."</i></p> <p><i>"I want math for my job. It's just hard, a little."</i></p>
✓ 28% (out of 160) who had neutral or negative responses regarding jobs in math showed an increase in interest in the post-test	

Outcome: Students will report that STEM business partner volunteer activities and presentations are engaging.

Post-test results showed this outcome was met. Students were overwhelmingly positive about the volunteers.

✓ 83% of students reported that hands-on activities were interesting or very interesting	<i>"The volunteers made it interesting to learn about science."</i>
✓ 80% would like to have the volunteers back in class	<i>"It makes me feel that in science I can do better than I think I can."</i>
✓ 79% of students reported volunteers were interesting or very interesting	<i>"This program is fun, please keep doing it."</i>
✓ 70% of students reported presentations were interesting or very interesting	<i>"I feel more interested because they teach it very kindly and in a fun way."</i>

The post-test survey also captured students' comments regarding the program. Of the 608 surveys, 22% (131) students commented on how their interest level changed or didn't change in math and science as a result of participating in the program. The majority reported positive comments about math and science. The following details if the comments were positive, neutral, and/or negative in math and/or science.

Forty-three percent (56) of comments were positive about both science and math.

"I feel more interested in science because you get [to] see stuff inside a bug."

"I feel more interested [in math] because we did the marble run."

"I like math because it makes me happy and smart."

"I like science because it is nice and informative."

"What I realized is that math could help a lot I will use it more but I still don't like it."

"Now I love science and the experiments."

Thirty percent (39) were positive about science, but neutral, negative or provided no comments about math.

"The science they taught was a fun hands on activity."

"I think S.T.E.M taught me lots of great things about science."

"Science is hard but really fun, I like the science experiments."

In contrast, just seven percent (9) were positive about math, but neutral, negative, or provided no comments about science.

"I feel more interested in math because STEM teaches it very kindly and in a fun way."

"I feel much better about math then I used to be."

"You made me love math 100%."

Fourteen percent (19) were negative or neutral about both areas. As one student stated, "Science is boring. I hate math and I always will!" And six percent (8) responses were neutral because they already liked the subject; therefore, the program didn't change their interest level.

Teacher and Volunteer Outcomes

In June 2015 the teacher and volunteer summative surveys were administered. 20 Teachers (23%) and 60 volunteers (37%) participated in the summative survey. We recognize that teacher response rate was low. Surveys were published to participants after the last contract day of many of our teachers. BEC will administer the survey earlier next program year to increase the response rate.

Key teacher and volunteer outcomes and survey results are as follows:

Overarching Program Goal: Volunteers will engage students in real world STEM applications.

The concept of student engagement is an outcome addressed in all data collection tools for teachers, volunteers, and students. This is key to the program's success. Teacher and volunteer summative surveys support that this goal was met.

<p>✓ 95% of teachers and 98% of the volunteers rated student's level of engagement as excellent or above average.</p>	<p><i>"Our class was highly engaged and thrilled to participate in the events."</i></p> <p><i>"It was great to see the excitement of the kids after they had successfully built/ implemented their project."</i></p> <p><i>"... the most powerful part was the fact that students got to make a design, test it, and then were able to go back to redesign any flaws they encountered! They got to see that learning comes from mistakes and that they are tools."</i></p>
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Outcome: Positive relationship between teacher and volunteer will be established.

<p>✓ Teachers (100%) and volunteers (91%) reported working relationship between themselves and volunteers was either very positive or positive.</p>	<p><i>"(Volunteer) was fondly referred to as "Our Engineer" by myself and my students."</i></p> <p><i>"I have a new respect for teachers! (Teacher) pours their heart into the class and you can tell cares a lot about the students. I was honored that I was able to be a part of that."</i></p>
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Outcome: Teacher and STEM business partners will have regular contact.

BEC implemented a volunteer visit reporting system in the 2015 program year. Feedback from volunteers stating the need for website improvements was consistent with the lack of data entered by volunteers to report visits. BEC is working to update the website for content and usability. Anecdotal feedback from volunteers on committee and in-person meetings with volunteers and teachers supports that program dosage is on track. Student outcomes can also be viewed as supportive of this.

Outcome: Business partners will become part of the school community.

Of the 60 volunteer survey participants, 22 reported they were involved with the event in the following ways: attended (50%), helped plan (31%) or presented (18%). Typically, the events were a STEM night of science fair. As one volunteer stated, "I attended the school's STEM night and assisted students and parents in one of the hands-on activities."

Considerations:

- Success: Those that were involved had positive comments to share.
- Challenge: 22% reported there wasn't a school wide event, and 42% didn't know if there was one.

What we learned:

In the 2016 program year BEC staff will help coordinate the school wide connection between the school and business.

Outcome : Teacher confidence in teaching STEM increased.

Confidence level in teaching STEM did not change for most teachers. For some, it improved (30%); for most (63%) there was no change.

What we learned:

During the initial program planning phase, BEC intended to integrate its Teaching & Learning Initiative with *STEM Connect*. This approach will not be part of the program design and implementation process in future program years. BEC will adopt a new approach to teacher training that complements NGSS and experiential learning.

Impact and Next Steps

Overall, survey results demonstrate that *STEM Connect* had a positive impact on students. One hundred percent of volunteers and teachers reported they felt this was the case.

As one volunteer shared, they distributed hot metal gloves to let the students try them on.

"While passing out the gloves to the kids, the classroom erupted in frenzied happiness."

Another volunteer observed increased interest in STEM.

"It was neat to see the kids go from almost no interest in STEM on the first visit, to considerable interest by the last visit."

One teacher reported students could recreate an activity at home.

"My students enjoyed the hands on STEM activities and were entirely engaged. We did three designs this year and were very positive with the students ... simple, fun, educational and students realized they could design one at home!"

Program Implications

Timing. Teacher and volunteer comments reported that starting later in the year was difficult.

- ▶ BEC will work to match volunteers and teachers earlier in the fall to facilitate conversations and connections before winter.

Introduction visit. Some teachers and volunteers commented the initial visit could have used more hands on activities/ interaction.

- ▶ BEC will provide a more structured outline for the introductory visits with examples of simple ways to engage students.

Classroom management. Volunteers commented in some cases, a substitute was there which made classroom management difficult.

- ▶ BEC will implement program guideline for rescheduling activities when a short-term substitute will be managing the classroom.

Second classroom visit activities. Volunteers commented that having more structured second classroom activities would be useful.

- ▶ BEC will increase visibility (website) of and volunteer access to recommended activities for second visits.

Additional math resources. Winter surveys of teachers and volunteers support the need for additional resources to talk to students about math, specifically around careers including all STEM-related careers. Qualitative student responses support they do not feel that math was talked about very much.

- ▶ BEC will earmark program funding and sponsorship dollars to develop resources for teachers and volunteers to talk about math and math careers. In addition BEC will create a take-home booklet or pamphlet highlighting diverse STEM-related careers.

Overall, the *STEM Connect™* program had a positive impact on students. The program included three classroom visits, and the return on this investment is converting some students who initially did not like math and/or science to increase their interest. The *STEM Connect™* program inspired them. Ultimately, this may lead to STEM career and/or educational paths that may otherwise have gone unknown for these students.

Reference

Germann, P. J. (1988). "Development of the Attitude Toward Science in School Assessment and its Use to Investigate the Relationship Between Science Achievement and Attitude Toward Science in School." *Journal of Research in Science Teaching*, 25, 680-703.