CampBioE 2018 Survey Report

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The CampBioE workshop occurred during the months of July and August in 2018. There were four separate camps each lasting one week. CampBioE in 2018 served a total of 96 students. Students were given a survey on the first day of the workshop (pretest) and on the fifth day of the workshop (posttest). There were some students who did not submit both surveys (pretest and posttest surveys) and some students who submitted incomplete responses. In order to examine any change in responses to survey items (from pretest to posttest), only student data reflecting complete responses to both the pretest and posttest surveys were analyzed. This set of students totaled 90.

Student Background Information

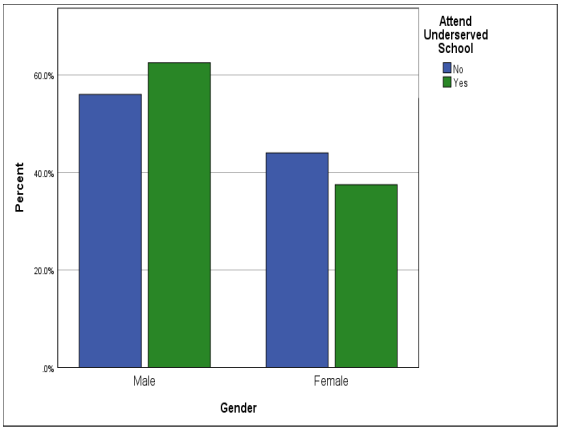
The characteristics of the students are given in Table 1. Across all four camps, there were slightly more male than female students. The majority of students were White and a majority of remaining students were approximately equally split between African American and Asian students. There was also a small group of Hispanic students and a group of "Other" students comprised mainly of mixed ethnicity. Most of the students were from middle and elementary schools. The vast majority of students were from public schools and from districts that did not reflect a majority of underserved students. Finally, the majority of students had a parent with a STEM job, took a number of STEM classes in school to date (2 or more classes), and had 4-year college aspirations. Finally, the majority of students learned about CampBioE from their parents.

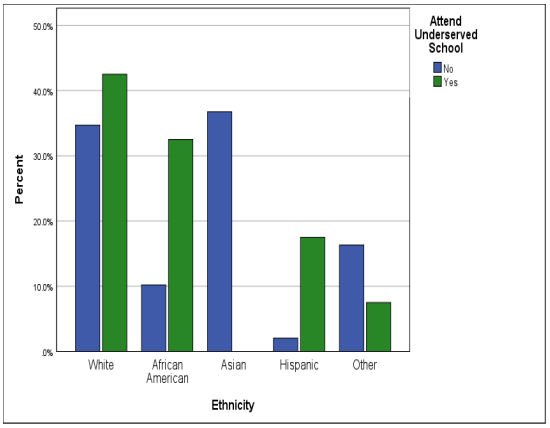
Table 1

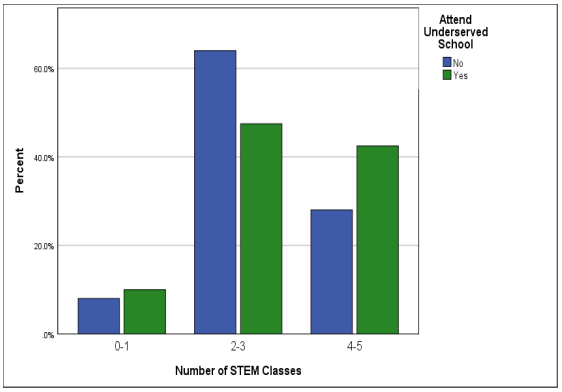
Student Characteristics			
		Count	Column N %
Gender	Male	53	58.9%
	Female	37	41.1%
Ethnicity	White	34	38.2%
	African American	18	20.2%
	Asian	18	20.2%
	Hispanic	8	9.0%
	Other	11	12.3%
Which grade did you just complete?	5th	16	17.8%
	6th	11	12.2%
	7th	29	32.2%
	8th	13	14.4%
	9th	12	13.3%
	10th	7	7.8%
	11th	2	2.2%
Attend private or public school?	Public	64	71.1%
	Private	26	28.9%
Attend Underserved School	No	50	55.6%
	Yes	40	44.4%
Parents have a STEM job	Yes	52	57.8%
	No	26	28.9%
	Not Sure	12	13.3%
Number of STEM Classes	0-1	8	8.9%
	2-3	51	56.7%
	4-5	31	34.4%
College Aspirations	2 year or community college	6	6.7%
	Technical or trade school	2	2.2%
	4 year college	80	88.9%
	None	2	2.2%
How did you find out about CampBioE? (Check one) - Selected Choice	Parents	60	66.7%
	School	5	5.6%
	Friend	8	8.9%
	Camp Website	6	6.7%
	Other Program	6	6.7%
	Other	5	5.6%

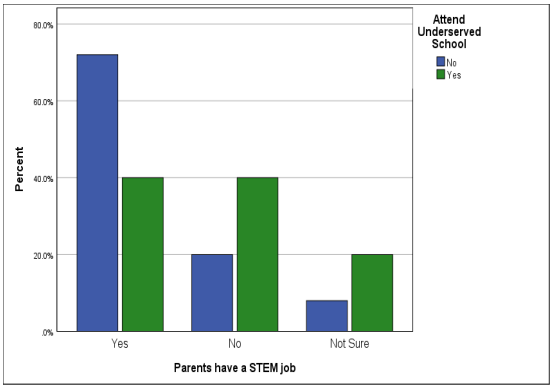
The characteristics of the students were further examined by comparing students from underserved districts as opposed to not underserved districts (see Figure 1 set of graphs). Some noteworthy observations include the following: there were relatively more males and fewer females from underserved districts; approximately equal percentages of White students from the different districts; markedly more African-American students from underserved districts, and no Asian students from underserved districts. Students from underserved schools took fewer STEM classes to date, and there were fewer parents with a STEM job for students from underserved districts. Finally, not surprisingly, more students attended public schools from underserved districts, and slightly more students from underserved districts had other than 4-year college aspirations.

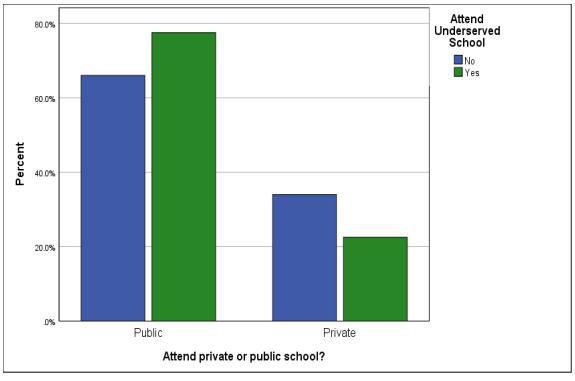
Figure 1

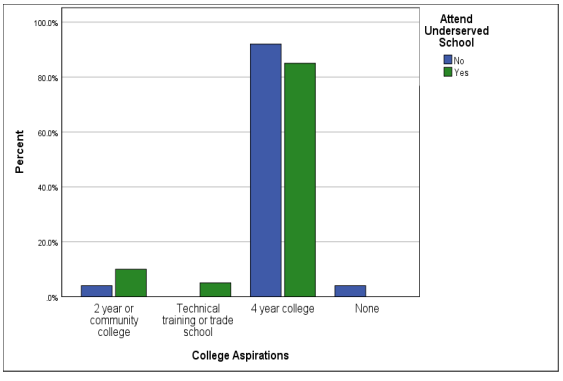












Camp Experience

Students were asked at post-testing to rate different aspects of the camp. The scale was from 1 (Strongly Disagree) to 6 (Strongly Agree). Table 3 presents the mean rating across all students. As can be seen, the mean ratings ranged from 4.5 to 5.5 with most ratings being above 4.9 (essentially at or beyond *Agree* on the scale). This indicates students were on average having a positive camp experience. Ratings were also examined for students from underserved versus not underserved districts. No items reflected a significant difference between the groups nor, except for one item, even approached a significant difference between the groups. The one exception, *It was helpful to work with instructors/students who were also interested in STEM*, approached significance with a mean rating of 5.3 (not underserved group) versus 4.9 (Underserved group)

Table 2

Camp Experience Ratings at Post Testing	
	Mean Rating (SD 1 - 6 SA)
It was helpful to work with instructors/students who were also interested in STEM.	*5.12*
I gained useful experience for a college application.	*4.53*
I learned how to conduct a project or study in STEM.	*5.01*
I learned what it's like to be a bioengineer and how bioengineers influence our lives.	*5.08*
I got hands-on experience using instruments.	*5.38*
I got experience collecting, analyzing and interpreting data.	*4.92*
I got information about future educational and career opportunities in STEM.	*4.93*
I'd like to learn even more about bioengineering.	*4.92*
I enjoyed participating in the CampBioE activities.	*5.34*
The lunches and snacks at CampBioE were good.	*5.49*

Students also identified their three favorite activities and challenges during their workshop experience. There were clearly some favorite activities and challenges for students which have implications for future workshops. The top 3 favorite activities and challenges selected by students are provided in the below table.

Table 3

Top 3 Activities		Top 3 Challenges	
	Number of Students		Number of Students
Body Mechanics	10	CSI Super Sleuth Challenge	52
Chicken Little	22	Jumping to Higher Heights Contest	18
Stem Cell Culturing	12	Taste the Difference Challenge	28
Mind Over Bladder	28	Operation Implantation Relay	45
Taste the Difference Extract Challenge	7	Cell Seeding Challenge	22
Cell Seeding	4	Stem Cell Extraction Ball Game	20
Telltale Toxins	8	Theme Day Challenge	20
Guest Module	10	Coroner's Challenge	21
Mannequin Overboard	45	iGem CRISPR Cash Madness	41
Who NOSE How to Build a Scaffold	24	Social Media Challenge	3
DNA Extraction	14		
A-Tension 2 Detail	6		
Reactor, Bioreactor	13		
Operation Implantation	15		
I Spy Something Red	27		
Gel Electrophoresis Analysis	9		
Staining Cells	3		
Coroner's Korner Game	10		

Changes in STEM Attitudes

Students were asked about STEM attitudes at the beginning and end of the camp. Students responded to the items on a scale from 1 (Strongly Disagree) to 6 (Strongly Agree). Mean ratings at the time of the pretest and posttest are provided in the below figure. As can be seen, mean ratings were slightly higher at posttest than pretest for all items. In addition, the ratings approximated 5 (Agree on the score scale) indicating positive attitudes about STEM attitudes at the time of the posttest. Finally, two items demonstrated the most change at posttest: One item (*I am confident in my STEM abilities*) exhibited a change from approximately 4.6 to 5.0, and another item (*I know what career opportunities are available in STEM*) exhibited a change from approximately 4.3 to 4.8. Change in these items, in particular, reflect a desired workshop outcome and therefore change in these items indicate the workshop was achieving its goals. Note that tables of mean values as well as the percentage responding in each response category are available in the Appendix.

Figure 2

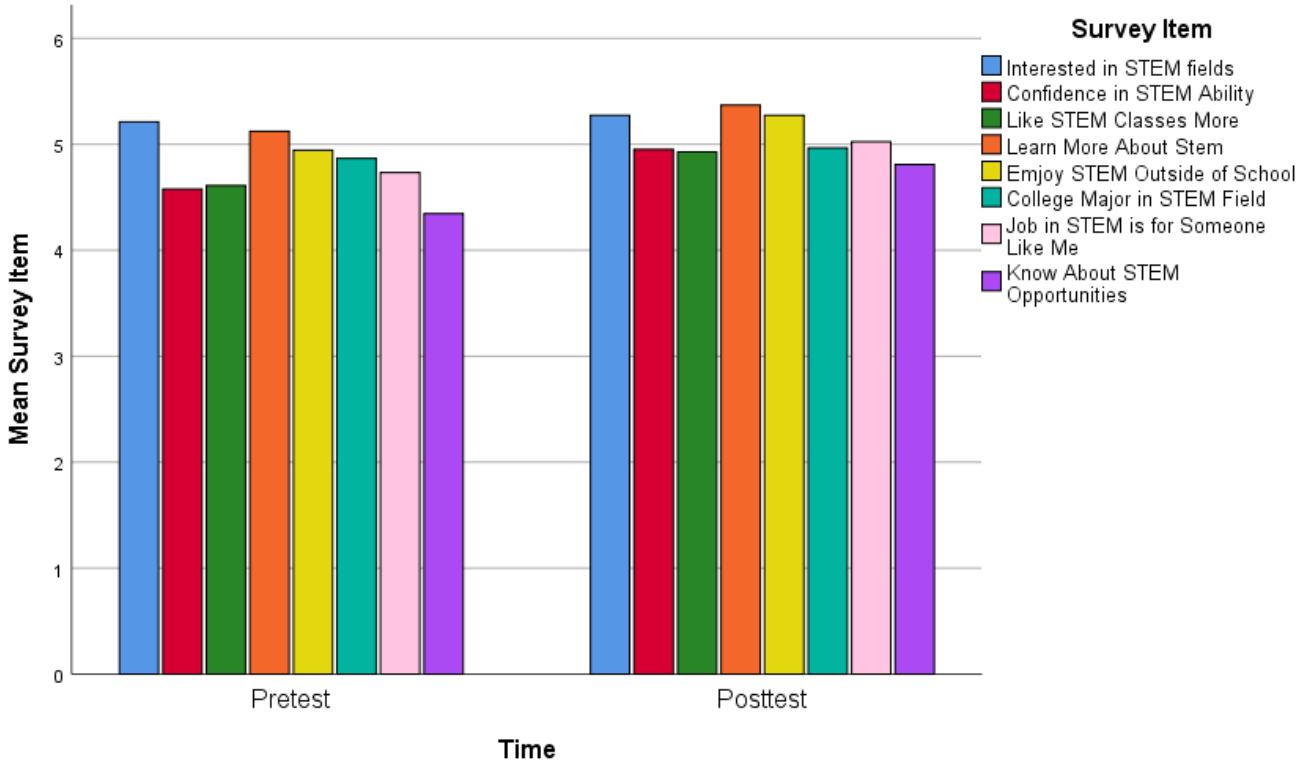


Figure 3 illustrates the comparison of groups of students (underserved versus not underserved) on the STEM attitude ratings. As can be seen, there is slightly more change from pretest to posttest for the underserved group of students. While the same two items across the groups (Figure 2) demonstrated approximately the same change from pretest to posttest (4.6 – 5.0; 4.3 – 4.8), several items for the underserved group reflected more change that that observed for the not underserved group. These items included *I like STEM classes more than other classes (4.4 – 4.8), I would like to learn more about STEM (5.0 – 5.4),* and *A STEM job is for someone like me (4.5 – 4.9).* Figure 4 illustrates the change in the response option pattern for one item, *A STEM job is for someone like me.* As can be seen, there was less change for the not underserved group and the most change occurred for individuals that changed their response from "Tend to Disagree" to "Agree". Whereas for the underserved group, there was a drop in the responses "Tend to Agree" and "Agree" in favor of more "Strongly Agree" responses. In summary, the finding that there were more positive changes in STEM attitudes for the underserved group again indicates the workshop was achieving one of its goals.

Figure 3

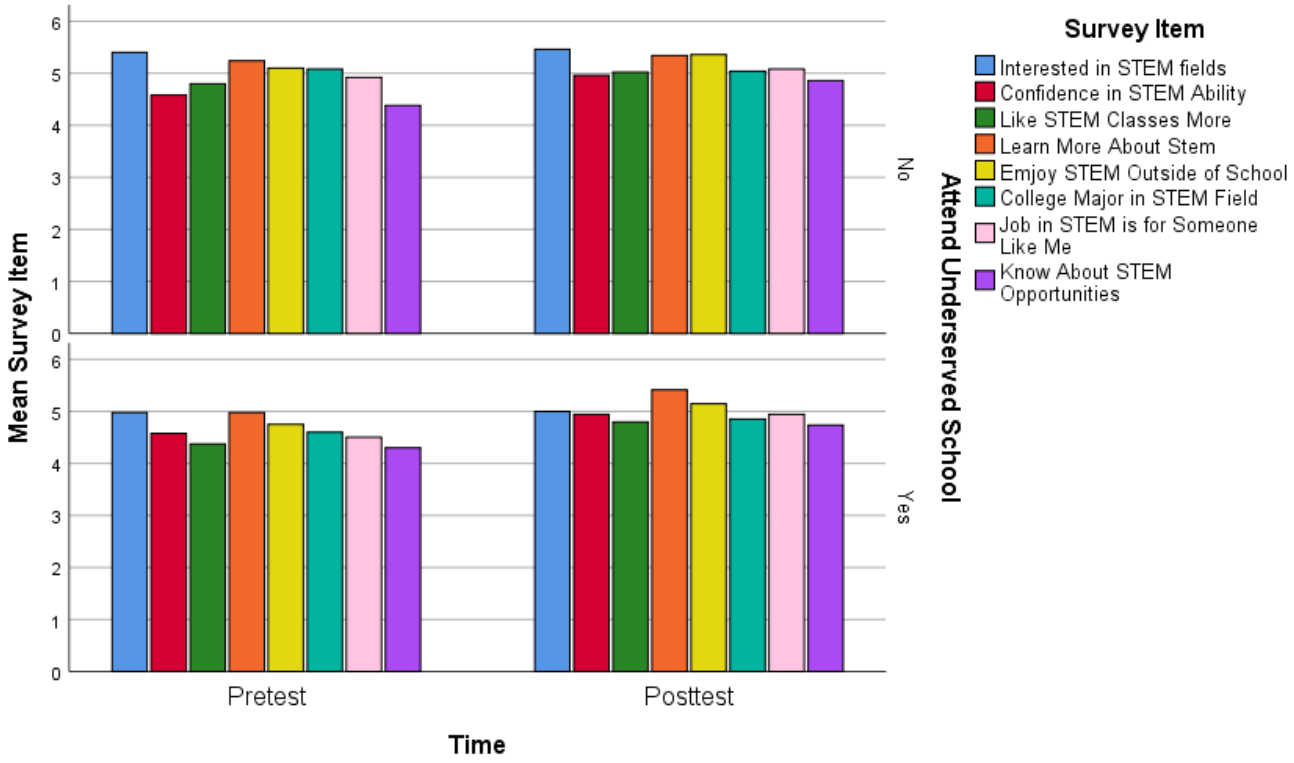
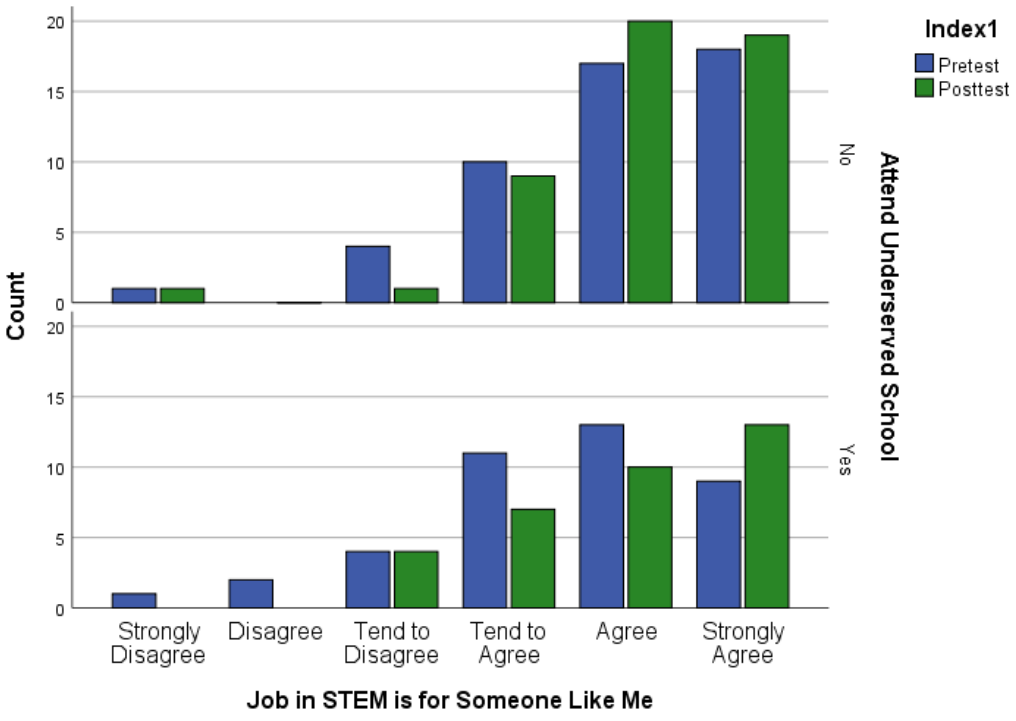
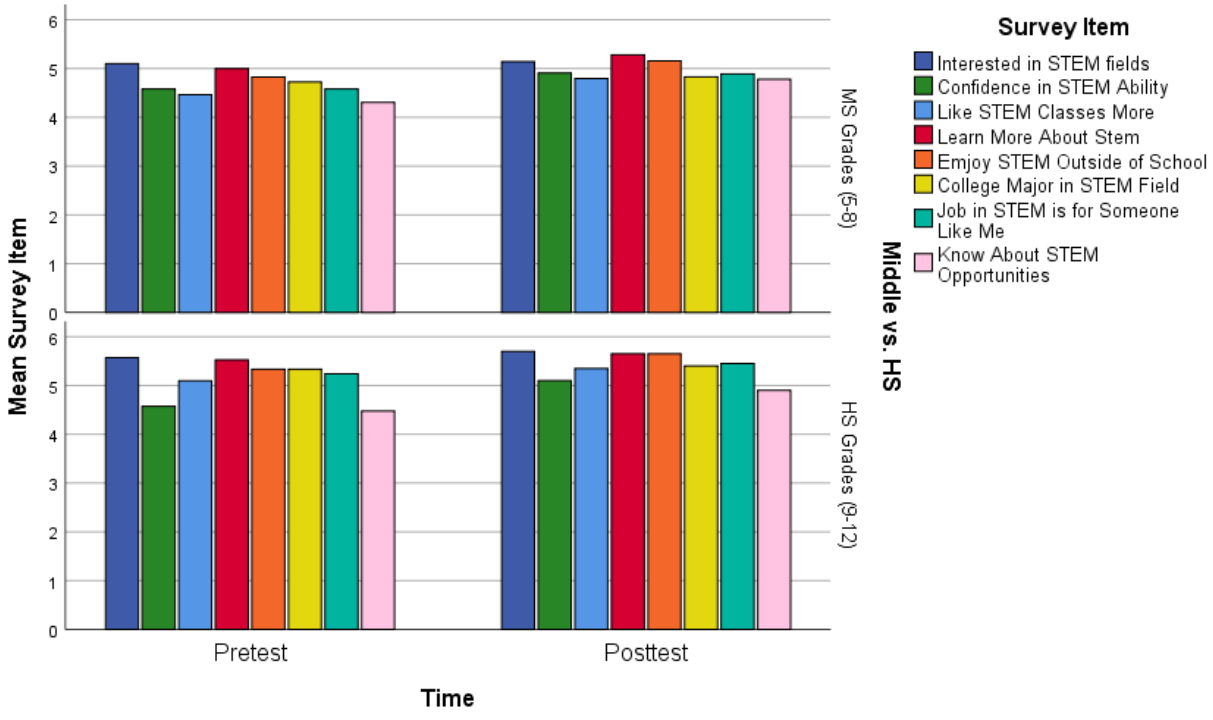


Figure 4



Finally, change in STEM attitudes were compared for students in earlier grades (5-8) and later grades (9-11) – see Figure 5. These comparisons were made as it is entirely possible that students in earlier grades may still be formulating their attitudes whereas students in later grades may have more stable attitudes. Two general observations may be made from the figure. First, higher mean values for high school students were observed when examining pretest and posttest attitudes separately. This may indicate that high school students had more thoroughly formulated opinions about STEM than middle school students. Second, STEM attitudes increased from pretest to posttest for both middle and high school students. Thus it would appear that the camp impacted STEM attitudes in both groups of students. More specifically, for middle school students, the largest change can be noted for the item *I know what career opportunities are available in STEM*; whereas the least amount of change was noted for the item *I am interested in STEM fields*. For high school students, the largest change can be noted for the item *I am confident in my STEM abilities*; whereas the least amount of change was noted for the item *I am interested in majoring in college in a STEM field*. Thus, for both groups of students, attitudes related to direct goals of the camp exhibited the largest change. In contrast, attitudes related to future plans displayed the least amount of change from pretest to posttest. This could, however, be for different reasons. The younger students may be less likely to think about the future whereas older students may have formed an opinion prior to the workshop. For both of these scenarios little change would be expected from pretest to posttest.

Figure 5



Appendix – Supplementary Tables

Comparison of Pre-Post STEM Attitudes by Underserved Grouping			
	Attend Underserved School		
	No	Yes	Over All Students
	Mean	Mean	
I am interested in science, technology, engineering, and mathematics (STEM) fields * PRE	5,4	5,0	5,2
I am interested in science, technology, engineering, and mathematics (STEM) fields * POST	5,5	5,0	5.3
I am confident in my STEM abilities * PRE	4,6	4,6	4.6
I am confident in my STEM abilities * POST	5,0	4,9	5.0
I like STEM classes more than other types of class (ex: Arts, History, English) * PRE	4,8	4,4	4.6
I like STEM classes more than other types of class (ex: Arts, History, English) * POST	5,0	4,8	4.9
I want to learn more about STEM * PRE	5,2	5,0	5.1
I want to learn more about STEM * POST	5,3	5,4	5.3
I enjoy learning about STEM outside of school * PRE	5,1	4,8	4.9
I enjoy learning about STEM outside of school * POST	5,4	5,1	5.2
I would like to go to college and major in one of the STEM fields * PRE	5,1	4,6	4.9
I would like to go to college and major in one of the STEM fields * POST	5,0	4,9	4.9
A job in STEM is for someone like me * PRE	4,9	4,5	4.7
A job in STEM is for someone like me * POST	5,1	4,9	5.0
I know what career opportunities are available for me in STEM * PRE	4,4	4,3	4.3
I know what career opportunities are available for me in STEM * POST	4,9	4,7	4.8

Comparison of Pretest and Posttest Scores on STEM Attitudes						
	Strongly Disagree	Disagree	Tend to Disagree	Tend to Agree	Agree	Strongly Agree
	Row N %	Row N %	Row N %	Row N %	Row N %	Row N %
I am confident in my STEM abilities * PRE	3.3%	3.3%	10.0%	21.1%	40.0%	22.2%
I am confident in my STEM abilities * POST	0.0%	1.1%	6.7%	16.7%	45.6%	30.0%
I like STEM classes more than other types of class (ex: Arts, History, English) * PRE	3.3%	3.3%	17.8%	13.3%	28.9%	33.3%
I like STEM classes more than other types of class (ex: Arts, History, English) * POST	0.0%	2.2%	10.0%	16.7%	33.3%	37.8%
I want to learn more about STEM * PRE	1.1%	2.2%	1.1%	15.6%	38.9%	41.1%
I want to learn more about STEM * POST	0.0%	0.0%	3.3%	12.2%	31.1%	53.3%
I enjoy learning about STEM outside of school * PRE	2.2%	1.1%	5.6%	18.9%	35.6%	36.7%
I enjoy learning about STEM outside of school * POST	1.1%	1.1%	3.3%	13.3%	31.1%	50.0%
I would like to go to college and major in one of the STEM fields * PRE	2.2%	2.2%	7.8%	20.0%	30.0%	37.8%
I would like to go to college and major in one of the STEM fields * POST	2.2%	1.1%	3.3%	22.2%	35.6%	35.6%
A job in STEM is for someone like me * PRE	2.2%	2.2%	8.9%	23.3%	33.3%	30.0%
A job in STEM is for someone like me * POST	2.2%	0.0%	5.6%	20.0%	34.4%	37.8%
I know what career opportunities are available for me in STEM * PRE	2.2%	6.7%	14.4%	28.9%	26.7%	21.1%
I know what career opportunities are available for me in STEM * POST	0.0%	0.0%	6.7%	33.3%	32.2%	27.8%
I am interested in science, technology, engineering, and mathematics (STEM) fields * PRE	1.1%	1.1%	4.4%	6.7%	42.2%	44.4%
I am interested in science, technology, engineering, and mathematics (STEM) fields * POST	3.3%	0.0%	1.1%	12.2%	30.0%	53.3%

Comparison of Middle vs. HS Students on STEM Attitudes						
	Pretest			Posttest		
	Middle vs. HS			Middle vs. HS		
	MS Grades (5-8)	HS Grades (9-12)	Overall	MS Grades (5-8)	HS Grades (9-12)	Overall
I am confident in my STEM abilities	4.58	4.57	4.58	4.91	5.10	4.95
I like STEM classes more than other classes	4.46	5.10	4.61	4.80	5.35	4.93
I want to learn more about STEM	5.00	5.52	5.12	5.28	5.65	5.37
I enjoy learning about STEM outside of school	4.83	5.33	4.94	5.16	5.65	5.27
I would like to major in one of the STEM fields	4.72	5.33	4.87	4.83	5.40	4.96
A job in STEM is for someone like me	4.58	5.24	4.73	4.89	5.45	5.02
I know what STEM opportunities are available	4.30	4.48	4.34	4.78	4.90	4.81
I am interested in STEM fields	5.10	5.57	5.21	5.14	5.70	5.27