APPLIED LEARNING STUDENT QUESTIONNAIRE: *OVERALL ANALYSIS*

Overall Results
May 2014

Executive Summary

Participants and Methods

In May 2014, 1,277 students across 9 Race to the Top programs completed the Applied Learning Student Questionnaire (ALSQ). The response rates displayed in Table 1 suggest that 74% of the total number of participating students responded to the survey.

Table 1. Survey Response Rates

Program	# of Survey Respondents	Total # of Participating Students	Survey Response Rate
STEM for Life Carroll County	151	240	63%
Drew Charter School- Partners of Innovation	304	415	73%
Murray County STEM Academy	42	64	66%
21st Century STEM Collaboration- Barrow County	358	444	81%
STEM Targeted Education Program (STEP) Academy- Sweetwater MS and Moore MS	118	138	86%
Tift County Mechatronics Program	66	66	100%
21st Century Academy of Environmental Studies – Rockdale County	179	289	62%
Computational Thinking: 21st Century STEM Problem-Solving Skills for Georgia Students	27	27	100%
Real STEM – Georgia Southern	32	53	60%
Total	**1,277**	**1,736**	**77%**

The ALSQ[1] is designed to measure pre and post gains related to student problem solving and communication skills, self-management and engagement.

The ALSQ is a self-report questionnaire that includes 36 items to assess students' attitudes on the following survey constructs:

1. **Intrinsic Motivation**: motivation stemming from goals of mastery, learning and challenge. Example, "It is important for me to learn what is being taught in this program."
2. **Self-Management/Self-Regulation:** effortful and persistent behaviors that are used to guide, monitor, and direct the success of one's learning and performance. Example, "I turn all my assignments in on time."
3. **Intent to Persist:** aspirations, plans, and goals to pursue additional education and a career in STEM. Example, "I intend to get a college degree in STEM (Science, Technology, Engineering, and Math)."
4. **Problem Solving:** inquiry-based learning environment that provides higher-order cognitive tasks and real-world applications. Example, "I work out explanations on my own."

[1] See Appendix A for information related to the construct reliabilities of the ALSQ.

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5. **Implementation Activities:** hands-on activities designed to increase exposure to STEM topics and real-world applications. Example, "We learn what scientists/technicians/engineers/ mathematicians or other STEM professionals do."

Results & Discussion

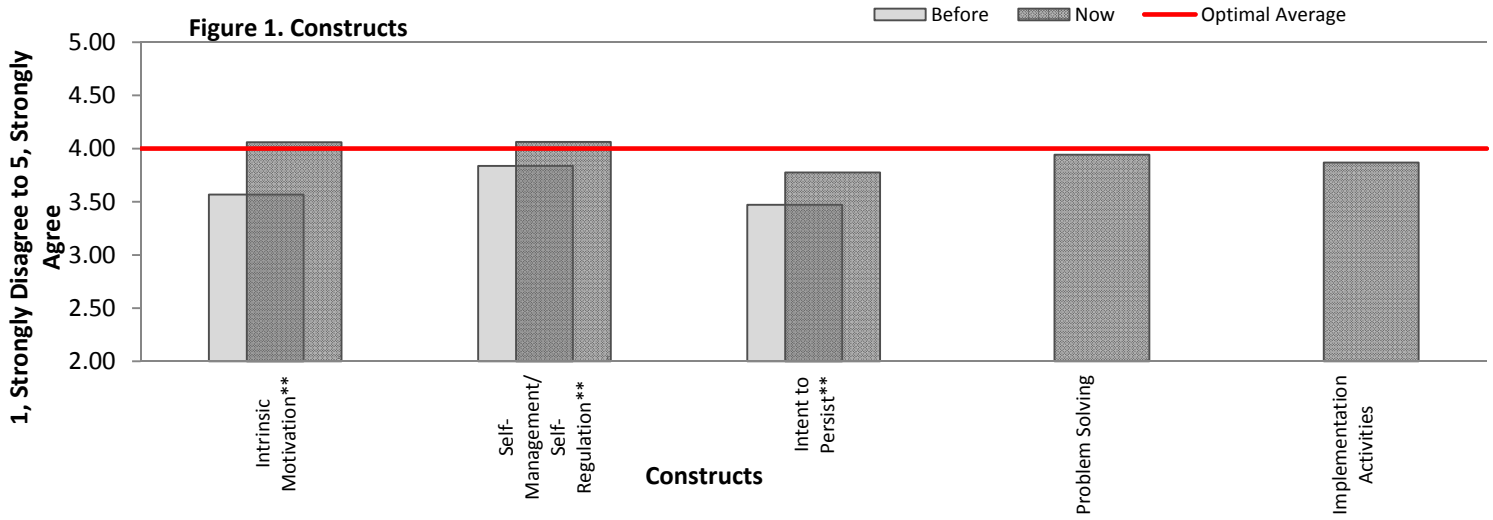
- **ALSQ Survey Constructs**

  Table 2 summarizes students' responses to the ALSQ survey constructs across all programs. In aggregate students show statistically significant increases in *Intrinsic Motivation*, *Self-Management/Self-Regulation* skills, and *Intent to Persist*. The largest student gains observed were in the *Intrinsic Motivation* construct. This suggests that the programs were particularly effective at enhancing students' interests to learn and derive value from the material being taught. In order to maximize effectiveness, we would expect students' average scores to exceed 4.0. It is important to note that the "now" scores across the following 3 constructs– *Intent to Persist*, *Problem Solving*, and *Implementation Activities*- did not reach or exceed the optimal average of 4.0 on a 5-point Likert scale (1, *Strongly Disagree* to 5, *Strongly Agree.* Figure 1 suggests that additional work may be needed in the above mentioned areas.

Table 2. Summary of Results by Constructs

Overall- Constructs				
Constructs		**n**	**Mean[1]**	**Paired Samples t-test[2]**
Intrinsic Motivation	Before	1277	3.57	p<0.001**
	Now	1271	4.06	
Self-Management/Self-Regulation	Before	1275	3.84	p<0.001**
	Now	1270	4.06	
Intent to Persist	Before	1274	3.47	p<0.001**
	Now	1271	3.78	
Problem Solving	Now	1275	3.94	N/A
Implementation Activities	Now	1271	3.87	N/A

Note. [1] Reference lines are set at 3.5 and 4. [2]Please note that only students with matched Pre and Post data were assessed for significance. Desired statistically significant changes are highlighted in green and undesired statistically significant changes are highlighted in red. **p<0.001, *p<0.01, †p<0.05. Negatively worded statements were reverse coded for mean computations.



**p<0.001, *p<0.01, †p<0.05; Scale is truncated for visual clarity.

Executive Summary, continued

- **ALSQ Survey Constructs by Program**

Examining the ALSQ results by individual program, it is evident that across all programs, students show statistically significant increases in *Intrinsic Motivation, Self-management/Self-regulation* and *Intent to Persist*; with the exception of the students in the Murray STEM Academy and RT3 Computational Thinking programs. While not statistically significant, students in the Real STEM program at Georgia Southern report increasing scores in the desired direction in the *Self-Management/Self-Regulation* Skills construct. Students in the Mechatronics program at Tift County and the STEP Academy at Moore and Sweetwater Middle School show the largest increases from before to now on all three of the above mentioned constructs; RT3 Computational Thinking students show the smallest average increases across all 9 programs.

Table 3. Summary of Results by Constructs per Program

Overall- Constructs per Program													
Constructs		**STEM for Life Carroll County (n=151)**		**Drew Charter (n=304)**		**Murray STEM Academy (n=42)**		**21st Century Barrow County (n=358)**		**STEP Academy Moore MS Sweetwater MS (n=118)**		**TIFT County Mechatronics (n=66)**	
		Mean	*t-test*	Mean	*t-test*	Mean	*t-test*	Mean	*t-test*	Mean	*t-test*	Mean	*t-test*
Intrinsic Motivation	Before	3.45	*p<0.001***	3.53	*p<0.001***	3.18	*p=0.434*	3.67	*p<0.001***	3.44	*p<0.001***	3.81	*p<0.001***
	Now	3.99		3.90		3.35		4.17		4.09		4.69	
Self-Management/ Self-Regulation	Before	3.72	*p<0.001***	3.78	*p<0.001***	3.50	p=0.135	3.98	*p<0.001***	3.66	*p<0.001***	4.01	*p<0.001***
	Now	4.01		3.96		3.65		4.16		3.99		4.46	
Intent to Persist	Before	3.37	*p<0.001***	3.47	*p<0.001***	2.90	p=0.304	3.48	*p<0.001***	3.45	*p<0.001***	3.63	*p<0.001***
	Now	3.74		3.66		3.08		3.73		3.88		4.65	
Problem Solving	Now	3.85	n/a	3.84	n/a	3.36	n/a	4.10	n/a	3.81	n/a	4.58	n/a
Implementation Activities	Now	3.64		3.79		3.11		4.08		3.77		4.63	

Note. Scale= 1, *Strongly Disagree* to 5, *Strongly Agree*. Negatively worded statements were reverse coded for mean computations. **p<0.001, *p<0.01, †p<0.05

Executive Summary, continued

Continued Table 3. Summary of Results by Constructs per Program

Overall – Constructs per Program							
Constructs		**21st Century Rockdale County (n=179)**		**RT3 Computational Thinking (n=27)**		**Real STEM Georgia Southern (n=32)**	
		Mean	*t-test*	Mean	*t-test*	Mean	*t-test*
Intrinsic Motivation	Before	3.68	*p<0.001***	3.38	p=0.342	3.36	*p<0.001***
	Now	4.19		3.49		3.95	
Self-Management/ Self-Regulation	Before	3.95	*p<0.001***	3.54	p=0.071	3.81	p=0.070
	Now	4.16		3.65		3.92	
Intent to Persist	Before	3.64	*p<0.001***	3.61	p=0.568	3.32	*p<0.020*†
	Now	3.89		3.69		3.59	
Problem Solving	Now	3.86	n/a	3.75	n/a	4.19	n/a
Implementation Activities	Now	3.69		3.81		4.33	

Note. Scale= 1, *Strongly Disagree* to 5, *Strongly Agree*. Negatively worded statements were reverse coded for mean computations. **p<0.001, *p<0.01, †p<0.05

Executive Summary, continued

In order for programs to maximize their effectiveness, we would expect "now" scores to reach or exceed the optimal average of 4.0. Figures 2 – 6 display "now" scores for each program and construct. For example, Figure 2 indicates that four out of nine programs met or exceeded the optimal average for *Intrinsic Motivation*. In general, programs not reaching or exceeding the horizontal line may need additional attention.

Figure 2. Intrinsic Motivation ("Now" Scores)

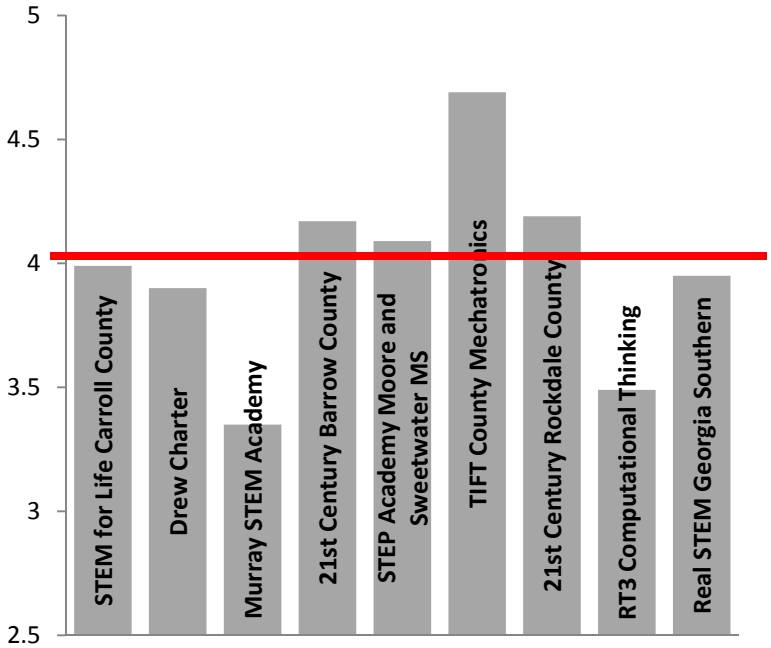
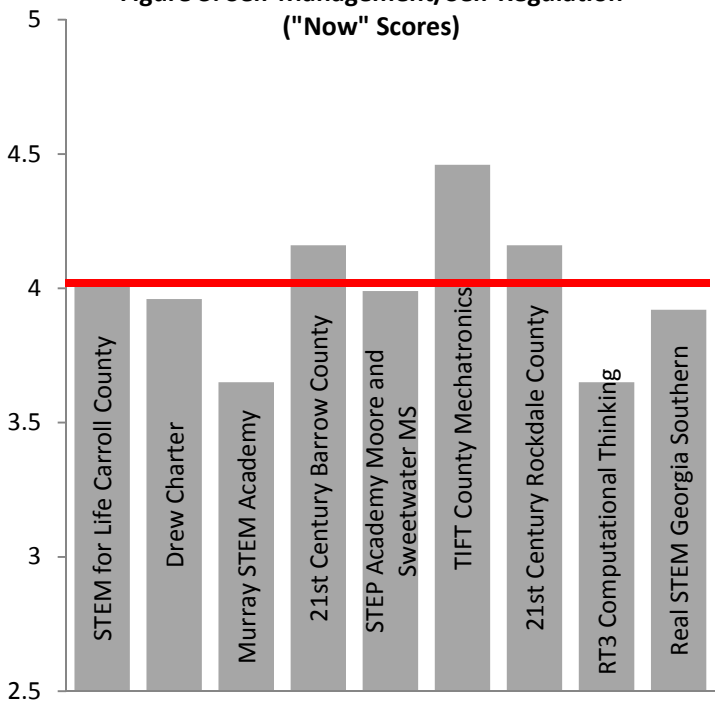
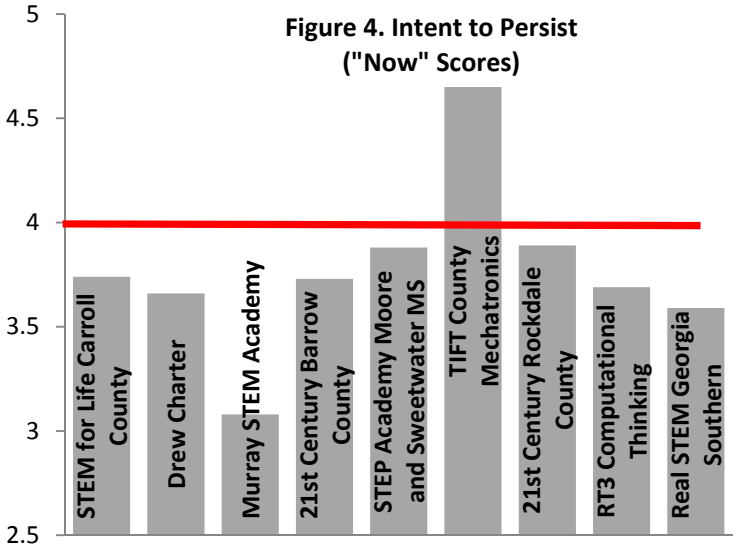
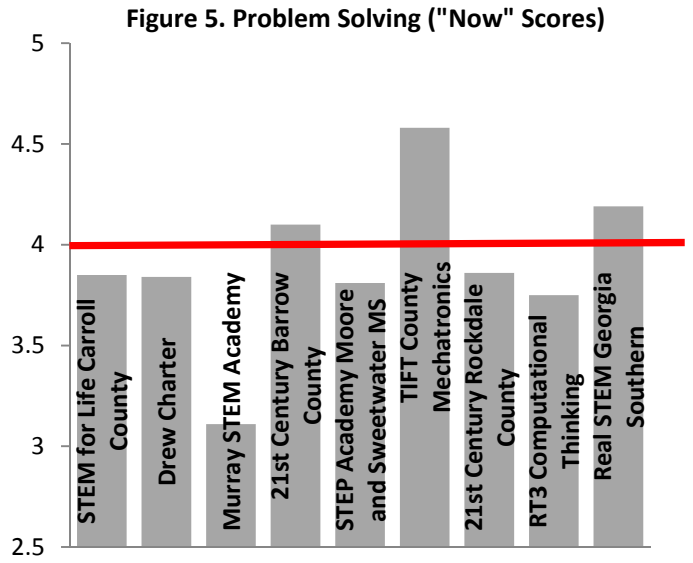


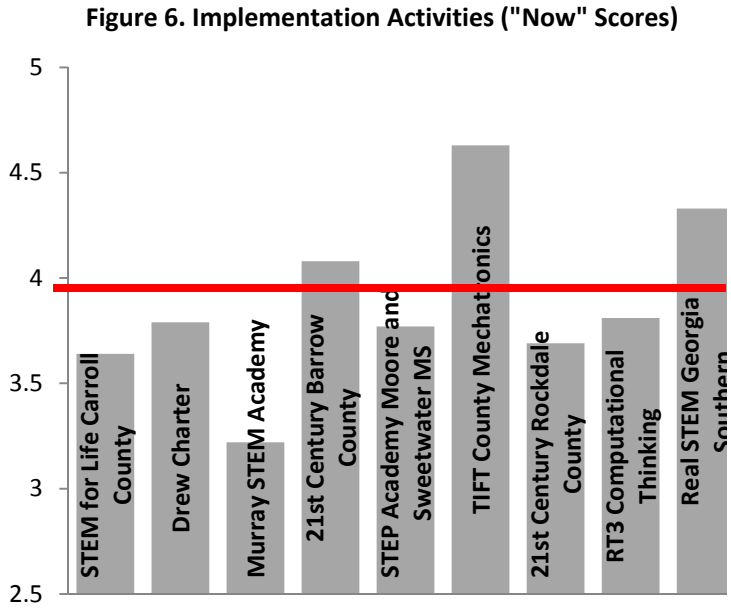
Figure 3. Self-Management/Self-Regulation ("Now" Scores)

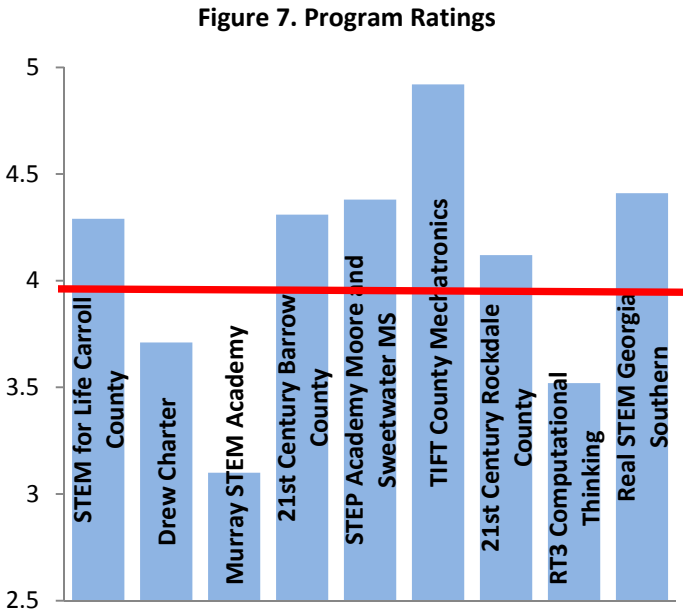


Scale= 1, Strongly Disagree to 5, Strongly Agree. Scale was truncated for visual clarity.









Scale= 1, Strongly Disagree to 5, Strongly Agree. Scale was truncated for visual clarity. Program Rating Scale= 1, Very Poor to 5, Excellent.

Executive Summary, continued

- **Program Rating**
  Collapsing across all programs, students' ratings exceeded the optimal average of 4.0. On a 5-point Likert scale where 1 signifies *very poor* and 5 signifies *excellent*, the average score was a 4.12. See Table 12. Looking at Figure 7, we see that six out of nine programs were rated above the optimal average. Murray County STEM Academy, Drew Charter School and the RT3 Computational Thinking program may need additional assistance in improving student enjoyment.

- **Areas for Further Improvement**
  Across all programs, further enhancing problem solving skills may be warranted. Specifically, students' ratings suggest that the inquiry-based learning environment may be improved by allowing students more opportunity to choose their own topics, work out explanations on their own, and plan and conduct their own projects. Likewise, encouraging programs to provide activities that foster interaction with STEM professionals may increase student exposure to real-world applications and careers. Such implementation activities may strengthen students' intentions and motivations to pursue additional education in STEM fields.

Table 4. Intrinsic Motivation

Intrinsic Motivation		n	Mean[1]		Paired Samples t-test[2]		1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
1. I prefer class work that is challenging so I can learn new things.	Before	1277		3.31	p<0.001**		7%	13%	38%	26%	16%
	Now	1271		3.83			4%	5%	24%	36%	30%
2. It is important to me to learn what is being taught in this program.	Before	1271		3.82	p<0.001**		4%	5%	26%	34%	31%
	Now	1264		4.26			3%	2%	12%	33%	50%
3. I like what I am learning in this program.	Before	1268		3.55	p<0.001**		5%	9%	33%	33%	20%
	Now	1260		4.04			3%	3%	19%	36%	39%
4. I think I will be able to use what I learn in this program in other classes.	Before	1265		3.56	p<0.001**		5%	10%	30%	33%	22%
	Now	1263		4.09			3%	3%	18%	34%	42%
5. Even when I do poorly on a test, I try to learn from my mistakes.	Before	1274		3.84	p<0.001**		5%	6%	23%	33%	33%
	Now	1265		4.29			2%	3%	11%	31%	53%
6. I think that what I am learning in this program is useful for me to know.	Before	1263		3.61	p<0.001**		5%	8%	33%	30%	24%
	Now	1258		4.08			4%	3%	17%	32%	43%
7. I think that what we are learning in this program is interesting.	Before	1266		3.41	p<0.001**		7%	11%	34%	29%	19%
	Now	1271		3.93			4%	6%	20%	33%	37%
8. Understanding STEM (Science, Technology, Engineering, and Math) is important to me.	Before	1271		3.56	p<0.001**		7%	8%	32%	28%	25%
	Now	1268		4.06			4%	4%	19%	30%	44%
9. I enjoy STEM (Science, Technology, Engineering, and Math) in general.	Before	1269		3.45	p<0.001**		9%	9%	33%	27%	22%
	Now	1265		3.95			5%	5%	20%	29%	41%

Note. [1] Reference lines are set at 3.5 and 4. [2]Please note that only students with matched Pre and Post data were assessed for significance. Desired statistically significant changes are highlighted in green and undesired statistically significant changes are highlighted in red. **p<0.001, *p<0.01, †p<0.05. Highest percentages are highlighted in gray.

Table 5. Self-Regulation/Self-Motivation

Self-Regulation/Self-Motivation		n	Mean[1]		Paired Samples t-test[2]		1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
10. I turn all my assignments in on time.	Before	1275		3.57	p<0.001**		4%	10%	33%	31%	23%
	Now	1263		3.88			3%	5%	25%	35%	32%
11. I miss class often. (n)	Before	1261		1.70	p=0.439		61%	20%	11%	5%	4%
	Now	1260		1.69			66%	15%	8%	5%	5%
12. I am often late for class. (n)	Before	1253		1.77	p=0.607		57%	22%	12%	5%	4%
	Now	1254		1.77			61%	18%	10%	6%	6%
13. I set aside time to do my homework and study.	Before	1271		3.32	p<0.001**		9%	12%	35%	28%	17%
	Now	1262		3.68			6%	6%	28%	32%	27%
14. When I say I'm going to do something, I do it.	Before	1271		3.72	p<0.001**		3%	6%	33%	32%	26%
	Now	1270		4.02			2%	3%	23%	35%	37%
15. I am a hard worker.	Before	1266		3.96	p<0.001**		3%	4%	23%	35%	35%
	Now	1260		4.24			2%	2%	15%	33%	49%
16. I finish whatever I begin.	Before	1260		3.76	p<0.001**		3%	6%	30%	32%	28%
	Now	1267		4.08			2%	3%	20%	35%	40%

Note. [1] Reference lines are set at 3.5 and 4. [2]Please note that only students with matched Pre and Post data were assessed for significance. Desired statistically significant changes are highlighted in green and undesired statistically significant changes are highlighted in red. **p<0.001, *p<0.01, †p<0.05; (n) negatively worded statement. Highest percentages are highlighted in gray.

Table 6. Intent to Persist

Intent to Persist		n	Mean[1]		Paired Samples t-test[2]		1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
17. I am considering a career in STEM (Science, Technology, Engineering, and Math).	Before	1274		3.17	p<0.001**		15%	15%	30%	20%	21%
	Now	1271		3.54			11%	10%	26%	22%	32%
18. I intend to get a college degree in STEM (Science, Technology, Engineering, and Math).	Before	1268		3.28	p<0.001**		11%	15%	30%	22%	21%
	Now	1270		3.63			9%	9%	25%	24%	33%
19. I can see myself working in STEM (Science, Technology, Engineering, and Math).	Before	1269		3.18	p<0.001**		14%	15%	31%	20%	20%
	Now	1268		3.53			11%	11%	24%	24%	31%
20. Someday, I would like to have a career in STEM (Science, Technology, Engineering, and Math).	Before	1270		3.15	p<0.001**		15%	16%	30%	20%	20%
	Now	1259		3.50			11%	11%	24%	23%	30%
21. I intend to graduate from high school.	Before	1269		4.58	p<0.001**		3%	2%	8%	9%	78%
	Now	1267		4.67			2%	1%	6%	8%	83%

Note. [1] Reference lines are set at 3.5 and 4. [2]Please note that only students with matched Pre and Post data were assessed for significance. Desired statistically significant changes are highlighted in green and undesired statistically significant changes are highlighted in red. **p<0.001, *p<0.01, †p<0.05. Highest percentages are highlighted in gray.

Table 7. Problem Solving, Now Only

Problem Solving	n	Mean		Assessment		1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
22. In this program, my teacher(s) tells me how to improve my work.	1258		4.08	Good ☺		4%	3%	17%	34%	42%
23. In this program, my teacher(s) lets us choose our own topics or projects to investigate.	1240		3.47	Action !		7%	10%	34%	25%	23%
24. In this program, I work out explanations on my own.	1275		3.79	Attention ✓		2%	3%	31%	41%	23%
25. In this program, I have opportunities to explain my ideas.	1272		3.89	Attention ✓		3%	5%	22%	40%	30%
26. In this program, we plan and do our own projects and/or experiments.	1268		3.75	Attention ✓		4%	7%	28%	33%	28%
27. In this program, we work on real-world problems.	1272		3.95	Attention ✓		4%	4%	22%	35%	36%
28. In this program, we have class discussions.	1272		4.13	Good ☺		3%	3%	16%	34%	44%
29. In this program, we investigate to see if our ideas are right.	1265		4.01	Good ☺		3%	3%	20%	37%	37%
30. In this program, we need to be able to think and ask questions.	1272		4.17	Good ☺		3%	2%	16%	34%	45%
31. In this program, we are expected to understand and explain ideas.	1275		4.17	Good ☺		2%	1%	16%	37%	43%

Note. [1] Reference lines are set at 3.5 and 4. Assessment: Good=Above 4.0; Attention=Below 4.0; Action=Below 3.5. Highest percentages are highlighted in gray.

Table 8. Implementation Activities, Now Only

Implementation Activities	n	Mean		Assessment		1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
32. In this program, my teacher(s) takes notice of students' ideas.	1260		3.84	Attention ✓		5%	5%	22%	34%	33%
33. In this program, my teacher(s) shows us how new information relates to what we have already learned.	1239		4.08	Good ☺		4%	2%	17%	35%	42%
34. In this program, we learn what scientists/ technicians/ engineers/ mathematicians or other STEM professionals do.	1268		3.82	Attention ✓		4%	7%	23%	34%	32%
35. In this program, we do our work in groups.	1269		3.82	Attention ✓		3%	3%	30%	35%	28%
36. In this program, we interact with scientists/ technicians/ engineers/ mathematicians or other STEM professionals.	1271		3.78	Attention ✓		5%	7%	25%	33%	30%

Note. [1] Reference lines are set at 3.5 and 4. Assessment: Good=Above 4.0; Attention=Below 4.0; Action=Below 3.5. Highest percentages are highlighted in gray.

Table 9. Educational Plans

What is the highest level of education you plan to achieve?	Before		Now		*Change*[1]	
	n	%	n	%	*n*	*%*
High School	182	15%	92	8%	-90	-7.36%
2-year college	149	12%	99	8%	-50	-4.09%
4-year college	356	29%	260	21%	-96	-7.86%
Graduate School	275	23%	331	27%	+56	+4.58%
Professional School	259	21%	440	36%	+181	+14.81%
Total	1222	100%	1222	100%		
Average[2]	**3.02**		**3.40**		**p<0.001** (*significant*)**[3]	

Note. [1] Change from Before to Now. Increases are highlighted in green; decreases are highlighted in red.
[2] To compute averages, the following codes were applied: High School (1), 2-year college (2), 4-year college (3), Graduate School (4), Professional School (4).
[3] Paired samples t-test, p-value: **p<0.001, *p<0.01, †p<0.05

Table 10. Demographics

Gender	n	%
Female	588	46%
Male	678	54%
Total	**1266**	**100%**

Ethnicity	n	%
Asian	37	3%
Black	534	42%
Hispanic	106	8%
Native American	12	1%
White	446	35%
Multiracial	101	8%
Other	37	3%
Total	**1273**	**100%**

Grade	n	%
6th	288	23%
7th	336	26%
8th	210	17%
9th	112	9%
10th	89	7%
11th	116	9%
12th	112	9%
Other	9	1%
Total	**1272**	**100%**

Table 11. Participation

How long have you participated in this program?		n	%
Dosage	0 semesters	6	0%
	1 semester	143	11%
	2 semesters	615	48%
	3 semesters	41	3%
	4 or more semesters	296	23%
	Summer Only	2	0%
	Don't Know	167	13%
	Total	**1270**	**100%**

Did you participate in this program during the summer?		n	%
Summer Participation	No	891	70%
	Yes	235	19%
	Don't Know	143	11%
	Total	**1270**	**100%**

Table 12. Program Rating

Program Rating: How would you rate this program?	n	Mean[1]	Assessment		1 (Very Poor)	2 (Poor)	3 (Average)	4 (Good)	5 (Excellent)
	1271	4.12	Good ☺		3%	2%	16%	36%	42%

Note. [1] Reference lines are set at 3.5 and 4. Assessment: Good=Above 4.0; Attention=Below 4.0; Action=Below 3.5. Highest percentage is highlighted in gray.

Appendix B. Construct Reliabilities

Table 13. Construct Reliabilities

Construct Reliabilities				
Constructs		**n**	**Cronbach's alpha**	***Reliability Interpretation***
Intrinsic Motivation (9-items)	Before	4461	.877	*Very good*
	Now	4387	.896	*Very good*
Self-Management/Self-Regulation (7-items)	Before	4546	.604	*Somewhat Low*
	Now	4494	.624	*Somewhat Low*
Intent to Persist (5-items)	Before	4595	.870	*Very good*
	Now	4545	.883	*Very good*
Problem Solving (10-items)	Now	4502	.884	*Very good*
Implementation Activities (5-items)	Now	4571	.810	*Very good*

Note. Construct reliabilities were computed based on December 2012 – May 2014 data.

Cronbach's Alpha Reliability Key: Cronbach's alpha is a measure of the internal consistency of items in a construct. This statistic ranges from 0 to 1.00; the higher the value the better. An alpha of .80 or higher is considered to have achieved very good measurement reliability; an alpha of .65 is considered acceptable (Field, 2009).

Reliability	Interpretation
.90 and above	Excellent reliability; at the level of the best measures
.80 - .90	Very good
.70 - .80	Good; in the range of most. There are probably a few items which could be improved.
.60 - .70	Somewhat low. This measure needs to be supplemented by other measures (e.g., more surveys) to determine outcomes. There are probably some items which could be improved.
.50 - .60	Suggests need for revision of measure, unless it is quite short (ten or fewer items). The test definitely needs to be supplemented by other measures (e.g., more tests).
.50 or below	Questionable reliability. This measure should not contribute heavily to the outcomes and needs revision.

From: J. C. Nunnally, Psychometric Theory. New York: McGraw-Hill, 1967, pp. 172-235.

Reference:

Field, A. (2009). *Discovering Statistics Using SPSS, 3rd Edition*. Thousand Oaks, CA: Sage Publications.