Report of Survey Results from 2015-2016 C-STEM Participants

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Executive Summary

Communication, Science, Technology, Engineering, and Mathematics (C-STEM) is a Houston-based education nonprofit (501(c)(3)) that provides hands-on, STEM-focused learning opportunities to disadvantaged students in grades Pre-K through 12, and professional training in STEM education to teachers. C-STEM evaluates its programming each year to learn about and from its participants. The purpose of the present evaluation is to address two of C-STEM's goals: Goal 3 (*Increase students' 21st century skills and STEM literacy by providing students through competition*) and Goal 7 (*Increase students' interest in and capacity to pursue careers in STEM-related fields*). To do so, a survey was administered to students at the end of the 2015-2016 school year to examine their experiences with, attitudes towards, and interest in STEM and STEM careers and their 21st century skills.

A total of 705 students (315 elementary, 175 middle school, and 215 high school students) participated in C-STEM in 2015-2016 and of them, 181 students responded to the online survey for a response rate of 25.6%. Students' attitudes towards STEM were measured using two versions of the *Students' Attitudes Towards STEM* survey (Unfried, Faber, Stanhope, & Wiebe, 2015). C-STEM administered an abridged version of the surveys that measured two constructs: Students' attitudes towards engineering and towards their own 21st century skills. The surveys also included a section of 12 items asking about students' relative interest in specific STEM and STEM-related careers.

In the 2015-2016 sample, 36.9% of the elementary students were male and 63.1% were female. Of the secondary students, 55.2% were male and 44.8% were female. Students who completed the survey were from 10 schools: Three were charter schools and seven were traditional public schools, and six were in Houston, Texas, one was in Detroit, Michigan, and two were in Wisconsin. Over half of the elementary students and over 60% of the secondary students responded that they only had participated in C-STEM programs, and almost all students indicated they would participate in future STEM programs. Both groups of students were very positive about STEM careers and reported high levels of support from their parents and/or families for STEM.

When asked to rate their abilities in mathematics and science, the secondary students overall were more positive than the elementary students. There were only a few differences between male and female students: More secondary males were interested in STEM careers than secondary females; more secondary females expected to do poorly in science than secondary males; and more males were sure about taking advanced mathematics courses than females, who were more uncertain. When comparing students who had participated previously only in C-STEM programming to those who had participated only in other STEM programming, the former group of students overall was less positive in their opinions than the latter group.

When asked about their interest in engineering and their assessment of their own 21st century skills, both the secondary and elementary students were more positive about their own 21st century skills than they were about engineering. When asked about their expectations for their performance in their own classes, an overwhelming majority of all of the students was very positive. What's more, a large majority of secondary students expected to enroll in advanced mathematics and science courses, as did a majority of elementary students. Almost all of the students were very positive about their college prospects.

Once the results were broken down, several differences between groups emerged. In general, the secondary students were more positive in their responses than the elementary students, though those differences were not tested for statistical significance. Differences by sex were examined, and both secondary and elementary males were more positive about STEM and several STEM careers than the female students. Differences according to prior experience with STEM programs also were investigated. No significant differences emerged at the elementary or secondary levels for the STEM dispositions. There were, however, several significant differences at the secondary level in terms of career interests such that students who had no prior C-STEM experience expressed higher interest for some career options.

The results provide some evidence that C-STEM is achieving two of its goals for some of its students: (Goal 3) *Increase students' 21st century skills and STEM literacy by providing students through competition,* and (Goal 7) *Increase students' interest in and capacity to pursue careers in STEM-related fields*. What's more, students who have participated in C-STEM over the past three years have been as or more positive about STEM and STEM careers as students participating in other, similar STEM programs. Finally, the report also provides some evidence that C-STEM's programming should continue to improve learning experiences for the students with whom it works in particular.

The report concludes with a set of recommendations to improve future data collection and evaluation efforts for C-STEM.

Introduction to C-STEM

Communication, Science, Technology, Engineering, and Mathematics (C-STEM) is a Houston-based education nonprofit (501(c)(3)) that provides hands-on, STEM-focused learning opportunities to disadvantaged students in grades Pre-K through 12, and professional training in STEM education to teachers. The program's mission is "*to inspire the next generation of innovators and thought leaders by engaging them in exciting hands-on projects solving real world problems to encourage entry into the talent pipeline, bolster self-confidence, and foster a well-rounded mastery of the areas of communication, science, technology, engineering, and mathematics*." The program seeks "*to enrich curriculum and instruction through integrated STEM learning experiences*."

C-STEM's goals are to:

1. Empower students to become innovators and technologically proficient problem solvers;
2. Ensure that students have access to the appropriate STEM instructional resources conducive to enhancing their learning experiences both inside and outside of the traditional classroom setting;
3. Increase students' 21st century skills and STEM literacy by providing students through competition;
4. Enrich community understanding of STEM education and its importance in building capacity to prepare students for work and life in the 21st century;
5. Increase teacher capacity to deliver STEM content grades Pre K-12 STEM;
6. Serve as a channel for connecting classroom learning with the business sector to improve students' college and career readiness skills;
7. Increase students' interest in and capacity to pursue careers in STEM-related fields.

Every year, C-STEM's curriculum has a new focus and during the 2015-2016 school year, the focus was, "The Urban Nexus: Improving the Quality of Life." As part of this, students had to analyze the multiple challenges that cities face as their populations grow. For example, students had to consider what infrastructure might need to be built, in what ways designing good infrastructure can help mitigate the negative effects of pollution and over-crowding, and how to balance the benefits of sustainable infrastructure with the costs. Students had to design their own solutions to the challenges posed by conducting original research and applying that knowledge.

Each spring, student teams compete in the CSTEM Challenge, which is the culmination of all the work they have done during the school year. In 2015-2016, students competed in any of eight areas: Robotics, Innovation, Computer programming, Civil engineering, Mural, Sculpture, Film, and Sculpture.

Evaluation

C-STEM evaluates its programming each year to learn from its participants. Previous evaluations have covered 2002-2006 (Flowers, 2008), 2007 (Owens & Johnson, 2007), and 2011-2015 (all reports available for download at www.cstem.org). The purpose of the present evaluation is to address two of C-STEM's goals, Goal 3 (*Increase students' 21st century skills* *and STEM literacy by providing students through competition*) and Goal 7 (*Increase students' interest in and capacity to pursue careers in STEM-related fields*). To do so, a student survey was administered at the end of the 2015-2016 school year to examine students' experiences with, attitudes towards, and interest in STEM and STEM careers (Goal 7 above) and their 21st century skills (Goal 3 above). The design of the evaluation does not permit any conclusions about whether the participating students improved in their attitudes towards and interest in STEM as the survey only was administered in the spring at the conclusion of the school year. The evaluation does allow for the presentation of summary descriptive statistics about the students who participated and for the comparison of subgroups of students within the sample of participants. Finally, the evaluation also will compare results from the 2015-2016 school year to both previous years (to the extent that is possible) and to results from participants in other, similar STEM programs. The evaluation did not include teachers as the survey was administered only to students.

A total of 705 students (315 elementary, 175 middle school, and 215 high school students) participated in C-STEM in 2015-2016, and of them, 181 students responded to the online survey for a response rate of 25.6%, which is a relatively low response rate for this type of study.[1] Some students completed the survey in their classrooms and others completed it at the annual C-STEM Challenge. What follows is a description of the surveys and their results and, where possible, results from 2015-2016 will be compared to those from the 2014-2015 and 2013-2014 evaluations.[2]

Student Survey Results

Student Survey Instruments

Students' attitudes towards STEM were measured using the *Students' Attitudes Towards STEM* survey (Unfried, Faber, Stanhope, & Wiebe, 2015). The survey was created with the support of the National Science Foundation and has been validated. Two versions of this survey are available: One for upper elementary (grades four and five) and one for secondary (middle and high school) students, though the questions are very similar (See Appendix A for a full copy of the surveys).

The original surveys comprise four scales that, together, measure students' attitudes towards STEM as well as towards 21st century skills. The scales are attitudes towards engineering, attitudes towards mathematics, attitudes towards science, and attitudes towards 21st century skills. All four scales utilize a five-point Likert scale for the response options (1= Strongly disagree to 5= Strongly agree). C-STEM administered an abridged version of the survey (See Appendix B for full copies of the C-STEM versions) and so only two of the four scales were fully measured: Attitudes towards engineering and towards 21st century skills. The surveys also both include a section of 12 items asking about students' relative interest in specific STEM and STEM-related careers.

Table 1 below presents the reliabilities (Cronbach's alpha) for each of the two scales for both the elementary and secondary C-STEM administrations. In all cases, the reliabilities were high

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[1] For example, the authors of the survey had a response rate of 82% when they administered the instrument as part of a pilot.
[2] It should be noted that different survey instruments were utilized in these two years, limiting the comparability of the results.

and in-line with pilot data from the creators of the surveys. Specifically, the reliabilities for the engineering scale and the 21st century skills scale were 0.86 and 0.88 for the elementary respondents, respectively, and 0.85 and 0.91 for the secondary respondents, respectively. These reliabilities are consistent with, or higher than, what the authors of the survey have reported (The Friday Institute, 2012).

Table 1: Reliability of scales for elementary and secondary respondents

Scale	Elementary	Secondary
Engineering	0.86	0.85
21st century skills	0.88	0.91

Student Demographics

In this section, descriptive statistics are presented for the students who responded to the survey. In 2015-2016, 36.9% of the elementary students were male and 63.1% were female (Table 2). Of the secondary students, 55.2% were male and 44.8% were female.

Table 2. Students' sex

Student Sex	Elementary Students		Secondary Students	
	Frequency	Percent	Frequency	Percent
Male	24	36.9%	64	55.2%
Female	41	63.1%	52	44.8%
Total	65	100%	116	100%

Of the elementary students, over half responded that they only had participated in C-STEM programs, and not other kinds of STEM programs (Table 3). For the secondary students, that number was even higher: Just over 60% of them only had participated in C-STEM programs. 20% of elementary students and just under 30% of secondary students had participated in between one and five other STEM programs, while only two elementary and 10 secondary students had participated in six to 10 STEM programs previous to their participation in 2015-2016 in C-STEM, and only one elementary and one secondary student reported participating in more than 10 STEM programs. In other words, these data suggest that C-STEM is serving a population of students that other STEM education organizations are not reaching.

Table 3. Prior participation in C-STEM or other STEM programs

	Elementary		Secondary	
	Frequency	Percent	Frequency	Percent
1-5 STEM programs	20	30.8%	32	29.1%
6-10 STEM programs	2	3.1%	10	9.1%
More than 10 STEM program	1	1.5%	1	0.9%
Only C-STEM programs	37	56.9%	67	60.9%
Total	60	100%	110	100%
Missing	5	7.7	6	5.2

Almost all of the students were very positive about their experience with C-STEM and other STEM programs (Table 4). When asked whether they would participate in future STEM programs, almost 95% of secondary students and 86% of elementary students indicated they would.

Table 4. Students' intention to participate in future STEM programs

	Secondary		Elementary	
	Frequency	Percent	Frequency	Percent
No	6	5.2	9	13.8
Yes	110	94.8	56	86.2
Total	116	100	65	100

C-STEM works with teachers and students from Pre-K through 12th grade. Among the students who responded to the survey, just over one third came from elementary school (defined as grades K-5), just under a quarter were from middle school (grade 6-8), and the remaining 40% were from high school (9-12), as depicted in Table 5 below. Interestingly, there was a large number of second grade students participating and responding, a grade level when students often are not afforded much time in subjects beyond literacy and mathematics.[3]

Table 5. Grade level distribution

Grade Level	Frequency	School Level Percent	Total Percent
2nd grade	24	36.9	13%
3rd grade	10	15.4	6%
4th grade	8	12.3	4%
5th grade	23	35.4	13%
Subtotal	**65**	**100**	**36%**
6th grade	12	10.3	7%
7th grade	16	13.8	9%
8th grade	15	12.9	8%
9th grade	16	13.8	9%
10th grade	24	20.7	13%
11th grade	28	24.1	15%
12th grade	5	4.3	3%
Subtotal	**116**	**100**	**64%**
Total	181		100%

C-STEM is an open enrollment program that allows schools to enter the program as they have the capacity to do so. There are no contracts, and C-STEM provides services to those schools that are able to register for the program by the deadline. Registration is affected when superintendents, principals, and teachers leave a school or district and, as a result, C-STEM has high *district* retention rates, but not *school* retention rates. As an example, schools from the Houston Independent School District have participated in C-STEM for 15 consecutive years, but not the same schools each year. Similarly, Prince George's Country Public Schools in

[3] The elementary survey was designed for fourth and fifth graders, but over a half of the respondents to the C-STEM elementary survey were in second or third grade. Results, therefore, should be interpreted with caution as students in second and third grade are still developing readers who may not have fully understood all of the questions on the survey.

Maryland has participated for five years, and the Michigan Charter School System and the Wisconsin Private School System have participated in C-STEM for three years.

In the 2015-2016 school year, a total of 14 schools participated in C-STEM: Nine schools were from Houston, Texas, three schools from Detroit, Michigan, and two schools were from Wisconsin. Two Houston area high schools, one public and one charter, did not complete C-STEM's curriculum. Of the students who responded to the survey, 10 schools were represented (see Table 6). Of these, three were charter schools and seven were traditional public schools. Of these schools, six were in Houston, Texas, one was in Detroit, Michigan, and two were in Wisconsin.

Table 6. Distribution of students from participating schools

Secondary School Name	Percent	State/District	Title I	Pct African American	Pct Latino	Pct White
Sharpstown International HS+	18.10%	TX/HISD	Yes	8.3%	82.0%	2.9%
Holy Redeemer$	7.80%	WI/Private	No	98.0%	2.0%	0.0%
Young Coggs$	3.40%	WI/Private	No	98.0%	2.0%	0.0%
Chandler Park MS$	9.50%	MI/Charter	Yes	100.0%	0.0%	0.0%
Hamilton MS+	17.20%	TX/HISD	Yes	8.4%	86.5%	3.6%
Energy Institute HS+	22.40%	TX/HISD	Yes	24.7%	59.9%	11.6%
North Houston Early College HS+	5.20%	TX/HISD	Yes	6.8%	92.1%	0.0%
Cypress Ridge HS+	0.90%	TX/CFISD	Yes	19.6%	55.8%	12.3%
Westside HS+	13.80%	TX/HISD	Yes	31.9%	37.2%	22.1%
Missing*	1.70%					
Total	100					

Elementary School Name	Percent	State/District	Title I	Pct African American	Pct Latino	Pct White
Holy Redeemer$	20%	WI/Private	No	98.0%	2.0%	0.0%
Windsor Village ES+	7.70%	TX/HISD	Yes	37.0%	60.0%	1.0%
Chandler Park ES$	35.40%	MI/Charter	Yes	100.0%	0.0%	0.0%
Betsy Ross ES+	32.30%	TX/HISD	Yes	62.80%	35.30%	0.70%
Missing*	5%					
Total	100					

*Several students did not respond to this question

+Data from Texas Education Agency, 2014-2015

$Data from GreatSchoosl.org, 2014-2015

Of the students who responded to the survey, most were very positive about STEM and STEM careers (Table 7). When asked whether they were interested in a STEM-related career, almost 85% of secondary students and almost 80% of elementary students indicated they indeed were, which indicates higher interest than students who participated in a similar afterschool STEM program run by the 4-H club (STEM Coalition, 2016).

Table 7. Students' interest in STEM-related careers

	Secondary		Elementary	
	Frequency	Percent	Frequency	Percent
No	18	15.5	14	21.5
Yes	98	84.5	51	78.5
Total	116	100	65	100

When asked whether their parents supported their interest and participation in STEM, students overall provided a positive assessment (Table 8). Slightly more secondary students (82.8%) indicated their parents were supportive than elementary students (80%), though both groups suggested high levels of support.

Table 8. Parental support of student's participation in STEM

	Secondary		Elementary	
	Frequency	Percent	Frequency	Percent
No	20	17.2%	13	20%
Yes	96	82.8%	52	80%
Total	116	100%	65	100%

Student Academic Background and Self-Assessment

The survey also asked students to rate their own abilities in mathematics and science, as well as to summarize their expected performance in English language arts, mathematics, and science. Responses to these questions were examined in the aggregate and then were disaggregated by gender and prior experience with C-STEM.

Aggregate responses. The first three questions, asking students to rate their ability in mathematics and science, were Likert scale questions in which students were asked to indicate the extent to which they agreed or disagreed with the statements made. The secondary students overall were more positive than the elementary students (Table 9). For the first of the three items, "I can handle most subjects well, but I'm bad at math", the elementary students had a higher average score, which means more of them agreed or strongly agreed with the statement and were negative about their abilities. For the second item, "I'm sure I could do advanced math work", the elementary students once again had a slightly higher average response, which meant that more agreed or strongly agreed with the statement, a result that somewhat contradicts the previous results. Finally, for the third item, "I can handle most subjects, but I can't do well in science", elementary students had a higher average score than the secondary students, which means that more of them agreed or strongly agreed with the statement and were less optimistic about their prospects in science.

Table 9. Comparison of secondary and elementary students' attitudes towards mathematics and science

	I can handle most subjects well, but I'm bad at math		I'm sure I could do advanced math work		I can handle most subjects, but I can't do well in science	
	Elementary	Secondary	Elementary	Secondary	Elementary	Secondary
Valid	65	116	65	116	65	116
Missing	0	0	0	0	0	0
Mean	2.66	2.23	3.91	3.87	2.94	2.03
Std. Deviation	1.43	1.16	1.09	1.10	1.52	1.05

When the responses were broken down, the differences remained clear (Table 10): Over 65% of the secondary students and just over 55% of elementary students either disagreed strongly or disagreed with the statement, "I can handle most subjects well, but I cannot do a good job with math." Similarly, only about 17% of secondary students either agreed or agreed strongly with the same statement, while over 30% of elementary students had the same reaction.

Table 10. I can handle most subjects well, but I cannot do a good job with math

	Secondary		Elementary	
	Frequency	Percent	Frequency	Percent
Strongly disagree	37	31.9%	18	27.7%
Disagree	40	34.5%	18	27.7%
Neither agree nor disagree	19	16.4%	5	7.7%
Agree	15	12.9%	16	24.6%
Strongly agree	5	4.3%	8	12.3%
Total	116	100	65	100

The next question prompted students with the statement, "I am sure I could do advanced math." Unlike the first question about mathematics, the secondary and elementary students both responded positively to this prompt (Table 11). Over 70% of the secondary elementary students either agreed or strongly agreed with the statement. While this result is consistent for the secondary students, it is not for the elementary students, which does not make sense and raises questions regarding whether the young students understood the prompts and the structure of the questions.

Table 11. I am sure I could do advanced math

	Secondary		Elementary	
	Frequency	Percent	Frequency	Percent
Strongly disagree	7	6%	3	4.6%
Disagree	6	5.2%	4	6.2%
Neither agree nor disagree	18	15.5%	11	16.9%
Agree	49	42.2%	25	38.5%
Strongly agree	36	31%	22	33.8%
Total	116	100	65	100

The third and final question mirrored the first, but was about science (Table 12). The secondary students were particularly positive in their assessment of their ability in science with almost 90% of students either disagreeing or strongly disagreeing with the statement, "I can handle most subjects well, but I cannot do a good job with science." The elementary students were somewhat more ambivalent about their prospects in science than in mathematics: About 50% of them either disagreed or strongly disagreed with the statement, but almost a quarter strongly agreed with the statement and over 15% agreed with it.

Table 12. I can handle most subjects well, but I cannot do a good job with science

	Secondary		Elementary	
	Frequency	Percent	Frequency	Percent
Strongly disagree	42	36.2%	14	21.5%
Disagree	46	39.7%	18	27.7%
Neither agree nor disagree	12	10.3%	7	10.8%
Agree	14	12.1%	10	15.4%
Strongly agree	2	1.7%	16	24.6%
Total	116	100	65	100

Several questions asked the students the extent to which they agreed with a set of statements about engineering and about their own 21st century skills (Table 13). In order to summarize students' dispositions toward both, an index was created for each in which students scores were averaged. For both grade levels, the students were more positive about their own 21st century skills than they were about engineering (elementary 21st century skills M = 4.15 vs. engineering M = 3.86; secondary 21st century skills M = 4.23 vs. engineering M = 4.09). For both scales, the secondary students were more positive than the elementary students. What's more, for both elementary and secondary students, the C-STEM students had higher average responses than students involved in other STEM programs (The Friday Institute, 2012).

Table 13. Students' average scores for engineering and 21st century skills

	Elementary		Secondary	
	Mean	Std. Deviation	Mean	Std. Deviation
Engineering Index	3.86	0.78	4.09	0.58
21st Century Skills Index	4.15	0.64	4.23	0.56

The next set of questions asked the students to indicate whether they thought they were doing well in their classes, whether they thought they would take advanced mathematics or science classes, whether they would attend college, and whether they knew any adults working in STEM fields. Each had different answer stems. Table 14 summarizes the students' responses to the first set of questions about student performance in their classes. Very few of the secondary or elementary students expected to do poorly in any of the three classes: English language arts (ELA), mathematics, or science. Instead, the vast majority of both groups believed they would do either "OK/Pretty well" or "Very well". The elementary students were more positive than the secondary students.

Table 14. Students' expectations for performance in different classes

	Secondary			Elementary		
	ELA	Math	Science	ELA	Math	Science
Not very well	0.90%	2.6%	3.4%	4.60%	4.60%	4.60%
OK/Pretty well	44%	39.7%	37.9%	30.80%	27.70%	29.20%
Very well	55.20%	57.8%	58.6%	64.60%	67.70%	66.20%
Total	100%	100%	100%	100%	100%	100%

The next set of questions asked the students whether they thought they might enroll in advanced mathematics or science courses, and whether they thought they might go to college (Table 15). Very few secondary students and slightly more elementary students answered negatively to all three questions. In contrast, a large majority (>65%) of secondary students expected to enroll in advanced mathematics and science courses, as did a majority (>50%) of elementary students. All of the students were very positive about their college prospects: 96.6% of secondary and 89.2% of elementary students expected to go to college. Indeed, the C-STEM students, both elementary and secondary, were more optimistic about going to college than students who participated in other similar STEM programs (The Friday Institute, 2012; STEM Coalition, 2016).

Table 15. Students' intentions

	Secondary			Elementary		
	Math	Science	College?	Math	Science	College?
No	4.3%	12.1%	2.6%	12.3%	13.8%	3.1%
Not sure	24.1%	19.0%	0.9%	29.2%	30.8%	7.7%
Yes	71.6%	69.0%	96.6%	58.5%	55.4%	89.2%
Total	100%	100%	100%	100%	100%	100%

The final set of four questions asked students whether they knew any adults working as scientists, engineers, mathematicians, or technologists (Table 16).[4] The secondary students were split in terms of knowing any adults working as scientists (43.1% responded no, while 39.7% responded yes) or as mathematicians (34.5% responded no, while 50% responded yes). Over 75% responded knowing an engineer, and 62.1% responded knowing a technologist. Among the elementary students, the responses were split across all four careers, though for each, more students indicated that they knew an adult in that career than indicated they did not. More elementary than secondary students were unsure whether they knew an adult in each of the four careers. The C-STEM students' responses were comparable to those of students participating in other STEM programs (The Friday Institute, 2012).

Table 16. Whether the students know adults in work in STEM careers

	Secondary			
	Scientists	Engineers	Mathematicians	Technologists
No	43.1%	16.4%	34.5%	22.4%
Not sure	17.2%	7.8%	15.5%	15.5%
Yes	39.7%	75.9%	50%	62.1%
Total	100	100	100	100
	Elementary			
	Scientists	Engineers	Mathematicians	Technologists
No	38.5%	29.2%	26.2%	32.3%
Not sure	20.2%	15.4%	23.1%	24.6%
Yes	41.5%	55.4%	50.8%	43.1%
Total	100	100	100	100

[4] The question stems did not provide any explanation regarding what these careers comprised.

Disaggregated responses.

Differences across student sex. In order to investigate whether there was any association between students' responses to the questions described in this section and students' sex, a Chi square test of association was conducted (Table 17). For the elementary sample, only one relationship was significant: Elementary females were more positive about their ability in mathematics than the elementary males. In the secondary sample, there were several significant relationships: More secondary males were interested in STEM careers than secondary females; more secondary females expected to do poorly in science than secondary males; and more males were sure about taking advanced mathematics courses than females, who were less certain.

Table 17. Differences across student sex

Student Sex	Elementary	Secondary
	Significant	
Future participation in STEM programs	N	N
Interest in STEM careers	N	Y*
Parental support for STEM participation	N	N
Bad at math	Y*	N
Advanced math coursework	N	N
Bad at science	N	N
Expectations for ELA	N	N
Expectations for Mathematics	N	N
Expectations for Science	N	Y*
Future advanced mathematics classes	N	Y*
Future advanced science classes	N	N
College intentions	N	N
Know scientists	N	N
Know mathematicians	N	N
Know engineers	N	N
Know technologists	N	N

*Significant at $p<0.05$

Differences by C-STEM participation. For this analysis, a second set of Chi square tests of association was conducted. Here, participation in STEM programs was converted into a dichotomous variable: Whether students had participated previously in C-STEM. The other three categories were collapsed into one single category. As a result, students who only had participated in C-STEM prior to the 2015-2016 school year were compared to student who had participated in none to more than 10 other STEM programs. The benefit of this approach is that the comparison is clearer, but the drawback is that it does not allow us to account for variation in the number of years of experience in STEM programs, whether in or out of C-STEM. Several relationships emerged at both the elementary and secondary levels (Table 18).

The elementary students who only had participated previously in C-STEM expressed significantly less interest in participating in a future STEM program. Similarly, the C-STEM-only elementary students reported lower levels of parental support for their participation in STEM. They also were more negative about their math abilities, and had lower expectations for enrolling in advanced mathematics in the future. Finally, significantly fewer C-STEM only students reported knowing an adult who worked as a technologist. All other relationships were not statistically significant within the elementary sample.

Among the secondary students who only had participated previously in C-STEM, several significant relationships emerged. C-STEM-only students expressed relatively less interest in STEM careers, and were more negative about their abilities in science. To the contrary, they were more positive about their performance in English language arts. The secondary C-STEM-only students were less certain about whether they would take advanced science classes in the future, and fewer of them reported knowing a scientist. There were no significant differences for students' appraisal of their own mathematics ability or expectations in mathematics.

Table 18. Differences by C-STEM participation

C-STEM Participation	Elementary	Secondary
	Significant	
Future participation in STEM programs	Y*	N
Interest in STEM careers	N	Y*
Parental support for STEM participation	Y*	N
Bad at math	Y*	N
Advanced math coursework	N	N
Bad at science	N	Y*
Expectations for ELA	N	Y*
Expectations for Mathematics	N	N
Expectations for Science	N	N
Future advanced mathematics classes	Y*	N
Future advanced science classes	N	Y*
College intentions	N	N
Know scientists	N	Y*
Know mathematicians	N	N
Know engineers	N	N
Know technologists	Y*	N

*Significant at $p<0.05$

Student Career Interests

The survey asked a series of questions about students' interest in a range of STEM and STEM-related careers. Table 19 depicts the elementary students' interests. The question asked how interested students were in each of the careers, and the question prompt provided a description of each career. For example, physics is described as, "…the study of basic laws governing the motion, energy, structure, and interactions of matter. This can include studying the nature of the universe", and sample careers provided included: Aviation engineer, alternative energy technician, lab technician, physicist, and astronomer. There was a separate item for each career, so students were able to express their relative interest for each. The responses for the elementary sample were coded as follows: Not all interested=0, Not so interested=1, Interested=2, Very interested=3.

The responses indicate that, on average across the career options, students rated themselves between not so interested and interested—right in the middle. For the elementary students, the most popular career options were computer science, engineering, and mathematics, while the least popular options were physics and veterinary science. When the responses were broken down, it became clear that the majority of students were either interested or very interested in each of the careers. Indeed, the following careers had at least 70% of the elementary students responding that they either were 'interested' or 'very interested') were: Environmental work, biology or zoology, mathematics, computer science, and engineering.

Table 19. Elementary student career interests

Career Interest	Average response	Not at all interested	Not so interested	Interested	Very Interested
Physics	1.58	21.5%	21.5%	33.8%	23.1%
Environmental Work	1.86	13.8%	15.4%	41.5%	29.2%
Biology or Zoology	1.89	10.8%	15.4%	47.7%	26.2%
Veterinary Science	1.62	21.5%	23.1%	27.7%	27.7%
Mathematics	1.92	15.4%	12.3%	36.9%	35.4%
Medicine	1.77	13.8%	23.1%	35.4%	27.7%
Earth Science	1.72	13.8%	27.7%	30.8%	27.7%
Computer Science	2.06	7.7%	15.4%	40.0%	36.9%
Medical Science	1.71	16.9%	27.7%	23.1%	32.3%
Chemistry	1.77	13.8%	20.0%	41.5%	24.6%
Energy	1.83	12.3%	23.1%	33.8%	30.8%
Engineering	1.97	13.8%	12.3%	36.9%	36.9%

The secondary students were asked to respond to the same questions about the same STEM and STEM-related careers (Table 20). The secondary students' responses were similar to the elementary students' responses, though they appear higher because the responses were coded 1-4. According to the average responses, the most popular careers were engineering and energy. This result was confirmed by the disaggregated results, which indicate that among these students the two most popular careers were energy (70.6% of students were either 'interested' or 'very interested') and engineering (84.5% of students were either 'interested' or 'very interested'). That these two topped the list for the secondary students is not surprising for two reasons: The first is that most of the secondary students were from Houston, where the energy industry is prominent, and the second is that many of the Houston students are exposed to energy and engineering careers through career and technical education at their schools, such as at the Energy Institute high school, one of the schools participating in C-STEM. Other popular careers (> 60% either 'interested' or 'very interested') were physics, mathematics, and computer science. Veterinary science was the least popular with only 42% of students expressing interest.

Table 20. Secondary student career interests

Career Interest	Average response	Not at all interested	Not so interested	Interested	Very Interested
Physics	2.68	10.3%	26.7%	47.4%	15.5%
Environmental Work	2.65	5.2%	36.2%	47.4%	11.2%
Biology or Zoology	2.68	9.5%	34.5%	34.5%	21.6%
Veterinary Science	2.38	16.4%	41.4%	30.2%	12.1%
Mathematics	2.76	9.5%	26.7%	42.2%	21.6%
Medicine	2.58	12.9%	32.8%	37.9%	16.4%
Earth Science	2.71	9.5%	31.0%	38.8%	20.7%
Computer Science	2.85	7.8%	25.9%	39.7%	26.7%
Medical Science	2.59	13.8%	31.0%	37.9%	17.2%
Chemistry	2.57	15.5%	30.2%	36.2%	18.1%
Energy	2.81	6.0%	23.3%	54.3%	16.3%
Engineering	3.24	3.4%	12.1%	41.4%	43.1%

Relationships Across Groups

In order to explore relationships in students' responses across different groups, the data were further disaggregated according to student sex and according to the kinds of STEM programs students had participated in prior to their most recent experience with C-STEM. Three kinds of analyses were conducted: A *t* test to examine whether there were differences in students' average responses to the question within each of the two scales (engineering and 21st century skills) between males and females, a *t* test to explore differences in the scales but according to students' prior participation in STEM programs (C-STEM only vs. other STEM programs), and finally a Chi-square test of association was used to explore relationships between each of the groups listed above and students' responses to the questions about their career interests. The tests were conducted using a significance level of 0.05 and all tests were conducted separately for elementary and secondary students.

Elementary Students.

Differences in scales. The existence of differences in students' responses to the questions within each of the three scales was explored using an independent samples *t* test. In order to conduct these tests, an index was created for each scale by averaging students' responses to the questions within each scale. In this way, each student had two index scores: One for engineering and one for 21st century skills. As continuous outcomes, each score could be utilized as a dependent variable in the two tests. Both of the indices had a theoretical minimum of 1 and a maximum of 5. The mean score for the engineering index was 3.86 ($SD = 0.78$) and for the 21st century skills index it was higher at 4.15 ($SD = 0.63$). The scores for both indices were normally distributed.

The *t* test comparing scores for males vs. females indicated that the elementary males had significantly more positive perceptions of both engineering (males $M = 4.18$, $SD = 0.86$ vs. females $M = 3.67$, $SD = 0.67$; $t(63) = 2.65$, $p < 0.05$) and their own 21st century skills (males *M*

= 4.38, *SD* = 0.64 vs. females *M* = 4.02, *SD* = 0.60; $t(63) = 2.23$, $p < 0.05$) than did the elementary females. These results are consistent with previous research using the same instrument and comparing males to females: Females were less optimistic about their own capabilities in and had less positive attitudes toward engineering and technology (Unfried, Faber, & Wiebe, 2014).

As there were too few responses for two of the four groups of experience with STEM (6-10 STEM programs and more than 10 programs), a second independent samples *t* test was conducted comparing scores across the two remaining groups: Only C-STEM and 1-5 programs. The test indicated that there were no significant differences between the two groups for either of the scales, which suggests that students who only had participated in C-STEM were just as positive about engineering and their own 21st century skills as those students who had participated 1-5 other STEM programs.

Differences in career interests. The final analysis of the elementary student sample examined student interest in STEM and STEM-related careers. First, a chi square test of association was utilized to examine whether there was a relationship between a student's sex and their prior STEM participation with his or her level of interest in different STEM-related careers ($df = 2$, critical value = 5.99). Table 21 presents results for the analysis of student sex and relative interest in different STEM careers. Given that none of the Chi square values reached the critical value, none of the relationships was statistically significant. In other words, there were no significant associations between the career preferences expressed by the male vs. the female elementary students in the sample.

Table 21. Significance of relationships for elementary males vs. females

Career	Significant (Y/N)
Physics	N
Environmental Work	N
Biology or Zoology	N
Veterinary Science	N
Mathematics	N
Medicine	N
Earth Science	N
Computer Science	N
Medical Science	N
Chemistry	N
Energy	N
Engineering	N

*Indicates relationship was statistically significant at $p < 0.05$ level

To examine the relationship between prior experience with STEM and career interests, the non-C-STEM groups were collapsed into larger group, which was compared to the C-STEM group using an independent samples *t* test. The 'no C-STEM' group had 28 individuals in it, and the 'C-STEM only' group had 37 individuals in it. Based on this analysis, several significant differences emerged: Environmental work, mathematics, medicine, medical science, chemistry, energy, and engineering. Specifically, students who had no prior experience with C-STEM were more interested in these careers than students who only had prior experience with C-

STEM: Environmental work (No C-STEM $M = 2.25$, $SD = 0.65$ vs. C-STEM only $M = 1.57$, $SD = 1.12$; $t(63) = 3.09$, $p < 0.05$); mathematics (No C-STEM $M = 2.46$, $SD = 0.64$ vs. C-STEM only $M = 1.51$, $SD = 1.12$; $t(63) = 4.31$, $p < 0.05$); medicine (No C-STEM $M = 2.07$, $SD = 0.94$ vs. C-STEM only $M = 1.54$, $SD = 1.02$; $t(63) = 2.15$, $p < 0.05$); medical science (No C-STEM $M = 2.04$, $SD = 1.07$ vs. C-STEM only $M = 1.46$, $SD = 1.07$; $t(63) = 2.15$, $p < 0.05$); chemistry (No C-STEM $M = 2.07$, $SD = 0.94$ vs. C-STEM only $M = 1.54$, $SD = 0.96$; $t(63) = 2.23$, $p < 0.05$); energy (No C-STEM $M = 2.18$, $SD = 0.86$ vs. C-STEM only $M = 1.57$, $SD = 1.04$; $t(63) = 2.52$, $p < 0.05$); and engineering (No C-STEM $M = 2.32$, $SD = 0.77$ vs. C-STEM only $M = 1.70$, $SD = 1.13$; $t(63) = 2.49$, $p < 0.05$).

As mentioned above, all of these elementary results should be interpreted with caution given that the majority of the elementary students responding were in second and third grades and the survey was intended for students in fourth and fifth grades.

Secondary Students.

Differences in scales. Similar analyses used for the elementary student sample were conducted using the secondary student sample: The existence of differences in students' responses to the questions within each of the three scales was explored using an independent samples *t* test and a one-way ANOVA. Also similar to the elementary sample, the dependent variable was created by averaging students' responses to the items that made up each scale. The mean score for the engineering scale was 4.1 ($SD = 0.58$) and the mean score for the 21st century skills scale was 4.2 ($SD = 0.56$). Unlike the elementary sample, the two dependent variables were not normally distributed, though the *t* test is considered robust to minor violations of the normality assumption.

In the independent samples *t* test analysis, significant differences were found between male and female students' engineering scores (males $M = 4.21$, $SD = 0.44$ vs. females $M = 3.94$, $SD = 0.68$; $t(114) = 2.55$, $p < 0.05$), but not for the 21st century skills scores. As with the elementary sample, the secondary male students had significantly more positive perceptions of engineering than did the secondary female students. Unlike the elementary sample, however, there were no significant differences in how the male and female students perceived their own 21st century skills. Again, these differences were consistent with previous research using the same instrument (Unfried et al., 2014).

In order to examine differences in students' average responses to the engineering and 21st century skills items according to their previous experience with STEM programs, an ANOVA was conducted. Of the four 'prior experience' categories, one had too responses to allow for post hoc tests. The results indicate that there were no significant differences in engineering or 21st century skills scores across the three groups (C-STEM only, 1-5 STEM programs, and 6-10 STEM programs) and so there was no need for post hoc tests.

Differences in career interests. A chi square test of association was conducted to explore whether there was a relationship between student sex and students' career preferences ($df = 2$, critical value = 7.82). Unlike in the analysis of career interests among the elementary students, several relationships were found between sex and career interests (Table 22). The only career choice for which the females were significantly more interested than males was biology and zoology. Male secondary students were more interested than female secondary students in math, computer science, and engineering. Of interest, the gap between male and female interest was particularly wide for engineering. For the other career options, there were no significant associations.

Table 22. Significance of relationships for secondary males vs. females

Career	Significant
Physics	N
Environmental Work	N
Biology or Zoology*	Y*
Veterinary Science	N
Mathematics*	Y*
Medicine	N
Earth Science	N
Computer Science*	Y*
Medical Science	N
Chemistry	N
Energy	N
Engineering*	N

*Indicates relationship was statistically significant at $p < 0.05$ level

To test whether there was a significant difference in students' career interests based on their prior experience with STEM programs, the secondary sample was divided into two groups: Students with no prior C-STEM experience (n=49) and those with prior C-STEM experience (n=67). Then, an independent samples t test was conducted to compare the two groups. There was only one significant difference, for energy careers: Students with no prior C-STEM experience expressed greater interest than did students who had only C-STEM experience (No C-STEM $M = 3.02$, $SD = 0.80$ vs. C-STEM only $M = 2.66$, $SD = 0.73$; $t(114) = 2.54$, $p < 0.05$)

Comparison to Previous Years

In the 2013-2014 and 2014-2015 school years, C-STEM surveyed its students and teachers using two separate instruments. Teachers were surveyed in both prior years using the STEM Semantics Survey, which was adapted from Knezek and Christensen's (1998) Teachers' Attitudes Towards Information Technology Questionnaire (TAT). The STEM Semantics Survey utilizes four adjective pairs that respondents use to describe their perceptions of the four STEM areas. A fifth scale reflecting perceptions of STEM careers was included in the 2015 administration of the survey. Students were surveyed using the STEM Semantics Survey as well as components of the Career Interest Questionnaire (CIQ; Christensen, Knezek, & Tyler-Wood, 2010). The CIQ has three scales measuring the following: (1) Perception of supportive environments for pursuing a career in science, (2) interest in pursuing educational opportunities that would lead to a career in science, and (3) perceived importance of a career in science. Results from the two surveys were discussed in the 2015 evaluation:

> When compared to student responses from the 2014 administration of a similar survey, students were less positive in general in 2015. It is not possible to know why responses were more negative in 2015 when compared to 2014 because many of the students are different, and also because the survey does not ask students why they have the perceptions about STEM that they do. (p. 22)

Comparing the results from the two previous years to the most recent year is difficult for two reasons. First, the instrument used this year was different, though it measured several similar concepts, including interest in STEM careers. A second challenge to comparability across the years is that the students are different (see explanation of C-STEM enrollment process above), so there likely are differences that are due to the fact that the students are different and therefore cannot be attributed to C-STEM and its programming.

As a result, only those areas where there is conceptual overlap will be compared across the years, and any conclusions should be viewed in light of the possibility that the students are different. These include: Interest in STEM careers, perception of support for STEM, interest in pursuing opportunities that would lead to a career in STEM, and students' disposition toward mathematics, science, and engineering. In general, it is possible to say that the students who participated in 2014-2015 were less positive than the students who participated in 2013-2014, and that the students who participated in 2015-2016 were in general very positive about STEM, STEM careers, and the support they had to participate in STEM.

STEM Dispositions

In 2014, the elementary students were most positive about technology, and engineering, and less positive about science and even more negative about math. In 2015, overall the students were similarly more positive about technology and engineering, and less positive about science and mathematics. The elementary students' responses were not significantly different than the middle and high school students' responses.

In the 2015-2016 school year, over half of the elementary respondents were positive about their math abilities, and an even larger majority indicated readiness for advanced mathematics. Over 50% of students responded they intended to take advanced mathematics classes and over 95% of them also indicated that they expected to do OK or very well in their mathematics course. As for the students' dispositions toward science, the elementary students were less positive than they were about mathematics. They were, however, almost as positive in their intentions to study advanced science, and they were equally as optimistic about their performance in their science class. Finally, the elementary students this past year were more positive about their own 21st century skills than they were about engineering.

As for the secondary students in 2015-2016, they overall held more positive views of science, mathematics, engineering, and their own 21st century skills as compared to the elementary students. They were more positive about their abilities in mathematics and science and more of them strongly agreed that they intended to take advanced mathematics and science courses. One key difference was that the secondary students were less optimistic about their performance in the mathematics and science courses in which they were enrolled.

Interest in STEM Careers

In 2013-2014, the students overall were very positive about STEM careers, though the high school students were more positive than the elementary students. In 2014-2015, elementary students were substantially less positive about STEM careers than they were in 2014. In 2015-2016, students were very positive about STEM careers as over ¾ of them agreed that they would be interested in a STEM career. What's more, students appeared to be interested in a wider variety of STEM careers than in past years.

Perception of Support

In 2013-2014, the elementary students' perceptions of how supportive their environment was for pursuing a career in STEM were relatively high. Their responses were higher than those of the middle school students, but lower than those of the high school students. Those differences, however, were not significant ($p < 0.05$). In 2014-2015, the students' perceptions of support in their environment were much more negative and, among the three grade levels, the elementary students' perceptions were the lowest; that difference was significant. In 2015-2016, the students were very positive about their parents' support for the participation in STEM activities: 80% of elementary students and almost 83% of secondary students responded that, yes, their parents supported them.

Opportunities in STEM

In 2013-2014, when asked about their interest in pursuing additional educational opportunities to prepare them for a career in STEM, the elementary students were as positive as the middle and high school students; the small differences that existed were not significant. In 2014-2015, the students were less positive. There only was a significant difference between middle and elementary students, and the middle school students were more positive than the elementary students.

In 2015-2016, 95% of secondary students and 86% of elementary students indicated they would participate again in a STEM program, which suggests that this past year's students are very interested in additional opportunities to prepare for a STEM career. Moreover, a solid majority of elementary and secondary students indicated they intended to enroll in advanced mathematics and science courses, and both groups of students were optimistic about enrolling in college, with almost 90% of elementary students stating they expected to and about 95% of secondary students stating the same expectation.

Conclusion

In 2015-2016, a total of 705 students (315 elementary, 175 middle school, and 215 high school students) from across three states and 14 schools participated in C-STEM. Of these, 181 elementary and secondary students responded to the online survey. The survey utilized this past year measured students' interest in engineering, their perception of their own 21st century skills, their perception of their academic ability in science, mathematics, and in English language arts, and their interest in various STEM-related careers. The results suggest overall that the participating students were very positive about STEM, STEM careers, and their own performance and potential in STEM subjects.

Once the results were broken down, several differences emerged. In general, the secondary students were more positive in their responses than the elementary students, though those differences were not tested for statistical significance. Differences by sex were examined, and both secondary and elementary males were positive about STEM and several STEM careers than the female students. Differences according to prior experience with STEM programs also were investigated. No significant differences emerged at the elementary or secondary levels for the STEM dispositions. There were, however, several significant differences at the secondary level in terms of career interests such that students who had no prior C-STEM experience expressed higher interest for some career options.

In conclusion, the results provide some evidence that C-STEM is achieving two of its goals for some of its students: (3) *Increase students' 21st century skills and STEM literacy by providing students through competition,* and (7) *Increase students' interest in and capacity to pursue careers in STEM-related fields*. What's more, students who have participated in C-STEM over the past three years have been as or more positive about STEM and STEM careers as students participating in other, similar STEM programs. Finally, the report also provides some evidence that C-STEM's programming should continue to improve the attitudes of the students with whom it works in particular.

Recommendations

Given the nature of this particular study and the limitations inherent in its design, there are several recommendations for future evaluations that should improve the quality and usefulness of the findings:

1. Coordinate with the Houston Independent School District by applying for formal permission to conduct a study; this will allow for access to more student data and for the creation of a control group;
2. Administer the survey in the fall in order to have a 'pre' measure of students' attitudes and interests;
3. Utilize a unique identifier to link students from the pre- to the post-survey and to their standardized test scores;
4. Consider providing an incentive for responding to the survey to increase response rates;
5. Consider using a teacher log in which teachers can record information about how and how often they are implementing C-STEM and its different; this will provide information on program implementation that would be useful for understanding differences in impact across teachers and schools.

References

Knezek, G., & Christensen, R. (1998, March). Internal consistency reliability for the teachers' attitudes toward information technology (TAT) questionnaire. In S. McNeil, J. Price, S. Boger-Mehall, B. Robin, & J. Willis (Eds.), *Proceedings of the Society for Information Technology in Teacher Education Annual Conference* (pp. 831-836). Bethesda, MD: Society for Information Technology in Teacher Education.

STEM Coalition. (2016). *The Case for Investing in Out-of-School Learning as a Core Strategy in Improving STEM Education*. http://www.stemedcoalition.org/2016/04/27/the-case-for-investing-in-out-of-school-learning-as-a-core-strategy-in-improving-stem-education/

Tyler-Wood, T., Knezek, G., & Christensen, R. (2010). Instruments for assessing interest in STEM content and careers. *Journal of Technology and Teacher Education, 18(*2), 341-363.

Unfried, A., Faber, M., & Wiebe, E. (2014). Gender and Student Attitudes toward Science, Technology, Engineering, and Mathematics. *The Friday Institute for Educational Innovation at North Carolina State University*.

Unfried, A., Faber, M., Stanhope, D. S., & Wiebe, E. (2015). The development and validation of a measure of student attitudes toward science, technology, engineering, and math (S-STEM). *Journal of Psychoeducational Assessment*, 0734282915571160.

Appendix A

C-STEM Surveys

Elementary School Students Attitudes Toward STEM

QUESTIONS RESPONSES 65

Student Attitudes towards STEM

The development of high school student survey.

Elementary School Student Attitudes toward STEM

Description (optional)

School Name *

Short answer text

Grade Level *

- 2nd Grade
- 3rd Grade
- 4th Grade
- 5th Grade

Gender *

- Female

Prior to C-STEM, I participated in other STEM *

- Only C-STEM Programs
- 1-5 STEM Programs
- 6-10 STEM Programs
- More than 10 STEM Programs
- Strongly Agree

I will participate in future STEM Programs *

- Yes
- No

I am interested in a STEM related career *

- Yes
- No

My parent(s) are involved with supporting my participation in *

- Yes
- No

I can handle most subjects well, but I cannot do a good job with *

- Strongly Disagree

- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

I am sure I could do advanced work in math. *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

I can handle most subjects well, but I cannot do a good job with *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Please read this paragraph before you answer the

ENGINEERS use math, science, and creativity to research and solve problems that improve everyone's life and to invent new iproducts. There are many different types of engineering, such as chemical, electrical, computer, mechanical, civil, environmental, and bio-medical. Engineers design and improve things like bridges, cars, fabrics, foods, and virtual reality amusement parks. Technologists implement the designs that engineers develop; they build, test, and maintain products and processes.

I like to imagine creating new products. *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

If I learn engineering, then I can improve things that people use every *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

I am good at building and fixing things. *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree

- Strongly Agree

I am interested in what makes machines work. *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Designing products or structures will be important for my future *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

I am curious about how electronics work. *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree

- Strongly Agree

I would like to use creativity and innovation in my future *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Knowing how to use math and science together will allow me to invent useful things. *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

I believe I can be successful in an engineering *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree

Strongly Agree

I am confident I can lead others to accomplish a *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I am confident I can encourage others to do their *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I am confident I can produce high quality work. *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I am confident I can respect the differences of my *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I am confident I can help my peers. *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I am confident I can include others' perspectives when making *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

- Strongly Agree

I am confident I can make changes when things do not go as *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

I am confident I can set my own learning goals. *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

I am confident I can manage my time wisely when working on my *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree

Strongly Agree

When I have many assignments, I can choose which ones need to be done first. *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I am confident I can work well with students from different *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

Your Future

Here are descriptions of subject areas that involve math, science, engineering and/or technology, and lists of jobs connected to each subject area. As you read the list below, you will know how interested you are in the subject and the jobs. Select the circle that relates to how interested you are.

There are no "right" or "wrong" answers. The only correct responses are those that are true for you.

*

Physics: is the study of basic laws governing the motion, energy, structure, and interactions of matter. This can include studying the nature of the universe. (aviation engineer, alternative energy technician, lab technician, physicist, astronomer)

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

Environmental Work: involves learning about physical and biological processes that govern nature and working to improve the environment. This includes finding and designing solutions to problems like pollution, reusing waste and recycling. (pollution control analyst, environmental engineer or scientist, erosion control specialist, energy systems engineer and maintenance technician) *

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

Biology and Zoology: involve the study of living organisms (such as plants and animals) and the processes of life. This includes working with farm animals and in areas like nutrition and breeding. (biological technician, biological scientist, plant breeder, crop lab technician, animal scientist, geneticist, zoologist) *

- Not at all Interested

- Not So Interested
- Interested
- Very Interested

Veterinary Work: involves the science of preventing or treating disease in animals. (veterinary assistant, veterinarian, livestock producer, animal caretaker) *

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

Mathematics: is the science of numbers and their operations. It involves computation, algorithms and theory used to solve problems and summarized data. (accountant, applied mathematician, economist, financial analyst, mathematician, statistician, market researcher, stock market analyst) *

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

Medicine: involves maintaining health and preventing and treating disease. (physician's assistant, nurse, doctor, nutritionist, emergency medical technician, physical therapist, dentist) *

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

Earth Science: is the study of earth, including the air, land, and ocean. (geologist, weather forecaster, archaeologist, Geo-scientist). *

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

Computer Science: consists of the development and testing of computer systems, designing new program and helping others to use computers. (computer support specialist, computer programmer, computer and network technician, gaming designer, computer software engineer, information technology specialist) *

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

*

Medical Science: involves researching human disease and working to find new solutions to human health problems. (clinical laboratory technologist, medical scientist, bio-medical engineer, epidemiologist,

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

Chemistry: uses math and experiments to search for new chemicals, and to study the structure of matter and how it behaves. (chemical technician, chemist, chemical engineer) *

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

Energy: Involves the study and generation of power, such as heat or electricity. (electrician, electrical engineer, heating, ventilation, and air conditioning (HVAC) technician, nuclear engineer, systems engineer, alternative energy systems installer or technician. *

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

Engineering: involves designing, testing, and manufacturing new products (like machines, bridges, buildings, and electronics) through the use of math, science, and computers. (civil, industrial, agricultural, or mechanical engineers, welder, auto-mechanic, engineering technician, construction manager) *

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

How well do you expect to do this year in your English/Language Arts *

- Not Very Well
- OK/Pretty Well
- Very Well

How well do you expect to do this year in your Math *

- Not Very Well
- OK/Pretty Well
- Very Well

How well do you expect to do this year in your Science *

- Not Very Well

- OK/Pretty Well
- Very Well

In the future, do you plan to take advanced classes in *

- Yes
- No
- Not Sure

In the future, do you plan to take advanced classes in *

- Yes
- No
- Not Sure

Do you plan to go to college? *

- Yes
- No
- Not Sure

Do you know any adults who work as scientists? *

- Yes
- No
- Not Sure

Do you know any adults who work as engineers? *

- Yes
- No
- Not Sure

Do you know any adults who work as *

- Yes
- No
- Not Sure

Do you know any adults who work as technologists? *

- Yes
- No
- Not Sure

Middle & High School Students Attitudes Toward STEM

QUESTIONS RESPONSES 116

Student Attitudes towards STEM

The development of high school student survey.

Middle & High School Student Attitudes toward STEM

Description (optional)

School Name *

Short answer text

Grade Level *

- 6th Grade
- 7th Grade
- 8th Grade
- 9th Grade
- 10th Grade
- 11th Grade
- 12th Grade

Gender *

- Female
- Male

Prior to C-STEM, I participated in other STEM *

- Only C-STEM Programs
- 1-5 STEM Programs
- 6-10 STEM Programs
- More than 10 STEM Programs
- Strongly Agree

I will participate in future STEM Programs *

- Yes
- No

I am interested in a STEM related career *

- Yes
- No

My parent(s) are involved with supporting my participation in *

- Yes

No

I can handle most subjects well, but I cannot do a good job with *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I am sure I could do advanced work in math. *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I can handle most subjects well, but I cannot do a good job with *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

Please read this paragraph before you answer the

ENGINEERS use math, science, and creativity to research and solve problems that improve everyone's life and to invent new iproducts. There are many different types of engineering, such as chemical, electrical, computer, mechanical, civil, environmental, and bio-medical. Engineers design and improve things like bridges, cars, fabrics, foods, and virtual reality amusement parks. Technologists implement the designs that engineers develop; they build, test, and maintain products and processes.

I like to imagine creating new products. *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

If I learn engineering, then I can improve things that people use every *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

I am good at building and fixing things. *

- Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I am interested in what makes machines work. *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

Designing products or structures will be important for my future *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I am curious about how electronics work. *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I would like to use creativity and innovation in my future *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

Knowing how to use math and science together will allow me to invent useful things. *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I believe I can be successful in an engineering *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I am confident I can lead others to accomplish a *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I am confident I can encourage others to do their *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I am confident I can produce high quality work. *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I am confident I can respect the differences of my *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I am confident I can help my peers. *

Strongly Disagree

Disagree

Neither Agree nor Disagree

Agree

Strongly Agree

I am confident I can include others' perspectives when making *

Strongly Disagree

Disagree

- Neither Agree nor Disagree
- Agree
- Strongly Agree

I am confident I can make changes when things do not go as *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

I am confident I can set my own learning goals. *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

I am confident I can manage my time wisely when working on my *

- Strongly Disagree
- Disagree

- Neither Agree nor Disagree
- Agree
- Strongly Agree

When I have many assignments, I can choose which ones need to be done first. *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

I am confident I can work well with students from different *

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Your Future

Here are descriptions of subject areas that involve math, science, engineering and/or technology, and lists of jobs connected to each subject area. As you read the list below, you will know how interested you are in the subject and the jobs. Select the circle that relates to how interested you are.

There are no "right" or "wrong" answers. The only correct responses are those that are true for you.

Physics: is the study of basic laws governing the motion, energy, structure, and interactions of matter. This can include studying the nature of the universe. (aviation engineer, alternative energy technician, lab technician, physicist, astronomer) *

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

Environmental Work: involves learning about physical and biological processes that govern nature and working to improve the environment. This includes finding and designing solutions to problems like pollution, reusing waste and recycling. (pollution control analyst, environmental engineer or scientist, erosion control specialist, energy systems engineer and maintenance technician) *

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

*

Biology and Zoology: involve the study of living organisms (such as plants and animals) and the processes of life. This includes working with farm animals and in areas like nutrition and breeding. (biological technician, biological scientist, plant breeder, crop lab technician, animal scientist, geneticist, zoologist)

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

Veterinary Work: involves the science of preventing or treating disease in animals. (veterinary assistant, veterinarian, livestock producer, animal caretaker) *

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

Mathematics: is the science of numbers and their operations. It involves computation, algorithms and theory used to solve problems and summarized data. (accountant, applied mathematician, economist, financial analyst, mathematician, statistician, market researcher, stock market analyst) *

- Not at all Interested
- Not So Interested

Interested

Very Interested

Medicine: involves maintaining health and preventing and treating disease. (physician's assistant, nurse, doctor, nutritionist, emergency medical technician, physical therapist, dentist) *

Not at all Interested

Not So Interested

Interested

Very Interested

Earth Science: is the study of earth, including the air, land, and ocean. (geologist, weather forecaster, archaeologist, Geo-scientist). *

Not at all Interested

Not So Interested

Interested

Very Interested

Computer Science: consists of the development and testing of computer systems, designing new program and helping others to use computers. (computer support specialist, computer programmer, computer and network technician, gaming designer, computer software engineer, information technology specialist) *

Not at all Interested

Not So Interested

Not So Interested

Interested

Very Interested

Medical Science: involves researching human disease and working to find new solutions to human health problems. (clinical laboratory technologist, medical scientist, bio-medical engineer, epidemiologist, *

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

Chemistry: uses math and experiments to search for new chemicals, and to study the structure of matter and how it behaves. (chemical technician, chemist, chemical engineer) *

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

Energy: Involves the study and generation of power, such as heat or electricity. (electrician, electrical engineer, heating, ventilation, and air conditioning (HVAC) technician, nuclear engineer, systems engineer, alternative energy systems installer or technician. *

- Not at all Interested

- Not So Interested
- Interested
- Very Interested

Engineering: involves designing, testing, and manufacturing new products (like machines, bridges, buildings, and electronics) through the use of math, science, and computers. (civil, industrial, agricultural, or mechanical engineers, welder, auto-mechanic, engineering technician, construction manager) *

- Not at all Interested
- Not So Interested
- Interested
- Very Interested

How well do you expect to do this year in your English/Language Arts *

- Not Very Well
- OK/Pretty Well
- Very Well

How well do you expect to do this year in your Math *

- Not Very Well
- OK/Pretty Well
- Very Well

How well do you expect to do this year in your Science *

- Not Very Well
- OK/Pretty Well
- Very Well

In the future, do you plan to take advanced classes in *

- Yes
- No
- Not Sure

In the future, do you plan to take advanced classes in *

- Yes
- No
- Not Sure

Do you plan to go to college? *

- Yes
- No
- Not Sure

*

Do you know any adults who work as scientists?

- Yes
- No
- Not Sure

Do you know any adults who work as engineers? *

- Yes
- No
- Not Sure

Do you know any adults who work as *

- Yes
- No
- Not Sure

Do you know any adults who work as technologists? *

- Yes
- No
- Not Sure

Appendix B

Original surveys

Appendix

Upper Elementary School Student Attitudes toward STEM (S-STEM) – 4-5th

Directions:

There are lists of statements on the following pages. Please mark your answer sheets by marking how you feel about each statement. For example:

Example 1:	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I like engineering.	○	○	○	○	○

As you read the sentence, you will know whether you agree or disagree. Fill in the circle that describes how much you agree or disagree.

Even though some statements are very similar, please answer each statement. This is not timed; work fast, but carefully.

There are no "right" or "wrong" answers! The only correct responses are those that are true for you. Whenever possible, let the things that have happened to you help you make a choice.

Please fill in on only one answer per question.

Recommended citation for this survey:

> Friday Institute for Educational Innovation (2012). *Upper Elementary School Student Attitudes toward STEM Survey*. Raleigh, NC: Author.

Math

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. Math has been my worst subject.	○	○	○	○	○
2. I would consider choosing a career that uses math.	○	○	○	○	○
3. Math is hard for me.	○	○	○	○	○
4. I am the type of student to do well in math.	○	○	○	○	○
5. I can handle most subjects well, but I cannot do a good job with math.	○	○	○	○	○
6. I am sure I could do advanced work in math.	○	○	○	○	○
7. I can get good grades in math.	○	○	○	○	○
8. I am good at math.	○	○	○	○	○

Science

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
9. I am sure of myself when I do science.	○	○	○	○	○
10. I would consider a career in science.	○	○	○	○	○
11. I expect to use science when I get out of school.	○	○	○	○	○
12. Knowing science will help me earn a living.	○	○	○	○	○
13. I will need science for my future work.	○	○	○	○	○
14. I know I can do well in science.	○	○	○	○	○
15. Science will be important to me in my life's work.	○	○	○	○	○
16. I can handle most subjects well, but I cannot do a good job with science.	○	○	○	○	○

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
17. I am sure I could do advanced work in science.	○	○	○	○	○

Engineering and Technology

Please read this paragraph before you answer the questions.

Engineers use math, science, and creativity to research and solve problems that improve everyone's life and to invent new products. There are many different types of engineering, such as chemical, electrical, computer, mechanical, civil, environmental, and biomedical. Engineers design and improve things like bridges, cars, fabrics, foods, and virtual reality amusement parks. **Technologists** implement the designs that engineers develop; they build, test, and maintain products and processes.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
18. I like to imagine creating new products.	○	○	○	○	○
19. If I learn engineering, then I can improve things that people use every day.	○	○	○	○	○
20. I am good at building and fixing things.	○	○	○	○	○
21. I am interested in what makes machines work.	○	○	○	○	○
22. Designing products or structures will be important for my future work.	○	○	○	○	○
23. I am curious about how electronics work.	○	○	○	○	○
24. I would like to use creativity and innovation in my future work.	○	○	○	○	○
25. Knowing how to use math and science together will allow me to invent useful things.	○	○	○	○	○
26. I believe I can be successful in a career in engineering.	○	○	○	○	○

21st Century Skills

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
27. I am confident I can lead others to accomplish a goal.	○	○	○	○	○
28. I am confident I can encourage others to do their best.	○	○	○	○	○
29. I am confident I can produce high quality work.	○	○	○	○	○
30. I am confident I can respect the differences of my peers.	○	○	○	○	○
31. I am confident I can help my peers.	○	○	○	○	○
32. I am confident I can include others' perspectives when making decisions.	○	○	○	○	○
33. I am confident I can make changes when things do not go as planned.	○	○	○	○	○
34. I am confident I can set my own learning goals.	○	○	○	○	○
35. I am confident I can manage my time wisely when working on my own.	○	○	○	○	○
36. When I have many assignments, I can choose which ones need to be done first.	○	○	○	○	○
37. I am confident I can work well with students from different backgrounds.	○	○	○	○	○

Your Future

Here are descriptions of subject areas that involve math, science, engineering and/or technology, and lists of jobs connected to each subject area. As you read the list below, you will know how interested you are in the subject and the jobs. Fill in the circle that relates to how interested you are.

There are no “*right*” or “*wrong*” answers. The only correct responses are those that *are true for you*.

	Not at all Interested	Not So Interested	Interested	Very Interested
1. **Physics:** is the study of basic laws governing the motion, energy, structure, and interactions of matter. This can include studying the nature of the universe. *(aviation engineer, alternative energy technician, lab technician, physicist, astronomer)*	○	○	○	○
2. **Environmental Work:** involves learning about physical and biological processes that govern nature and working to improve the environment. This includes finding and designing solutions to problems like pollution, reusing waste and recycling. *(pollution control analyst, environmental engineer or scientist, erosion control specialist, energy systems engineer and maintenance technician)*	○	○	○	○
3. **Biology and Zoology:** involve the study of living organisms (such as plants and animals) and the processes of life. This includes working with farm animals and in areas like nutrition and breeding. (*biological technician, biological scientist, plant breeder, crop lab technician, animal scientist, geneticist, zoologist)*	○	○	○	○
4. **Veterinary Work:** involves the science of preventing or treating disease in animals. *(veterinary assistant, veterinarian, livestock producer, animal caretaker)*	○	○	○	○
5. **Mathematics:** is the science of numbers and their operations. It involves computation, algorithms and theory used to solve problems and summarize data. *(accountant, applied mathematician, economist, financial analyst, mathematician, statistician, market researcher, stock market analyst)*	○	○	○	○

	Not at all Interested	Not So Interested	Interested	Very Interested
6. **Medicine:** involves maintaining health and preventing and treating disease. *(physician's assistant, nurse, doctor, nutritionist, emergency medical technician, physical therapist, dentist)*	○	○	○	○
7. **Earth Science:** is the study of earth, including the air, land, and ocean. *(geologist, weather forecaster, archaeologist, geoscientist)*	○	○	○	○
8. **Computer Science:** consists of the development and testing of computer systems, designing new programs and helping others to use computers. *(computer support specialist, computer programmer, computer and network technician, gaming designer, computer software engineer, information technology specialist)*	○	○	○	○
9. **Medical Science:** involves researching human disease and working to find new solutions to human health problems. *(clinical laboratory technologist, medical scientist, biomedical engineer, epidemiologist, pharmacologist)*	○	○	○	○
10. **Chemistry:** uses math and experiments to search for new chemicals, and to study the structure of matter and how it behaves. *(chemical technician, chemist, chemical engineer)*	○	○	○	○
11. **Energy:** involves the study and generation of power, such as heat or electricity. *(electrician, electrical engineer, heating, ventilation, and air conditioning (HVAC) technician, nuclear engineer, systems engineer, alternative energy systems installer or technician)*	○	○	○	○

	Not at all Interested	Not So Interested	Interested	Very Interested
12. **Engineering:** involves designing, testing, and manufacturing new products (like machines, bridges, buildings, and electronics) through the use of math, science, and computers. *(civil, industrial, agricultural, or mechanical engineers, welder, auto-mechanic, engineering technician, construction manager)*	○	○	○	○

About Yourself

1. How well do you expect to do this year in your:

	Not Very Well	OK/Pretty Well	Very Well
English/Language Arts Class?	○	○	○
Math Class?	○	○	○
Science Class?	○	○	○

2. More about you.

	Yes	No	Not Sure
Do you know any adults who work as scientists?	○	○	○
Do you know any adults who work as engineers?	○	○	○
Do you know any adults who work as mathematicians?	○	○	○
Do you know any adults who work as technologists?	○	○	○

Middle/High School Student Attitudes toward STEM (S-STEM) – 6-12th

Directions:

There are lists of statements on the following pages. Please mark your answer sheets by marking how you feel about each statement. For example:

Example 1:	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I like engineering.	○	○	○	○	○

As you read the sentence, you will know whether you agree or disagree. Fill in the circle that describes how much you agree or disagree.

Even though some statements are very similar, please answer each statement. This is not timed; work fast, but carefully.

There are no "right" or "wrong" answers! The only correct responses are those that are true *for you*. Whenever possible, let the things that have happened to you help you make a choice.

Please fill in only one answer per question.

Recommended citation for this survey:

> Friday Institute for Educational Innovation (2012). *Middle/High School Student Attitudes toward STEM Survey*. Raleigh, NC: Author.

Math

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
27. Math has been my worst subject.	○	○	○	○	○
28. I would consider choosing a career that uses math.	○	○	○	○	○
29. Math is hard for me.	○	○	○	○	○
30. I am the type of student to do well in math.	○	○	○	○	○
31. I can handle most subjects well, but I cannot do a good job with math.	○	○	○	○	○
32. I am sure I could do advanced work in math.	○	○	○	○	○
33. I can get good grades in math.	○	○	○	○	○
34. I am good at math.	○	○	○	○	○

Science

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
35. I am sure of myself when I do science.	○	○	○	○	○
36. I would consider a career in science.	○	○	○	○	○
37. I expect to use science when I get out of school.	○	○	○	○	○
38. Knowing science will help me earn a living.	○	○	○	○	○
39. I will need science for my future work.	○	○	○	○	○
40. I know I can do well in science.	○	○	○	○	○
41. Science will be important to me in my life’s work.	○	○	○	○	○
42. I can handle most subjects well, but I cannot do a good job with science.	○	○	○	○	○

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
43. I am sure I could do advanced work in science.	○	○	○	○	○

Engineering and Technology

Please read this paragraph before you answer the questions.

Engineers use math, science, and creativity to research and solve problems that improve everyone's life and to invent new products. There are many different types of engineering, such as chemical, electrical, computer, mechanical, civil, environmental, and biomedical. Engineers design and improve things like bridges, cars, fabrics, foods, and virtual reality amusement parks. **Technologists** implement the designs that engineers develop; they build, test, and maintain products and processes.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
44. I like to imagine creating new products.	○	○	○	○	○
45. If I learn engineering, then I can improve things that people use every day.	○	○	○	○	○
46. I am good at building and fixing things.	○	○	○	○	○
47. I am interested in what makes machines work.	○	○	○	○	○
48. Designing products or structures will be important for my future work.	○	○	○	○	○
49. I am curious about how electronics work.	○	○	○	○	○
50. I would like to use creativity and innovation in my future work.	○	○	○	○	○
51. Knowing how to use math and science together will allow me to invent useful things.	○	○	○	○	○
52. I believe I can be successful in a career in engineering.	○	○	○	○	○

21st Century Skills

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
38. I am confident I can lead others to accomplish a goal.	○	○	○	○	○
39. I am confident I can encourage others to do their best.	○	○	○	○	○
40. I am confident I can produce high quality work.	○	○	○	○	○
41. I am confident I can respect the differences of my peers.	○	○	○	○	○
42. I am confident I can help my peers.	○	○	○	○	○
43. I am confident I can include others' perspectives when making decisions.	○	○	○	○	○
44. I am confident I can make changes when things do not go as planned.	○	○	○	○	○
45. I am confident I can set my own learning goals.	○	○	○	○	○
46. I am confident I can manage my time wisely when working on my own.	○	○	○	○	○
47. When I have many assignments, I can choose which ones need to be done first.	○	○	○	○	○
48. I am confident I can work well with students from different backgrounds.	○	○	○	○	○

Your Future

Here are descriptions of subject areas that involve math, science, engineering and/or technology, and lists of jobs connected to each subject area. As you read the list below, you will know how interested you are in the subject and the jobs. Fill in the circle that relates to how interested you are.

There are no "*right*" or "*wrong*" answers. The only correct responses are those that *are true for you*.

	Not at all Interested	Not So Interested	Interested	Very Interested
13. **Physics:** is the study of basic laws governing the motion, energy, structure, and interactions of matter. This can include studying the nature of the universe. *(aviation engineer, alternative energy technician, lab technician, physicist, astronomer)*	○	○	○	○
14. **Environmental Work:** involves learning about physical and biological processes that govern nature and working to improve the environment. This includes finding and designing solutions to problems like pollution, reusing waste and recycling. *(pollution control analyst, environmental engineer or scientist, erosion control specialist, energy systems engineer and maintenance technician)*	○	○	○	○
15. **Biology and Zoology:** involve the study of living organisms (such as plants and animals) and the processes of life. This includes working with farm animals and in areas like nutrition and breeding. (*biological technician, biological scientist, plant breeder, crop lab technician, animal scientist, geneticist, zoologist)*	○	○	○	○
16. **Veterinary Work:** involves the science of preventing or treating disease in animals. *(veterinary assistant, veterinarian, livestock producer, animal caretaker)*	○	○	○	○
17. **Mathematics:** is the science of numbers and their operations. It involves computation, algorithms and theory used to solve problems and summarize data. *(accountant, applied mathematician, economist, financial analyst, mathematician, statistician, market researcher, stock market analyst)*	○	○	○	○

	Not at all Interested	Not So Interested	Interested	Very Interested
18. **Medicine:** involves maintaining health and preventing and treating disease. *(physician's assistant, nurse, doctor, nutritionist, emergency medical technician, physical therapist, dentist)*	○	○	○	○
19. **Earth Science:** is the study of earth, including the air, land, and ocean. *(geologist, weather forecaster, archaeologist, geoscientist)*	○	○	○	○
20. **Computer Science:** consists of the development and testing of computer systems, designing new programs and helping others to use computers. *(computer support specialist, computer programmer, computer and network technician, gaming designer, computer software engineer, information technology specialist)*	○	○	○	○
21. **Medical Science:** involves researching human disease and working to find new solutions to human health problems. *(clinical laboratory technologist, medical scientist, biomedical engineer, epidemiologist, pharmacologist)*	○	○	○	○
22. **Chemistry:** uses math and experiments to search for new chemicals, and to study the structure of matter and how it behaves. *(chemical technician, chemist, chemical engineer)*	○	○	○	○
23. **Energy:** involves the study and generation of power, such as heat or electricity. *(electrician, electrical engineer, heating, ventilation, and air conditioning (HVAC) technician, nuclear engineer, systems engineer, alternative energy systems installer or technician)*	○	○	○	○

	Not at all Interested	Not So Interested	Interested	Very Interested
24. **Engineering:** involves designing, testing, and manufacturing new products (like machines, bridges, buildings, and electronics) through the use of math, science, and computers. *(civil, industrial, agricultural, or mechanical engineers, welder, auto-mechanic, engineering technician, construction manager)*	○	○	○	○

About Yourself

1. How well do you expect to do this year in your:

	Not Very Well	OK/Pretty Well	Very Well
English/Language Arts Class?	○	○	○
Math Class?	○	○	○
Science Class?	○	○	○

2. In the future, do you plan to take advanced classes in:

	Yes	No	Not Sure
Mathematics?	○	○	○
Science?	○	○	○

3. Do you plan to go to college?

❍ Yes
❍ No
❍ Not Sure

4. More about you.

	Yes	No	Not Sure
Do you know any adults who work as scientists?	○	○	○
Do you know any adults who work as engineers?	○	○	○
Do you know any adults who work as mathematicians?	○	○	○
Do you know any adults who work as technologists?	○	○	○