Overall Results
December 2015

Executive Summary

Participants and Methods

In December 2015, 466 students across 4 Race to the Top programs completed the Applied Learning Student Questionnaire (ALSQ). The response rates displayed in Table 1 suggest that 87% of the total number of participating students responded to the survey. The response rates per program ranged from 76% (STE(A)M Truck) to 99% (Gwinnett Gear Up). Although there is no agreed-upon standard for a minimum response rate, Martella, Nelson, Morgan, and Marchand-Martella (2013)[1] suggest that a response rate of 50% is *adequate* for analysis and reporting, 60% is *good*, and 75% or higher is considered *very good*. Overall, the response rate achieved across 4 Race to the Top programs is considered *very good* for reporting and analysis.

Table 1. Survey Response Rates

Program	# of Survey Respondents	Total # of Participating Students	Survey Response Rate
Real STEM Georgia Southern	271	306	89%
STE(A)M Truck[2]	84	110	76%
Gwinnett Gear Up	76	77	99%
Tift County Mechatronics	35	41	85%
Total	**466**	**534**	**87%**

Note. The number of participating students represent approximations and may not reflect recent changes to the participant population (e.g., dropouts).

The ALSQ[3] 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."

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[1] Martella, R., Nelson, J., Morgan, R., & Marchand-Martella, N. (2013). *Understanding and Interpreting Education Research*. New York, NY: The Guilford Press.

[2] Data was collected in November 2015 for the STE(A)M Truck program and represents mid-point findings.

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

Executive Summary, continued

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*. In addition to assessing statistical significance from "before" to "now," effect sizes—a measure of the magnitude of an intervention on students' attitudes—were computed. Specifically, effect sizes were computed using Cohen's *d* and are intended to measure the practical importance of a significant finding. Cohen (1988) classified effect sizes as small, *d*=0.2; medium, *d*=0.5; and large, *d*=0.8.[4] Table 2 suggests that medium effect sizes were found for *Intrinsic Motivation,* Self-*Management/Self-Regulation,* and *Intent to Persist*. Across all constructs, the largest effect size observed was for *Intrinsic Motivation* (*d*=0.59). This suggests that the programs were particularly effective at enhancing students' interests to learn and derive value from the material being taught. For example, AFTER participating in the programs, 77% of students said that understanding STEM is important to them, compared to 61% before the program. See Table 4 for more information.

  To maximize impact, we would expect students' average scores to exceed 4.00 on a 5-point Likert scale (1, *Strongly Disagree* to 5, *Strongly Agree*). In light of this benchmark, it is important to note that the "now" scores for one construct— *Intent to Persist*— did *not* reach or exceed the optimal average of 4.00. Figure 1 suggests that additional work may be needed in the above mentioned area.

Table 2. Summary of Results by Constructs

Overall- Constructs						
Constructs		**n**	**Mean[1]**		**Paired Samples t-test[2]**	**Effect Size (interpretation)[3]**
Intrinsic Motivation	Before	466		3.76	p<0.001**	.59[M]
	Now	461		4.13		
Self-Management/Self-Regulation	Before	465		3.91	p<0.001**	.46[M]
	Now	462		4.11		
Intent to Persist	Before	464		3.52	p<0.001**	.40[M]
	Now	463		3.75		
Problem Solving	Now	463		4.06	N/A	N/A
Implementation Activities	Now	458		4.05	N/A	N/A

Note. Scale; 1, *Strongly Disagree* to 5, *Strongly Agree*. [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. **p<0.001, *p<0.01, †p<0.05. Negatively worded statements were reverse coded for mean computations. [3]Effect size (Cohen's *d*): Small (<.2); Medium (.2 to .8); Large (>.8). Small effect sizes are highlighted in light red; medium effect sizes are highlighted in dark orange; large effect sizes are highlighted in dark green.

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[4] Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed). Hillsdale, NJ: Lawrence Earlbaum Associates.

Figure 1. Constructs
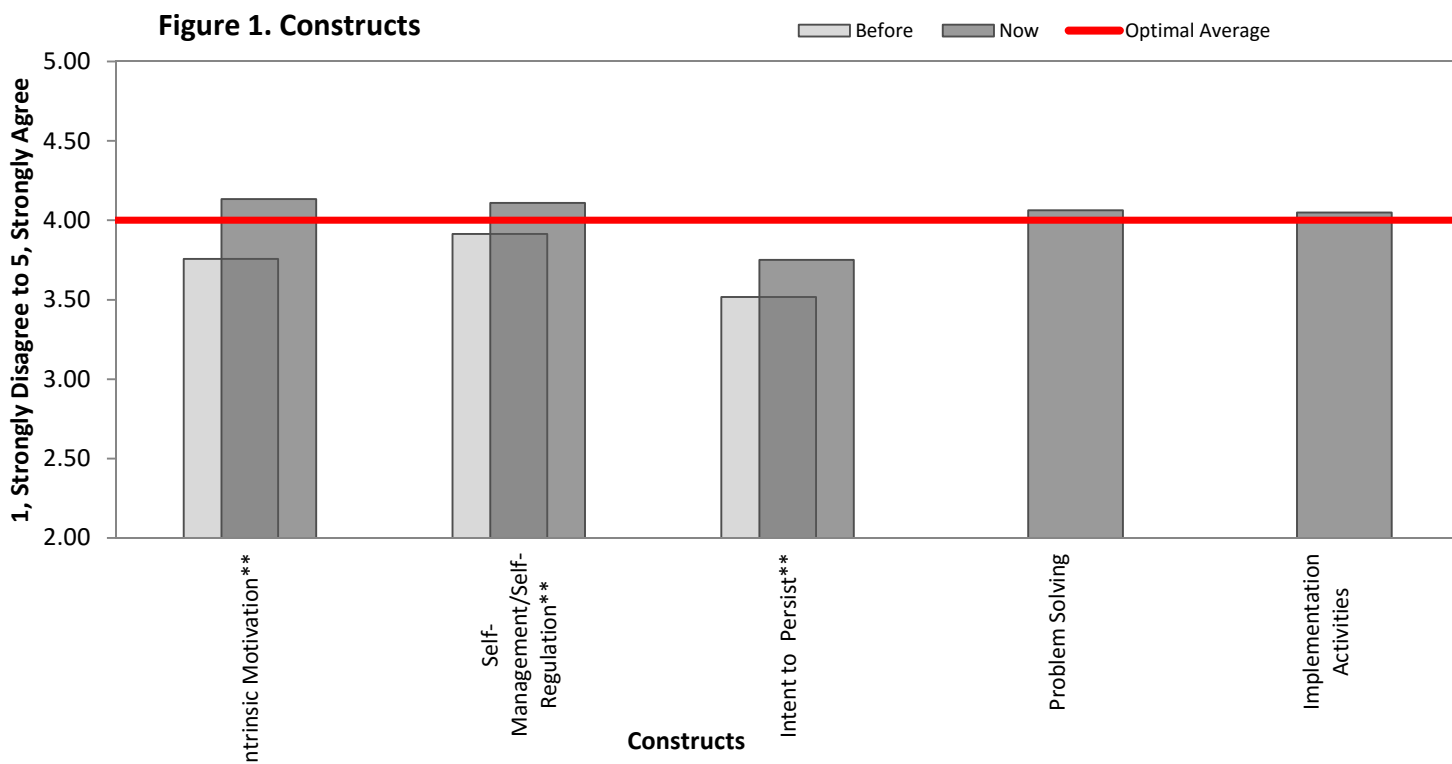
Note. **p<0.001, *p<0.01, †p<0.05; Scale is truncated for visual clarity.

- **ALSQ Survey Constructs by Program**

Examining the ALSQ results by individual program, it is evident that 3 out of 4 of the programs show statistically significant increases in *Intrinsic Motivation, Self-Management/Self-Regulation* and *Intent to Persist*. Tift County Mechatronics did not produce statistically significant gains across constructs. Examining effect sizes, nearly all programs exhibit medium effect sizes across all constructs. There are two notable exceptions: 1) Gwinnett Gear Up students show a *large* effect size for *Self-Management/Self-Regulation* skills; and 2) Tift County Mechatronics students show a *small* effect size for *Intent to Persist*.

Table 3. Summary of Results by Constructs per Program

		Overall- Constructs per Program											
Constructs		**Real STEM Georgia Southern (n=271)**			**STE(A)M Truck (n=84)**			**Gwinnett Gear Up (n=76)**			**Tift County Mechatronics (n=35)**		
		Mean	*t-test*	Effect Size	Mean	*t-test*	Effect Size	Mean	*t-test*	Effect Size	Mean	*t-test*	Effect Size
Intrinsic Motivation	Before	3.77	p<0.001**	.63M	3.78	p<0.001**	.68M	3.79	p<0.001**	.52M	3.46	p=0.189	.23M
	Now	4.19			4.15			4.19			3.59		
Self-Management/ Self-Regulation	Before	4.02	p<0.001**	.41M	3.83	p=0.012†	.28M	3.64	p<0.001**	.92L	3.92	p=0.225	.22M
	Now	4.18			3.95			4.11			3.96		
Intent to Persist	Before	3.54	p<0.001**	.37M	3.40	p<0.001**	.61M	3.54	p<0.001**	.46 M	3.60	p=0.408	.15S
	Now	3.74			3.69			3.86			3.70		
Problem Solving	Now	4.19	N/A	N/A	3.95	N/A	N/A	4.06	N/A	N/A	3.34	N/A	N/A
Implementation Activities	Now	4.10			4.08			4.08			3.47		

Note. Scale= 1, *Strongly Disagree* to 5, *Strongly Agree*. 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. Effect size (Cohen's d): Small (<.2); Medium (.2 to .8); Large (>.8). Small effect sizes are highlighted in light red; medium effect sizes are highlighted in dark orange; large effect sizes are highlighted in dark green.

Executive Summary, continued

In order for programs to maximize their effectiveness, we would expect "now" scores to reach or exceed the optimal average of 4.00 on a 5-point Likert scale (1, *Strongly Disagree* to 5, *Strongly Agree*). Figures 2 – 6 display "now" scores for each program and construct. For example, Figure 2 indicates that 3 out of 4 programs met or exceeded the optimal average for *Intrinsic Motivation*. In general, programs not reaching or exceeding the red horizontal line may need additional attention. For instance, 4 out of 4 programs did not reach the optimal average for *Intent to Persist*.

Figure 2. Intrinsic Motivation ("Now" Scores)
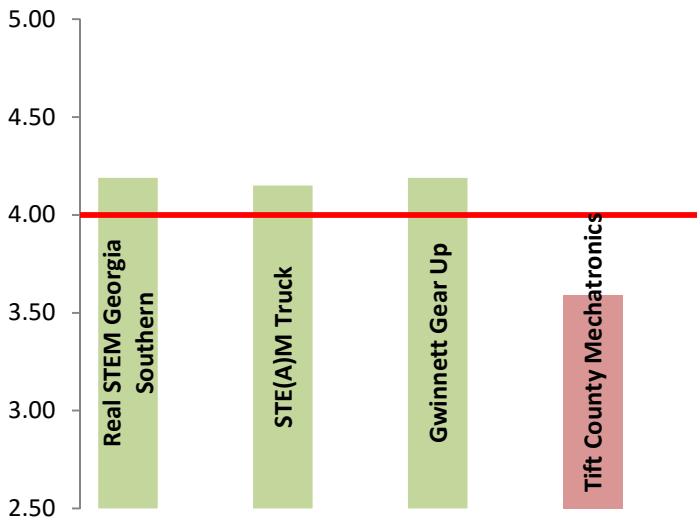
Figure 3. Self-Management/Self-Regulation ("Now" Scores)

Scale= 1, Strongly Disagree to 5, Strongly Agree. Scale was truncated for visual clarity. Programs that met or exceeded the optimal average of 4.00 are reflected in green; programs that fell below the optimal average are reflected in red.

Executive Summary, continued

Figure 4. Intent to Persist ("Now" Scores)
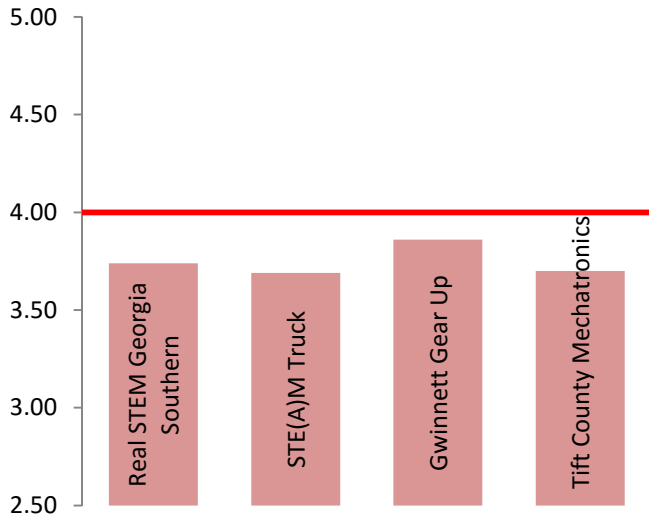
Figure 5. Problem Solving ("Now" Scores)
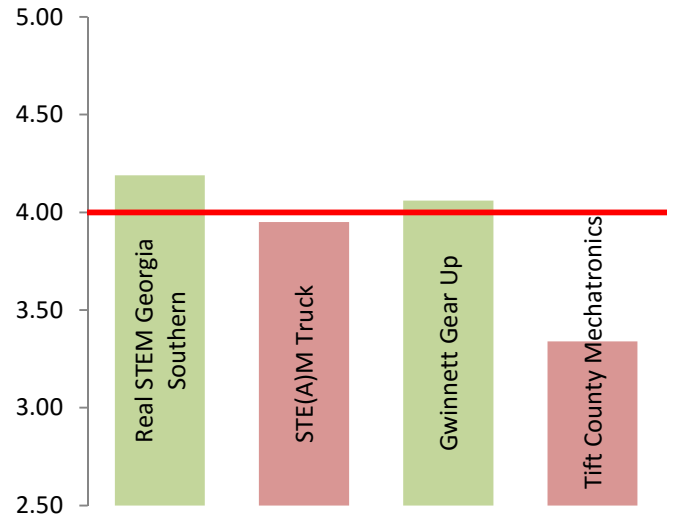
Figure 6. Implementation Activities ("Now" Scores)
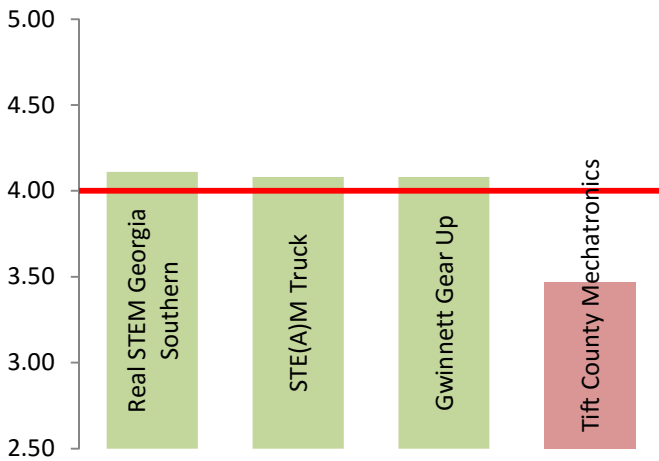
Figure 7. Overall Program Ratings
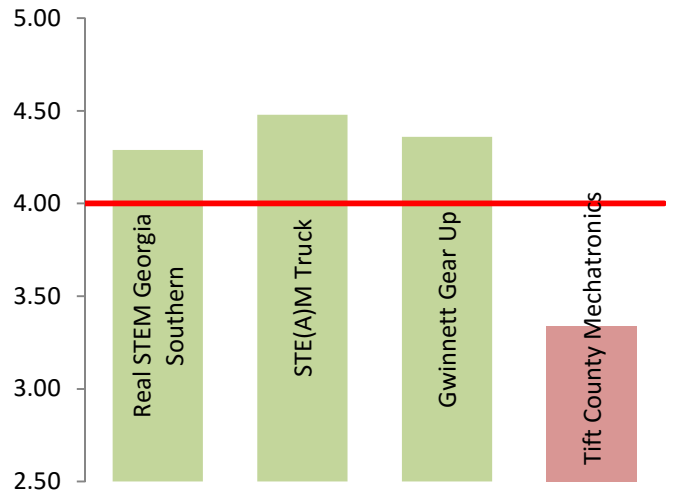
Scale= 1, *Strongly Disagree* to 5, *Strongly Agree*. Scale was truncated for visual clarity. Programs that met or exceeded the optimal average of 4.00 are reflected in green; programs that fell below the optimal average are reflected in red.
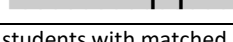
Executive Summary, continued
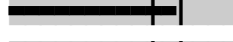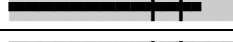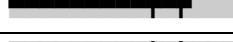
- **Program Rating**
  Collapsing across all programs, students' ratings of their programs exceeded the optimal average of 4.00. On a 5-point Likert scale where 1 signifies *Very Poor* and 5 signifies *Excellent*, the average score was a 4.26. See Table 12. Looking at Figure 7, it is evident that 3 out of 4 programs were rated above the optimal average. The Tift County Mechatronics may need additional support to reach the optimal average. Changes in staff and programmatic activities may account for the comparatively low rating among students in the Tift County Mechatronics program. Additional inquiry may be needed.

- **Areas for Further Improvement**
  Across all programs, further enhancing implementation activities and students' intentions to persist in STEM 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 interact with STEM professionals. Also, providing additional support to the Tift County Mechatronics program may be advisable as students' ratings suggest that the program may not be meeting their learning needs.

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	466	3.52	p<0.001**		6%	6%	36%	32%	19%
	Now	461	3.91			4%	4%	23%	34%	35%
2. It is important to me to learn what is being taught in this program.	Before	465	3.92	p<0.001**		3%	5%	21%	39%	32%
	Now	460	4.28			3%	2%	10%	33%	51%
3. I like what I am learning in this program.	Before	459	3.75	p<0.001**		3%	7%	28%	33%	28%
	Now	456	4.16			3%	4%	16%	28%	49%
4. I think I will be able to use what I learn in this program in other classes.	Before	463	3.58	p<0.001**		3%	10%	32%	35%	20%
	Now	456	4.04			3%	5%	20%	31%	42%
5. Even when I do poorly on a test, I try to learn from my mistakes.	Before	462	4.01	p<0.001**		2%	5%	20%	36%	37%
	Now	457	4.30			2%	2%	12%	32%	52%
6. I think that what I am learning in this program is useful for me to know.	Before	463	3.77	p<0.001**		2%	7%	29%	35%	26%
	Now	458	4.12			3%	3%	17%	31%	45%
7. I think that what we are learning in this program is interesting.	Before	462	3.73	p<0.001**		4%	9%	27%	31%	29%
	Now	457	4.12			3%	6%	14%	30%	47%
8. Understanding STEM (Science, Technology, Engineering, and Math) is important to me.	Before	463	3.81	p<0.001**		3%	6%	30%	29%	32%
	Now	457	4.16			3%	3%	17%	29%	47%
9. I enjoy STEM (Science, Technology, Engineering, and Math) in general.	Before	460	3.72	p<0.001**		5%	9%	27%	26%	33%
	Now	455	4.11			3%	4%	21%	23%	49%
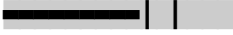
Note. [1] Reference lines are set at 3.5 and 4. [2] Please note that only students with matched Pre and Post data were assessed for significance. Desired statistically significant changes are highlighted in green and undesired statistically significant changes are highlighted in red. **p<0.001, *p<0.01, †p<0.05.

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	464		3.72	p<0.001**		3%	10%	27%	33%	27%
	Now	459		3.98			2%	5%	24%	33%	37%
11. I miss class often. (n)	Before	465		1.69	p=0.289		62%	21%	9%	5%	4%
	Now	458		1.64			65%	18%	8%	4%	5%
12. I am often late for class. (n)	Before	456		1.70	p=0.547		63%	16%	13%	5%	4%
	Now	451		1.69			64%	16%	10%	4%	5%
13. I set aside time to do my homework and study.	Before	463		3.32	p<0.001**		7%	14%	36%	26%	17%
	Now	461		3.67			4%	10%	27%	34%	26%
14. When I say I'm going to do something, I do it.	Before	464		3.76	p<0.001**		3%	6%	30%	35%	26%
	Now	462		4.03			2%	3%	22%	36%	37%
15. I am a hard worker.	Before	465		4.13	p<0.001**		1%	3%	19%	35%	42%
	Now	462		4.32			1%	1%	16%	30%	53%
16. I finish whatever I begin.	Before	462		3.86	p<0.001**		2%	6%	28%	34%	31%
	Now	460		4.08			2%	2%	22%	35%	39%

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.

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	464	3.21	p<0.001**		13%	16%	30%	21%	20%
	Now	461	3.49			9%	13%	27%	21%	30%
18. I intend to get a college degree in STEM (Science, Technology, Engineering, and Math).	Before	462	3.22	p<0.001**		11%	17%	32%	18%	22%
	Now	463	3.50			9%	13%	28%	19%	31%
19. I can see myself working in STEM (Science, Technology, Engineering, and Math).	Before	463	3.21	p<0.001**		11%	15%	33%	23%	18%
	Now	461	3.51			8%	14%	26%	22%	30%
20. Someday, I would like to have a career in STEM (Science, Technology, Engineering, and Math).	Before	462	3.18	p<0.001**		13%	15%	32%	21%	19%
	Now	459	3.44			11%	13%	26%	20%	29%
21. I intend to graduate from high school.	Before	462	4.76	p=0.018†		2%	1%	4%	7%	87%
	Now	463	4.81			1%	1%	4%	4%	90%

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. **$p<0.001$, *$p<0.01$, †$p<0.05$.
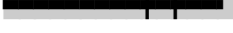
Table 7. Problem Solving, Now Only

Problem Solving	n	Mean[1]		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.	461		4.20	Good ☺		2%	3%	14%	34%	46%
23. In this program, my teacher(s) lets us choose our own topics or projects to investigate.	456		3.58	Attention ✓		5%	11%	29%	29%	25%
24. In this program, I work out explanations on my own.	463		3.76	Attention ✓		2%	4%	29%	45%	20%
25. In this program, I have opportunities to explain my ideas.	462		4.06	Good ☺		2%	5%	15%	44%	35%
26. In this program, we plan and do our own projects and/or experiments.	460		3.86	Attention ✓		3%	7%	22%	36%	32%
27. In this program, we work on real-world problems.	463		4.09	Good ☺		2%	3%	17%	38%	40%
28. In this program, we have class discussions.	461		4.20	Good ☺		1%	2%	16%	37%	44%
29. In this program, we investigate to see if our ideas are right.	459		4.20	Good ☺		1%	3%	14%	37%	44%
30. In this program, we need to be able to think and ask questions.	457		4.37	Good ☺		1%	2%	10%	33%	54%
31. In this program, we are expected to understand and explain ideas.	458		4.30	Good ☺		1%	2%	12%	36%	49%

Note. [1] Reference 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[1]		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.	458		4.12	Good ☺	▪▪▪ll	3%	4%	16%	35%	43%
33. In this program, my teacher(s) shows us how new information relates to what we have already learned.	447		4.26	Good ☺	▪▪▪ll	1%	3%	13%	35%	48%
34. In this program, we learn what scientists/ technicians/ engineers/ mathematicians or other STEM professionals do.	456		3.93	Attention ✓	▪▪▪ll	3%	6%	21%	36%	34%
35. In this program, we do our work in groups.	457		4.42	Good ☺	▪▪▪ll	1%	1%	11%	30%	58%
36. In this program, we interact with scientists/ technicians/ engineers/ mathematicians or other STEM professionals.	457		3.52	Attention ✓	▪▪▪ll	7%	10%	32%	26%	25%

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	52	12%	26	6%	-26	-5.61%
2-year college	40	9%	18	4%	-22	-4.77%
4-year college	120	27%	86	20%	-34	-6.99%
Graduate School	132	29%	134	31%	+2	+1.33%
Professional School	106	24%	173	40%	+67	+16.03%
Total	**450**	**100%**	**437**	**100%**		
Average[2]	**3.21**		**3.54**		**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	214	47%
Male	240	53%
Total	**454**	**100%**

Ethnicity	n	%	Grade	n	%
Asian	18	4%	5th	34	7%
Black	158	35%	6th	35	8%
Hispanic	66	15%	7th	45	10%
Native American	5	1%	8th	198	44%
White	157	35%	9th	--	--
Multiracial	27	6%	10th	17	4%
Other	23	5%	11th	43	9%
Total	**454**	**100%**	12th	81	18%
			Other	1	0%
			Total	**454**	**93%**

Table 11. Participation

How long have you participated in this program?		n	%
	0 semesters	17	4%
	1 semester	311	69%
	2 semesters	62	14%
Dosage	3 semesters	14	3%
	4 or more semesters	7	2%
	Summer Only	--	--
	Don't Know	42	9%
	Total	**453**	**100%**
Did you participate in this program during the summer?		n	%
	No	420	93%
Summer	Yes	10	2%
Participation	Don't Know	22	5%
	Total	**452**	**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)
	449	4.26	Good ☺		2%	2%	14%	33%	49%

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

Appendix A. Construct Reliabilities

Table A1. Construct Reliabilities (Omnibus, December 2015)

Constructs		Cronbach's alpha	*Reliability Interpretation*
Intrinsic Motivation (9-items)	Before	0.882	*Very good*
	Now	0.912	*Excellent*
Self-Management/Self-Regulation (7-items)	Before	0.750	*Good*
	Now	0.772	*Good*
Intent to Persist (5-items)	Before	0.873	*Very good*
	Now	0.887	*Very good*
Problem Solving (10-items)	Now	0.896	*Very good*
Implementation Activities (5-items)	Now	0.810	*Very good*

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.