

APPLIED LEARNING STUDENT QUESTIONNAIRE: *OVERALL* *ANALYSIS*

Overall Results
December 2013

Executive Summary

Participants and Methods

In December 2013, 1,611 students across 9 Race to the Top programs completed the Applied Learning Student Questionnaire (ALSQ). The response rates displayed in Table 1 suggest that 81% 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	219	240	91%
Drew Charter School- Partners of Innovation	388	426	91%
Murray County STEM Academy	75	86	87%
21 st Century STEM Collaboration- Barrow County	422	451	94%
STEM Targeted Education Program (STEP) Academy- Sweetwater MS and Moore MS	129	140	92%
Tift County Mechatronics Program	67	69	97%
21st Century Academy of Environmental Studies – Rockdale County	169	292	58%
Computational Thinking: 21st Century STEM Problem-Solving Skills for Georgia Students	88	219	40%
Real STEM – Georgia Southern	54	78	69%
Total	1611	2001	81%

The ALSQ¹ 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.

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.”

Executive Summary, continued

Results & Discussion

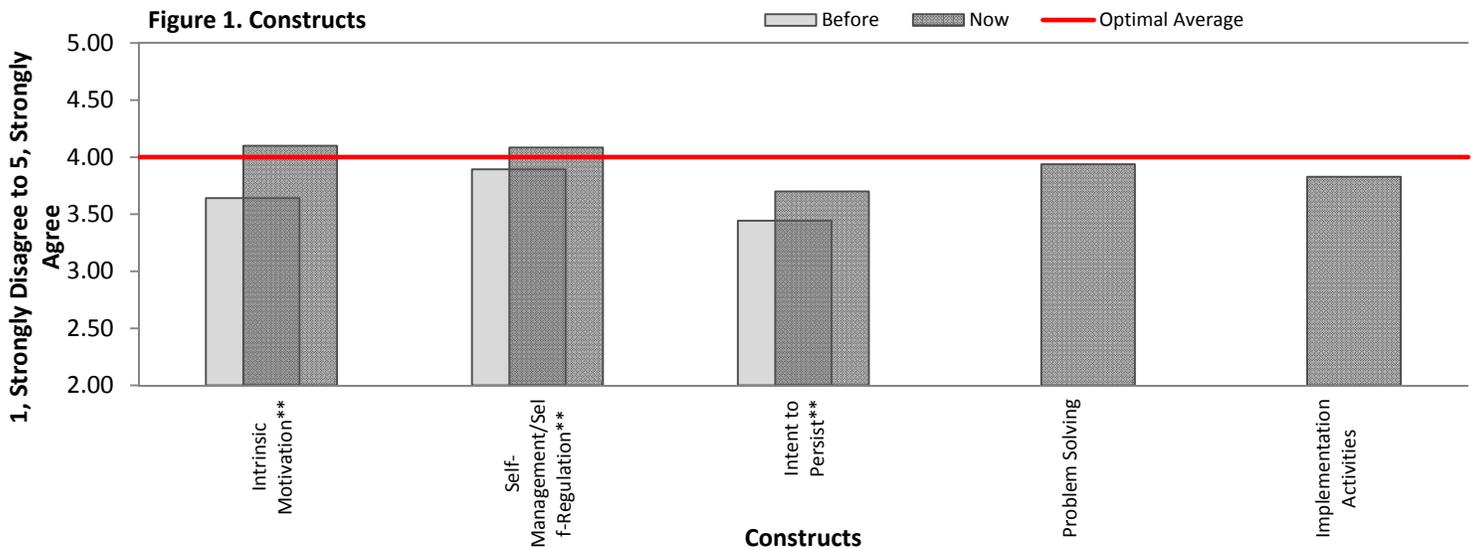
• **ALSQ Survey Constructs**

Table 2 summarizes students’ responses to the ALSQ survey constructs across all programs. Students reported 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. Before the program, 56% of students indicated that they derive value and see the importance in learning about STEM; now, more than 75% say that they are intrinsically motivated to tackle STEM-related tasks and projects. Despite these statistically significant gains, it is important to note that the “now” scores across the following 3 constructs did not reach or exceed the optimal average of 4.0 on a 5-point Likert scale (1, *strongly disagree* to 5, *strongly agree*): *Intent to Persist*, *Problem Solving*, and *Implementation Activities*. See Figure 1. In order to maximize effectiveness, we would expect students’ average scores to exceed 4.0. 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		1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)	
Intrinsic Motivation	Before	1606	3.64	p<0.001**		4%	9%	30%	32%	24%	
	Now	1591	4.10			2%	4%	18%	34%	42%	
Self-Management/Self-Regulation	Before	1605	3.89	p<0.001**		20%	11%	24%	26%	19%	
	Now	1598	4.08			20%	8%	18%	27%	27%	
Intent to Persist	Before	1605	3.44	p<0.001**		12%	13%	25%	17%	32%	
	Now	1602	3.70			10%	10%	21%	18%	41%	
Problem Solving	Now	1590	3.89	N/A		3%	5%	24%	37%	32%	
Implementation Activities	Now	1582	3.79	N/A		4%	6%	26%	36%	28%	

¹Reference lines are set at 3.5 and 4. Negatively worded statements were reverse coded for mean computations. ²The lowest value of n was used to complete a paired-samples t-test. **p<0.001, *p<0.01, †p<0.05



**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 in all programs, students report 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. Students in the STEM for Life program at Carroll County and the Mechatronics program at Tift County 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=160)		Drew Charter (n=388)		Murray STEM Academy (n=75)		21 st Century Barrow County (n=422)		STEP Academy Moore MS Sweetwater MS (n=129)		TIFT County Mechatronics (n=67)	
		Mean	t-test	Mean	t-test	Mean	t-test	Mean	t-test	Mean	t-test	Mean	t-test
Intrinsic Motivation	Before	3.50	p<0.001**	3.65	p<0.001**	3.25	p=0.001*	3.61	p<0.001**	3.60	p<0.001**	3.92	p<0.001**
	Now	4.10		3.96		3.57		4.20		4.09		4.62	
Self-Management/ Self-Regulation	Before	3.74	p<0.001**	3.84	p<0.001**	3.51	p=0.918	4.04	p<0.001**	3.67	p<0.001**	4.01	p<0.001**
	Now	4.11		3.97		3.52		4.22		3.94		4.40	
Intent to Persist	Before	3.35	p<0.001**	3.40	p<0.001**	3.06	p=0.108	3.33	p<0.001**	3.38	p<0.001**	3.83	p<0.001**
	Now	3.75		3.56		3.19		3.60		3.65		4.58	
Problem Solving	Now	3.87		3.86		3.42		4.11		3.75		4.53	
Implementation Activities	Now	3.90	n/a	3.64	n/a	3.22	n/a	4.09	n/a	3.58	n/a	4.56	n/a

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

Continued Table 3. Summary of Results by Constructs per Program

Overall – Constructs per Program							
Constructs		21st Century Rockdale County (n=169)		RT3 Computational Thinking (n=88)		Real STEM Georgia Southern (n=54)	
		Mean	t-test	Mean	t-test	Mean	t-test
Intrinsic Motivation	Before	4.00	p<0.001**	3.66	p=0.017†	3.58	p<0.001**
	Now	4.36		3.83		4.10	
Self-Management/ Self-Regulation	Before	4.14	p<0.001**	3.83	p=0.012†	3.94	p=0.003*
	Now	4.31		3.91		4.08	
Intent to Persist	Before	3.92	p<0.001**	3.60	p=0.079	3.43	p<0.001**
	Now	4.11		3.71		3.78	
Problem Solving	Now	3.99	n/a	3.59	n/a	4.24	n/a
Implementation Activities	Now	3.82		3.47		4.12	

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

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 all programs met or exceeded the optimal average for intrinsic motivation, with the exception of Murray STEM Academy. In general, programs not reaching or exceeding the horizontal line may need additional attention.

Figure 2. Intrinsic Motivation ("Now" Scores)

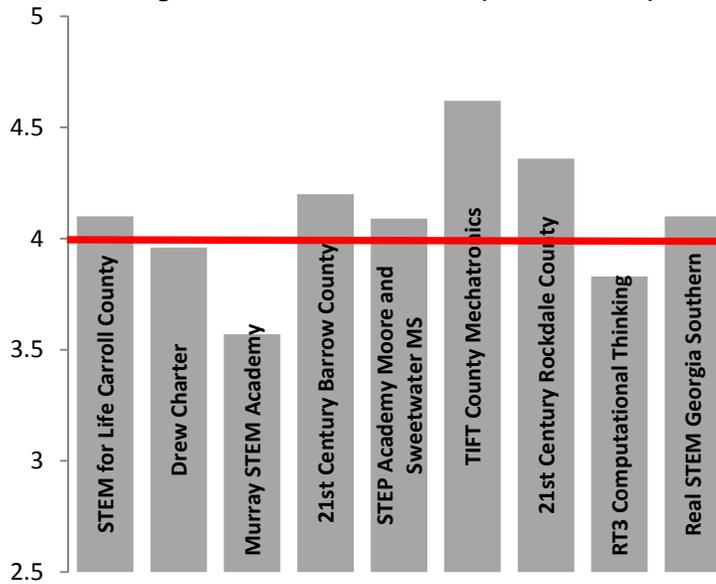
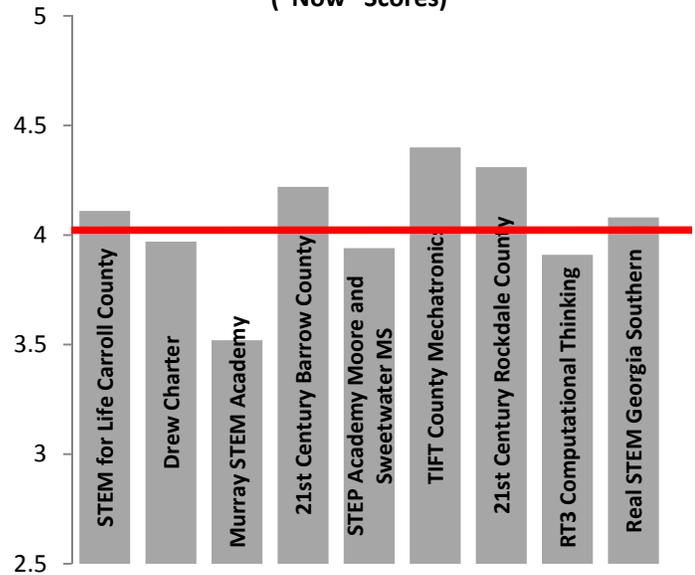


Figure 3. Self Management/Self Regulation ("Now" Scores)



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

Executive Summary, continued

Figure 4. Intent to Persist ("Now" Scores)

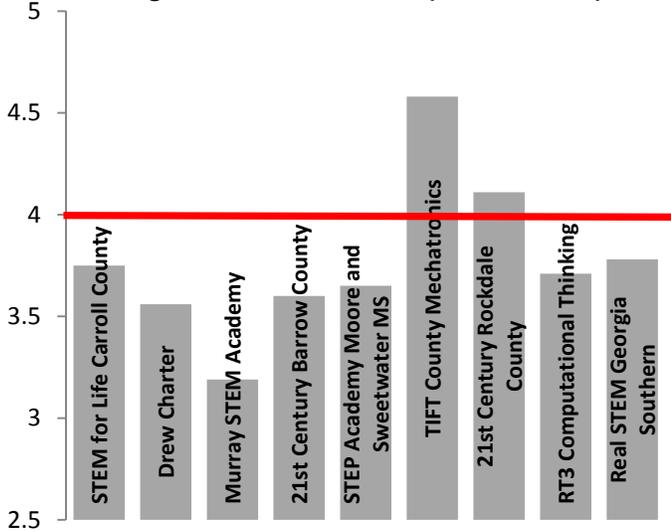


Figure 5. Problem Solving ("Now" Scores)

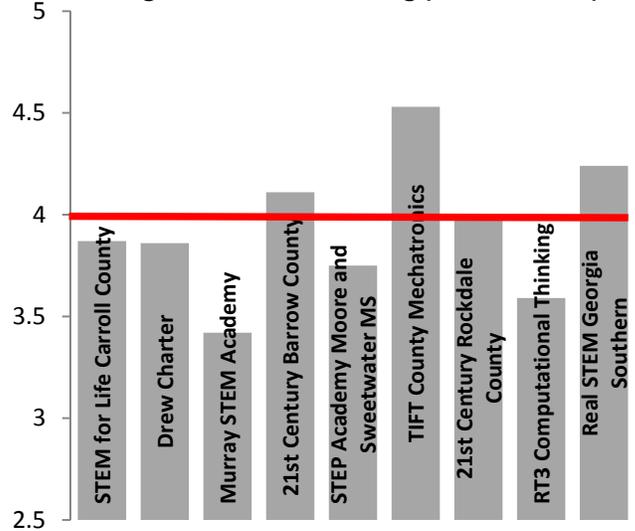


Figure 6. Implementation Activities ("Now" Scores)

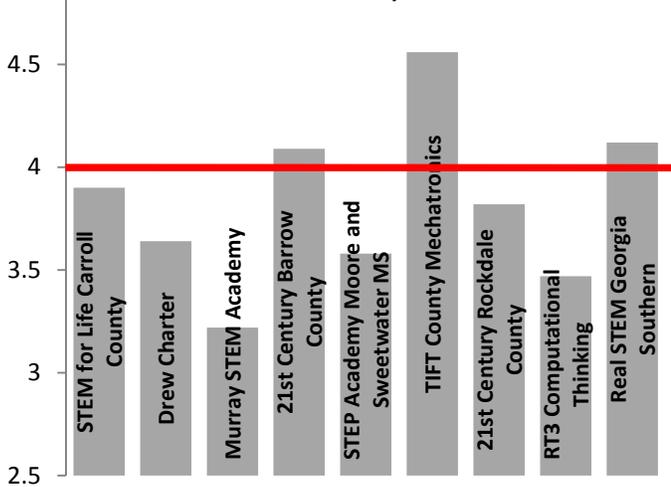
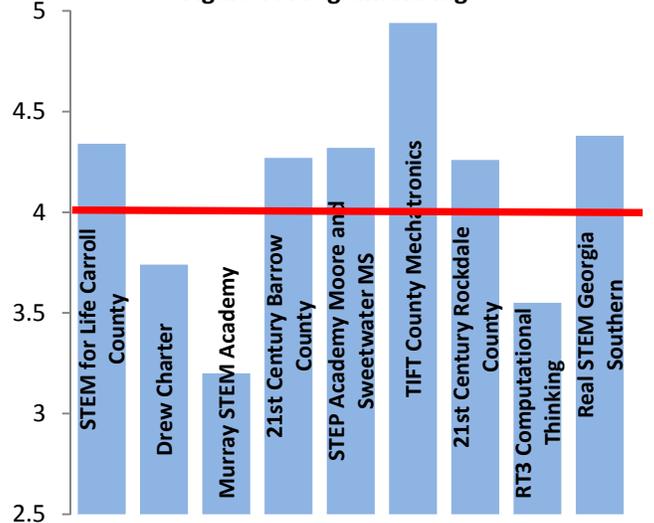


Figure 7. Program Ratings



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

- **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 4.09. Looking at Figure 7, above, we see that 6 out of 9 programs were rated highly. Murray County STEM Academy, Drew Charter School and the 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.

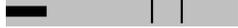
APPENDIX

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	1606	 3.29	p<0.001**		7%	14%	37%	27%	15%
	Now	1591	 3.82			3%	6%	25%	38%	28%
2. It is important to me to learn what is being taught in this program.	Before	1604	 3.90	p<0.001**		2%	6%	24%	37%	31%
	Now	1585	 4.29			1%	2%	13%	34%	50%
3. I like what I am learning in this program.	Before	1598	 3.60	p<0.001**		4%	8%	34%	34%	21%
	Now	1582	 4.08			2%	3%	20%	35%	40%
4. I think I will be able to use what I learn in this program in other classes.	Before	1592	 3.61	p<0.001**		3%	11%	30%	34%	22%
	Now	1578	 4.12			2%	4%	16%	36%	42%
5. Even when I do poorly on a test, I try to learn from my mistakes.	Before	1599	 4.00	p<0.001**		3%	5%	19%	37%	37%
	Now	1586	 4.40			1%	1%	10%	32%	56%
6. I think that what I am learning in this program is useful for me to know.	Before	1593	 3.71	p<0.001**		3%	7%	29%	35%	25%
	Now	1574	 4.17			2%	3%	15%	33%	46%
7. I think that what we are learning in this program is interesting.	Before	1587	 3.47	p<0.001**		5%	11%	35%	29%	20%
	Now	1575	 3.97			3%	6%	21%	33%	38%
8. Understanding STEM (Science, Technology, Engineering, and Math) is important to me.	Before	1601	 3.66	p<0.001**		5%	9%	28%	31%	27%
	Now	1589	 4.12			3%	3%	17%	34%	44%
9. I enjoy STEM (Science, Technology, Engineering, and Math) in general.	Before	1598	 3.51	p<0.001**		6%	10%	34%	27%	23%
	Now	1586	 3.93			4%	5%	23%	30%	38%

¹ Reference lines are set at 3.5 and 4. ² The lower value of n for each question was used to complete a paired samples t-test. **p<0.001, *p<0.01, †p<0.05

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	1605		3.62	p<0.001**		3%	11%	30%	32%	24%
	Now	1595		3.87			2%	7%	25%	35%	31%
11. I miss class often. (n)	Before	1598		1.66	0.439		64%	18%	10%	5%	3%
	Now	1592		1.64			67%	16%	7%	7%	3%
12. I am often late for class. (n)	Before	1579		1.70	0.607		60%	20%	12%	5%	3%
	Now	1571		1.71			61%	19%	10%	6%	4%
13. I set aside time to do my homework and study.	Before	1600		3.42	p<0.001**		6%	11%	34%	32%	17%
	Now	1594		3.75			4%	7%	27%	35%	27%
14. When I say I'm going to do something, I do it.	Before	1604		3.77	p<0.001**		2%	6%	29%	37%	25%
	Now	1595		4.05			2%	3%	22%	37%	37%
15. I am a hard worker.	Before	1599		3.98	p<0.001**		2%	5%	22%	35%	36%
	Now	1592		4.23			1%	2%	16%	32%	48%
16. I finish whatever I begin.	Before	1598		3.80	p<0.001**		2%	7%	29%	34%	28%
	Now	1598		4.05			1%	4%	21%	37%	37%

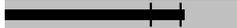
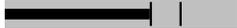
¹Reference lines are set at 3.5 and 4. ²The lower value of n for each question was used to complete a paired samples t-test. **p<0.001, *p<0.01, †p<0.05; (n) negatively worded statement

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	1605		p<0.001**		16%	19%	28%	18%	20%
	Now	1602				12%	13%	25%	20%	29%
18. I intend to get a college degree in STEM (Science, Technology, Engineering, and Math).	Before	1603		p<0.001**		13%	15%	30%	20%	22%
	Now	1596				10%	12%	26%	21%	31%
19. I can see myself working in STEM (Science, Technology, Engineering, and Math).	Before	1601		p<0.001**		15%	17%	30%	20%	19%
	Now	1595				12%	13%	24%	23%	29%
20. Someday, I would like to have a career in STEM (Science, Technology, Engineering, and Math).	Before	1602		p<0.001**		15%	16%	30%	20%	19%
	Now	1585				12%	14%	25%	21%	28%
21. I intend to graduate from high school	Before	1598		p<0.001**		2%	1%	6%	9%	82%
	Now	1597				1%	1%	4%	7%	87%

¹ Reference lines are set at 3.5 and 4. ² The lower value of n for each question was used to complete a paired samples t-test. **p<0.001, *p<0.01, †p<0.05

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.	1577	 4.07	Good 😊		3%	3%	18%	36%	40%
23. In this program, my teacher(s) lets us choose our own topics or projects to investigate.	1561	 3.47	Action !		7%	11%	33%	27%	22%
24. In this program, I work out explanations on my own.	1592	 3.73	Attention ✓		2%	4%	34%	42%	19%
25. In this program, I have opportunities to explain my ideas.	1584	 3.86	Attention ✓		2%	5%	23%	43%	27%
26. In this program, we plan and do our own projects and/or experiments.	1584	 3.69	Attention ✓		4%	8%	28%	35%	25%
27. In this program, we work on real-world problems.	1587	 3.90	Attention ✓		2%	5%	24%	36%	32%
28. In this program, we have class discussions.	1583	 4.17	Good 😊		2%	3%	15%	36%	44%
29. In this program, we investigate to see if our ideas are right.	1579	 4.03	Good 😊		2%	3%	20%	41%	34%
30. In this program, we need to be able to think and ask questions.	1579	 4.24	Good 😊		1%	1%	14%	37%	46%
31. In this program, we are expected to understand and explain ideas.	1583	 4.22	Good 😊		1%	2%	14%	39%	44%

¹Reference lines are set at 3.5 and 4. Assessment: Good=Above 4.0; Attention=Below 4.0; Action=Below 3.5.

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.	1565		3.87	Attention ✓		3%	6%	24%	36%	31%
33. In this program, my teacher(s) shows us how new information relates to what we have already learned.	1547		4.09	Good ☺		2%	3%	17%	40%	38%
34. In this program, we learn what scientists/ technicians/ engineers/ mathematicians or other STEM professionals do.	1576		3.73	Attention ✓		5%	8%	25%	36%	27%
35. In this program, we do our work in groups.	1576		3.81	Attention ✓		2%	4%	31%	37%	26%
36. In this program, we interact with scientists/ technicians/ engineers/ mathematicians or other STEM professionals.	1567		3.65	Attention ✓		6%	9%	25%	34%	26%

¹Reference lines are set at 3.5 and 4. Assessment: Good=Above 4.0; Attention=Below 4.0; Action=Below 3.5.

Table 9. Educational Plans

What is the highest level of education you plan to achieve?	Before		Now		Change ¹	
	n	%	n	%	n	%
High School	239	16%	124	8%	-115	-7.46%
2-year college	199	13%	151	10%	-48	-3.05%
4-year college	440	29%	330	22%	-110	-7.00%
Graduate School	334	22%	382	25%	+48	+3.40%
Professional School	313	21%	523	35%	+210	+14.11%
Total	1525	100%	1510	100%		
Average²	2.98		3.34		p<0.001** (significant)³	

¹Change from Before to Now. Increases are highlighted in green; decreases are highlighted in red.

²To compute averages, the following codes were applied: High School (1), 2-year college (2), 4-year college (3), Graduate School (4), Professional School (4). ³Paired samples t-test, p-value: **p<0.001, *p<0.01, †p<0.05

Table 10. Demographics

Gender	n	%
Female	739	47%
Male	827	53%
Total	1566	100%

Ethnicity	n	%	Grade	n	%
Asian	59	4%	6 th	274	17%
Black	606	39%	7 th	292	19%
Hispanic	116	7%	8 th	315	20%
Native American	17	1%	9 th	124	8%
White	602	39%	10 th	109	7%
Multiracial	112	7%	11 th	165	11%
Other	51	3%	12 th	270	17%
Total	1563	100%	Other	22	1%
			Total	1571	100%

Table 11. Participation

How long have you participated in this program?		n	%
Dosage	0 semesters	74	5%
	1 semester	906	58%
	2 semesters	130	8%
	3 semesters	104	7%
	4 or more semesters	143	9%
	Summer Only	6	0%
	Don't Know	200	13%
	Total	1563	100%

Did you participate in this program during the summer?		n	%
Summer Participation	No	1153	74%
	Yes	255	16%
	Don't Know	151	10%
	Total	1559	100%

Table 12. Program Rating

Program Rating:	n	Mean¹	Assessment	1 (Very Poor)	2 (Poor)	3 (Average)	4 (Good)	5 (Excellent)
How would you rate this program?	1560	 4.09	Good 😊	 3%	3%	18%	36%	41%

¹Reference lines are set at 3.5 and 4. Assessment: Good=Above 4.0; Attention=Below 4.0; Action=Below 3.5.

Appendix B. Construct Reliabilities

Table 13. Construct Reliabilities

Construct Reliabilities				
Constructs		n	Cronbach's alpha	<i>Reliability Interpretation</i>
Intrinsic Motivation (9-items)	Before	3208	.866	<i>Very good</i>
	Now	3123	.890	<i>Very good</i>
Self-Management/Self-Regulation (7-items)	Before	3223	.580	<i>Low</i>
	Now	3147	.603	<i>Somewhat Low</i>
Intent to Persist (5-items)	Before	3315	.869	<i>Very good</i>
	Now	3265	.884	<i>Very good</i>
Problem Solving (10-items)	Now	3206	.877	<i>Very good</i>
Implementation Activities (5-items)	Now	3247	.805	<i>Very good</i>

Note. Construct reliabilities were computed based on December 2012 – December 2013 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.