



THE UNIVERSITY OF
MEMPHIS[™]

The Center for Research in
Educational Policy (CREP)

The LASER Model:
A Systemic and Sustainable Approach
for Achieving High Standards in Science Education
Summative Report Section 5:
Student Attitudes

Yun Tang, B.A.

Todd Zoblotsky, Ph.D.

The University of Memphis

7/15/2015

Acknowledgments

The success of this evaluation would not have been possible without the herculean efforts built on strong partnerships among the Center for Research in Educational Policy (CREP), the Smithsonian Science Education Center (SSEC), Abt Associates, Bernalillo Public Schools, Chama Public Schools, Cleveland County Schools, Greene County Schools, Houston Independent School District, Jemez Valley Public Schools, Johnston County Schools, Los Alamos Public Schools, McDowell County Schools, Moore County Schools, Mora Public Schools, Pecos Independent School District, Rio Rancho Public Schools, Santa Fe Public Schools, Warren County Schools, and Wilson County Schools. We extend our heartfelt thanks and appreciation to all who contributed to this amazing endeavor, and sought – and still seek – to improve the state of science education in America.

CREP Project Staff:

Marty Alberg	Principal Investigator
Carolyn Kaldon	Co-Principal Investigator
Dan Strahl	Co-Principal Investigator
Michael Rowe	Project Manager
John Burgette	Qualitative Analysis
Todd Zoblotsky	Statistics
Lou Franceschini	Statistics
Haixia Qian	Statistics
Bryan Winter	Statistics
Ying Huang	Statistics
Adrian Young	School Liaison
Cindy Muzzi	School Liaison
Dallas Burkhardt	Site Researcher Liaison
Margie Stevens	SMS Administration
Ruby Booth	SMS Administration

Introduction

PASS student attitudes survey data results from the Fall 2011 (baseline or pre-intervention) and Spring 2014 (third posttest for the Elementary and the Middle School Cohort) administrations are currently available and are reported below. There were a total of 14 questions on the PASS that addressed classroom achievement in core subjects (reading, math, and science) and different aspects of science engagement and science activities in the school.

Survey Questions: Student Attitudes Toward Science

Of the 14 total attitude questions on the student survey, the five questions related to student attitudes towards science have been selected for discussion. The data for each of the five questions were analyzed separately. To be included in the analysis for a particular question, a student had to meet two criteria: 1) a student had to have scores on the multiple choice sections of PASS in both Fall 2011 and Spring 2014, and 2) a student had to have answered that question in both Fall 2011 and Spring 2014 to ensure we were looking at the same students across the two time points.

Fall 2011 & Spring 2014 Results: Comparison of Phase 1 and Phase 2 Student Attitudes Toward Science

The first set of analyses examines differences in attitudes toward science between Phase 1 and Phase 2 students in Fall 2011 and Spring 2014 separately. Of the five items that were selected for discussion, three items are Likert-scale items.¹ Due to the ordinal (i.e., ranked) nature of the data, the Mann-Whitney *U* test was used to compare the differences between Phase 1 and Phase 2 students' rankings of each of these three survey items. The remaining two items are measured using a nominal scale (i.e., categories with no implied ranking).² Therefore, for these two items, the chi-square test of independence was employed to evaluate differences in level of agreement between Phase 1 and Phase 2 students. If the chi-square test result was statistically significant, standardized residuals were examined to explore which cell(s) produced the statistically significant relationship.³

In addition to the probability level associated with each statistical outcome, in the tables following, an effect size is provided as an indicator of the impact or "practical" significance of the treatment (i.e., being a Phase 1 student). The "effect size" is a descriptive statistic that indicates the magnitude of the difference (in standard deviation units) between two measures. Except in the case of the chi-square test, for the current between-group comparison study, a positive effect size would indicate a higher outcome for Phase 1 students, while a negative effect size would indicate a higher outcome for the non-treatment group (Phase 2). For the chi-square test, the effect size is a measure of the strength of association between the group and the outcome, with a larger effect size indicating a stronger relationship between group membership and the outcome. Based on guidelines from the What Works Clearinghouse (WWC), part of the research arm of the U.S. Department of Education, a Hedge's *g* effect size of at least 0.25 is considered "substantively important" (What Works Clearinghouse, 2014). In cases where the default effect size for a statistical test was not calculated as the Hedge's *g*, (e.g., the phi coefficient (ϕ) for a chi-square test), the default effect size was converted to Hedge's *g* for interpretation. As the analyses were considered exploratory in nature, no correction for multiple comparisons was made.

¹ The item "Do you like science" was measured using a 3-point Likert scale (0 = Not At All; 1 = A Little; 2 = A Lot). The items "How often do you talk to your family about what you do in science class?" and "How often do you talk to your friends about what you do in science class?" were also measured using a 3-point Likert scale (0 = Never or Almost Never; 1 = Some; 2 = A Lot).

² The items "Do you think science will be useful when you are older?" and "Would you like to be a scientist when you are older?" were measured using a nominal scale (0 = No; 1 = Maybe; 2 = Yes).

³ In our analyses, the critical value for a standardized residual is -1.96 and +1.96, which corresponds to a level of significance of 0.05.

Comparison of Student Attitudes Toward Science from Fall 2011 to Spring 2014

In addition to evaluating attitudinal differences between Phase 1 and Phase 2 students in Fall 2011 and Spring 2014 separately, a second set of analyses was conducted to assess how students' attitudes toward science changed from Fall 2011 to Spring 2014 within the Phase 1 and Phase 2 groups. Again, because of the non-interval, longitudinal, and matched-pair nature of the data, nonparametric methods for related samples were employed to compare differences between the two time points for the Phase 1 and Phase 2 groups separately. Specifically, the Wilcoxon Signed-rank test was performed on Likert-scale items and the marginal homogeneity test was performed on nominal scale items. The effect size measure r for the Wilcoxon signed-rank test was calculated.⁴ In the case of the present within-group comparison study, a positive effect size would indicate a higher outcome in Spring 2014, while a negative effect size would indicate a higher outcome in Fall 2011. No effect size measure is available for the marginal homogeneity test.

Results for All Regions combined are presented first, followed by the outcomes for the Houston Independent School District (HISD), the New Mexico region, and the North Carolina region. A summary of the Key Findings for each set of analyses is presented at the beginning of each report, followed by information on the samples included, the detailed outcomes by grade level (i.e., elementary cohort and middle school cohort), and either between or within the Phase 1 and Phase 2 groups.

⁴ The calculation of the effect size of Wilcoxon Signed-rank test is $r = \frac{z}{\sqrt{N}}$, where N is the total of number of observations (see <http://yatani.jp/HCIstats/WilcoxonSigned>). The effect was negligible if $|r| \leq 0.10$, small if $|r| > 0.10$, medium if $|r| > 0.30$, and large if $|r| > 0.50$.

All Regions:
Results for Spring 2014 PASS
Student Attitudes Toward Science

All Regions Spring 2014 PASS Student Attitudes Key Findings for Phase 1

For students across all three regions, the following outcomes favoring Phase 1 students were found on the Spring 2014 PASS Student Attitudes section.

- For the between-group differences, on the nominal question “Do you think science will be useful to you when you are older?”, a higher percentage of Phase 1 students in the Elementary Cohort responded “Yes” in Spring 2014 (51.7% vs. 49.0%). However, while this difference was statistically significant, it was not substantively important. For the Likert-scale item “How often do you talk to your friends about what you do in science class?”, Phase 1 students in the Elementary Cohort had statistically higher scores in Spring 2014 (i.e. were more likely to talk to their friends), but the associated effect size was not substantively important.

All Regions: Fall 2011 to Spring 2014 PASS Student Attitudes Results

PASS student attitudes survey data results across all three regions from the Fall 2011 (baseline or pre-intervention) and Spring 2014 (third posttest for the Elementary and the Middle School Cohort) administrations are currently available and are reported below.

Survey Questions: Student Attitudes Toward Science

Of the 14 total attitude questions on the student survey, the five questions related to student attitudes towards science have been selected for discussion. See Table A - 1 and Table A - 2 in Appendix A for the outcomes on all 14 student attitudes questions. Table 1 and Table 2 show the final analytic sample sizes included for the Elementary and Middle School cohorts respectively⁵.

Table 1. PASS, All Regions, Spring 2014: Samples for the Survey Analyses for Elementary Cohort

Sample	Phase 1	Phase 2
Initial Samples ¹		
I like science.	2,064	1,558
How often do you talk to your family about what you do in science class?	2,067	1,559
How often do you talk to your friends about what you do in science class?	2,038	1,552
Do you think science will be useful when you are older?	2,099	1,585
Would you like to be a scientist when you are older?	2,068	1,551

¹ The number of students who answered at least one Student Attitudes question in Spring 2014

Table 2. PASS, All Regions, Spring 2014: Samples for the Survey Analyses for Middle School Cohort

Sample	Phase 1	Phase 2
Initial Samples ¹		
I like science.	883	983
How often do you talk to your family about what you do in science class?	889	1,007
How often do you talk to your friends about what you do in science class?	887	1,000
Do you think science will be useful when you are older?	894	1,011
Would you like to be a scientist when you are older?	880	1,003

¹ The number of students who answered at least one Student Attitudes question in Spring 2014

⁵ The sample size for the Elementary cohort across all three regions includes the students from New Mexico, North Carolina and HISD, whereas the sample size for the Middle School cohort includes only students from New Mexico and North Carolina because HISD Middle School students did not take Fall 2011 PASS.

Fall 2011 & Spring 2014 All Regions Results: Comparison of Phase 1 and Phase 2 Student Attitudes Toward Science

The results of the Mann-Whitney U test for the Elementary Cohort and Middle School cohort are summarized in Table 3 and Table 5, respectively. The results of the chi-square test of independence for the Elementary Cohort and Middle School cohort are summarized in Table 4 and Table 6, respectively.

Elementary Cohort Results (Figure 1, page 17): Between Group Comparisons

- “I like science”

As shown in Table 3, the Mann-Whitney U test results revealed that Phase 1 students had slightly higher scores (i.e., a higher level of agreement) than Phase 2 students in both Fall 2011 and Spring 2014. However, the differences were neither statistically significant nor substantively important.

- “How often do you talk to your family about what you do in science class?”

As shown in Table 3, the Mann-Whitney U test results revealed that Phase 1 students had slightly higher scores (i.e., a higher level of agreement) than Phase 2 students in both Fall 2011 and Spring 2014. However, the differences were neither statistically significant nor substantively important.

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 3, the Mann-Whitney U test results revealed that Phase 1 students had higher scores (i.e., a higher level of frequency) than Phase 2 students in both Fall 2011 and Spring 2014, with the difference in Spring 2014 being statistically significant ($Z = -3.78$, $p < 0.001$, $g = 0.13$). However, neither of the associated effect sizes was substantively important.

- “Do you think science will be useful when you are older?”

As shown in the top section of Table 4, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was not statistically significantly different in Fall 2011, whereas the difference was statistically significant in Spring 2014 ($\chi^2(2) = 7.54$, $p = 0.023$, $g = 0.09$). However, neither difference was substantively important. Examination of the cell standardized residuals (s.r.) showed that none of the cells individually was a major contributor to the overall statistically significant relationship between Phase and response for students in Spring 2014. Rather, they worked jointly to contribute to the overall statistical significance, with a higher percentage of Phase 1 students responding “Yes” (51.7% vs. 49.0%).

- “Would you like to be a scientist when you are older?”

As shown in the bottom section of Table 4, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was not statistically significantly different in Spring 2014, whereas the difference was statistically significant in Fall 2011 ($\chi^2(2) = 9.28$, $p = 0.010$, $g = 0.10$). However, neither difference was substantively important. Examination of the cell standardized residuals (s.r.) showed that none of the cells individually was a major contributor to the overall statistically significant relationship between Phase and response for students in Fall 2011. Rather, they worked jointly to contribute to the overall statistical significance, with a higher percentage of Phase 1 students responding “Yes” (25.1% vs. 20.8%). It should be noted that the largest percentage of both Phase 1 and Phase 2 students at both time points responded “No”, with the percentage for Phase 1 being smaller at both time points.

Table 3. Results of Mann-Whitney U Test: Comparison of Overall Elementary Cohort Phase 1 and Phase 2 Students' Responses

	Fall 2011						Spring 2014							
	Phase 1			Phase 2			Phase 1			Phase 2				
	N	Mean		N	Mean	Z	g	N	Mean		N	Mean	Z	g
I like science.	2,064	1.62		1,558	1.60	-0.80	0.03	2,064	1.53		1,558	1.50	-1.79	0.06
How often do you talk to your family about what you do in science class?	2,067	1.04		1,559	1.00	-1.91	0.06	2,067	0.91		1,559	0.89	-1.27	0.04
How often do you talk to your friends about what you do in science class?	2,038	0.77		1,552	0.73	-1.62	0.05	2,038	0.73		1,552	0.64	-3.78***	0.13

*** $p < 0.001$, two-tailed. A negative g indicates that Phase 2 had a higher score relative to Phase 1.

Table 4. Results of Chi-Square Test: Comparison of Overall Elementary Cohort Phase 1 and Phase 2 Students' Responses

Do you think science will be useful to you when you are older?												
	Fall 2011						Spring 2014					
	Phase 1			Phase 2			Phase 1			Phase 2		
	n	%	s.r.	n	%	s.r.	n	%	s.r.	n	%	s.r.
Yes	1,077	51.3	0.9	761	48.0	-1.1	1,086	51.7	0.8	776	49.0	-0.9
Maybe	881	42.0	-0.5	692	43.7	0.6	888	42.3	-1.2	735	46.4	1.4
No	141	6.7	-1.2	132	8.3	1.3	125	6.0	1.1	74	4.7	-1.3

Would you like to be a scientist when you are older?												
	Fall 2011						Spring 2014					
	Phase 1			Phase 2			Phase 1			Phase 2		
	n	%	s.r.	n	%	s.r.	n	%	s.r.	n	%	s.r.
Yes	520	25.1	1.7	323	20.8	-2.0	207	10.0	0.9	133	8.6	-1.1
Maybe	640	30.9	-0.7	511	33.0	0.8	695	33.6	0.6	494	31.9	-0.7
No	908	43.9	-0.7	717	46.2	0.8	1,166	56.4	-0.8	924	59.6	0.9

Note. s.r. = standardized residual.

*Statistically significant at $p < 0.05$

Middle School Cohort Results (Figure 2, page 19): Between Group Comparisons

- “I like science”

As shown in Table 5, the Mann-Whitney U test results revealed that although Phase 1 students had higher scores than Phase 2 students in Fall 2011, the difference was neither statistically significant nor substantively meaningful. In contrast, compared to Phase 1 students, Phase 2 students scored higher in Spring 2014. However, the magnitude of the difference was neither statistically significant nor substantively important.

- “How often do you talk to your family about what you do in science class?”

As shown in Table 5, the Mann-Whitney U test results revealed that although Phase 2 students had slightly higher scores than Phase 1 students in Fall 2011, the difference was neither statistically significant nor substantively important. In contrast, compared to Phase 1 students, Phase 2 students had statistically significantly higher scores in Spring 2014 ($Z = 3.52$, $p < 0.001$, $g = -0.16$), but again, the associated effect size was not substantively important.

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 5, Phase 2 students had slightly higher scores than Phase 1 students in both Fall 2011 and Spring 2014, with the difference in Spring 2014 being statistically significant ($Z = 2.15$, $p = 0.031$, $g = -0.10$). However, neither of the associated effect sizes was substantively important.

- “Do you think science will be useful when you are older?”

As shown in the top section of Table 6, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was not statistically significant in Fall 2011, whereas the difference was statistically significant in Spring 2014 ($\chi^2(2) = 25.59$, $p < 0.001$, $g = 0.23$). However, neither difference was substantively important. Examination of the cell standardized residuals (*s.r.*) showed that the responses of “Yes” and “No” by both groups were major contributors to the overall statistically significant relationship between Phase and students’ response in Spring 2014, with a larger than expected percentage of Phase 2 students responding “Yes” in Spring 2014 (44.1% vs. 34.9%), and a larger than expected percentage of Phase 1 students responding “No” (14.2% vs. 8.4%). Note that the largest percentage of both Phase 1 and Phase 2 students responded “Yes” in Fall 2011, but “Maybe” in Spring 2014.

- “Would you like to be a scientist when you are older?”

As shown in the bottom section of Table 6, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was neither statistically significant nor substantively important in either Fall 2011 or Spring 2014. The largest percentage of Phase 1 and Phase 2 students at both time points responded “No”.

Table 5. Results of Mann-Whitney U Test: Comparison of Overall Middle School Cohort Phase 1 and Phase 2 Students' Responses

	Fall 2011						Spring 2014					
	Phase 1		Phase 2		Z	g	Phase 1		Phase 2		Z	g
	N	Mean	N	Mean			N	Mean	N	Mean		
I like science.	883	1.49	983	1.47	-0.71	0.03	883	1.15	983	1.21	1.78	-0.08
How often do you talk to your family about what you do in science class?	889	0.97	1,007	0.98	0.41	-0.02	889	0.55	1,007	0.64	3.52***	-0.16
How often do you talk to your friends about what you do in science class?	887	0.73	1,000	0.78	1.17	-0.05	887	0.62	1,000	0.68	2.15*	-0.10

* $p < 0.05$, two-tailed; *** $p < 0.001$, two-tailed. A negative g indicates that Phase 2 had a higher score relative to Phase 1.

Table 6. Results of Chi-Square Test: Comparison of Overall Middle School Cohort Phase 1 and Phase 2 Students' Responses

Do you think science will be useful to you when you are older?												
	Fall 2011						Spring 2014					
	$(\chi^2(2) = 1.30, p = 0.523, \phi = 0.03, g = 0.05)$						$(\chi^2(2) = 25.59, p < 0.001^*, \phi = 0.12, g = 0.23)$					
	Phase 1			Phase 2			Phase 1			Phase 2		
	n	%	s.r.	n	%	s.r.	n	%	s.r.	n	%	s.r.
Yes	493	55.2	-0.2	565	55.9	0.1	312	34.9	-2.3	446	44.1	2.2
Maybe	374	41.8	0.4	407	40.3	-0.4	455	50.9	0.8	480	47.5	-0.7
No	27	3.0	-0.7	39	3.9	0.7	127	14.2	2.8	85	8.4	-2.6

Would you like to be a scientist when you are older?												
	Fall 2011						Spring 2014					
	$(\chi^2(2) = 5.84, p = 0.05, \phi = 0.06, g = 0.11)$						$(\chi^2(2) = 0.33, p = 0.846, \phi = 0.01, g = 0.03)$					
	Phase 1			Phase 2			Phase 1			Phase 2		
	n	%	s.r.	n	%	s.r.	n	%	s.r.	n	%	s.r.
Yes	81	9.2	1.4	67	6.7	-1.3	36	4.1	0.4	36	3.6	-0.4
Maybe	306	34.8	0.5	330	32.9	-0.5	204	23.2	-0.1	236	23.5	0.1
No	493	56.0	-0.9	606	60.4	0.9	640	72.7	0.0	731	72.9	0.0

Note. s.r. = standardized residual.

*Statistically significant at $p < 0.05$

All Regions Results: Comparison of Student Attitudes Toward Science from Fall 2011 to Spring 2014

The results of the Wilcoxon Signed-rank test for the Elementary and Middle School cohorts are summarized in Table 7 and Table 9, respectively. The results of the marginal homogeneity test for the Elementary and Middle School cohorts are summarized in Table 8 and Table 10, respectively.

Elementary Cohort Results (Figure 1, page 17): Within Group Comparisons

- “I like science”

As shown in Table 7, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores in Fall 2011 than in Spring 2014 ($Z = 5.34, p < 0.001, r = -0.08$ and $Z = 5.35, p < 0.001, r = -0.10$, respectively). However, the associated effects were negligible for Phase 1 and small for Phase 2.

- “How often do you talk to your family about what you do in science class?”

As shown in Table 7, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores in Fall 2011 than in Spring 2014 ($Z = 6.73, p < 0.001, r = -0.10$ and $Z = 5.09, p < 0.001, r = -0.09$, respectively). However, the associated effects were negligible.

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 7, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores in Fall 2011 than in Spring 2014 ($Z = 2.28, p = 0.022, r = -0.04$ and $Z = 3.92, p < 0.001, r = -0.07$, respectively). However, the associated effects were negligible.

- “Do you think science will be useful when you are older?”

As shown in Table 8, the marginal homogeneity tests showed that there was a statistically significant difference in the level of agreement for this question within the Phase 2 student group from Fall 2011 to Spring 2014 ($MH = -2.23, p = 0.001$), with the level of agreement being higher in Spring 2014, whereas the difference within the Phase 1 student group, while higher in Spring 2014, was not statistically significant.

- “Would you like to be a scientist when you are older?”

As shown in Table 8, the marginal homogeneity tests showed that there were statistically significant differences between Fall 2011 and Spring 2014 in the level of agreement for this question within both the Phase 1 and Phase 2 groups ($MH = 13.01, p < 0.001$ and $MH = 10.83, p < 0.001$, respectively), with the level of agreement being higher in Fall 2011 for both groups.

Table 7. Results of Wilcoxon Signed-Rank Test: Comparison of Overall Elementary Cohort Students' Responses within the Phase 1 and Phase 2 Groups

	Phase 1						Phase 2					
	Fall 2011		Spring 2014		Z	r	Fall 2011		Spring 2014		Z	r
	N	Mean	N	Mean			N	Mean	N	Mean		
I like science.	2,064	1.62	2,064	1.53	5.34***	-0.08	1,558	1.60	1,558	1.50	5.35***	-0.10
How often do you talk to your family about what you do in science class?	2,067	1.04	2,067	0.91	6.73***	-0.10	1,559	1.00	1,559	0.89	5.09***	-0.09
How often do you talk to your friends about what you do in science class?	2,038	0.77	2,038	0.73	2.28*	-0.04	1,552	0.73	1,552	0.64	3.92***	-0.07

** $p < 0.01$, two-tailed; *** $p < 0.001$, two-tailed. A negative r indicates that Fall 2011 had a higher score relative to Spring 2014.

Table 8. Results of Marginal Homogeneity Test: Comparison of the Distributions of Overall Elementary Cohort Students' Responses within the Phase 1 and Phase 2 Groups

		Marginal Homogeneity Test		
		N	Standard MH Statistic	p
Do you think science will be useful to you when you are older?	Phase 1	2,099	-0.68	0.498
	Phase 2	1,585	-2.23	0.026*
Would you like to be a scientist when you are older?	Phase 1	2,068	13.01	<0.001*
	Phase 2	1,551	10.83	<0.001*

*Statistically significant at $p < 0.05$. For the Standard MH Statistic, a negative value indicates that the Spring 2014 has a higher score relative to Fall 2011.

Middle School Cohort Results (Figure 2, page 19): Within Group Comparisons

- “I like science”

As shown in Table 9, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores in Fall 2011 than in Spring 2014 ($Z = 12.47$, $p < 0.001$, $r = -0.30$ and $Z = 11.10$, $p < 0.001$, $r = -0.25$, respectively). The associated effect size for both group differences was small.

- “How often do you talk to your family about what you do in science class?”

As shown in Table 9, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores in Fall 2011 than in Spring 2014 ($Z = 14.24$, $p < 0.001$, $r = -0.34$ and $Z = 13.51$, $p < 0.001$, $r = -0.30$, respectively). The associated effects for both groups were medium.

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 9, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores in Fall 2011 than in Spring 2014 ($Z = 4.20$, $p < 0.001$, $r = -0.10$ and $Z = 3.45$, $p = 0.001$, $r = -0.08$, respectively). The associated effects for both groups were small.

- “Do you think science will be useful when you are older?”

As shown in Table 10, the marginal homogeneity tests showed that there were statistically significant differences between Fall 2011 and Spring 2014 in the level of agreement for this question within both the Phase 1 and Phase 2 groups ($MH = 11.26$, $p < 0.001$ and $MH = 6.92$, $p < 0.001$, respectively), with the level of agreement being higher in Fall 2011 for both groups.

- “Would you like to be a scientist when you are older?”

As shown in Table 10, the marginal homogeneity tests showed that there were statistically significant differences between Fall 2011 and Spring 2014 in the level of agreement for this question within both the Phase 1 and Phase 2 groups ($MH = 9.09$, $p < 0.001$ and $MH = 7.08$, $p < 0.001$, respectively), with the level of agreement being higher in Fall 2011 for both groups.

Table 9. Results of Wilcoxon Signed-Rank Test: Comparison of Overall Middle School Cohort Students' Responses within the Phase 1 and Phase 2 Groups

	Phase 1						Phase 2					
	Fall 2011		Spring 2014		Z	r	Fall 2011		Spring 2014		Z	r
	N	Mean	N	Mean			N	Mean	N	Mean		
I like science.	883	1.49	883	1.15	12.47***	-0.30	983	1.47	983	1.21	11.10***	-0.25
How often do you talk to your family about what you do in science class?	889	0.97	889	0.55	14.24***	-0.34	1,007	0.98	1,007	0.64	13.51***	-0.30
How often do you talk to your friends about what you do in science class?	887	0.73	887	0.62	4.20***	-0.10	1,000	0.78	1,000	0.68	3.45**	-0.08

*** $p < 0.001$, two-tailed. A negative r indicates that Fall 2011 had a higher score relative to Spring 2014

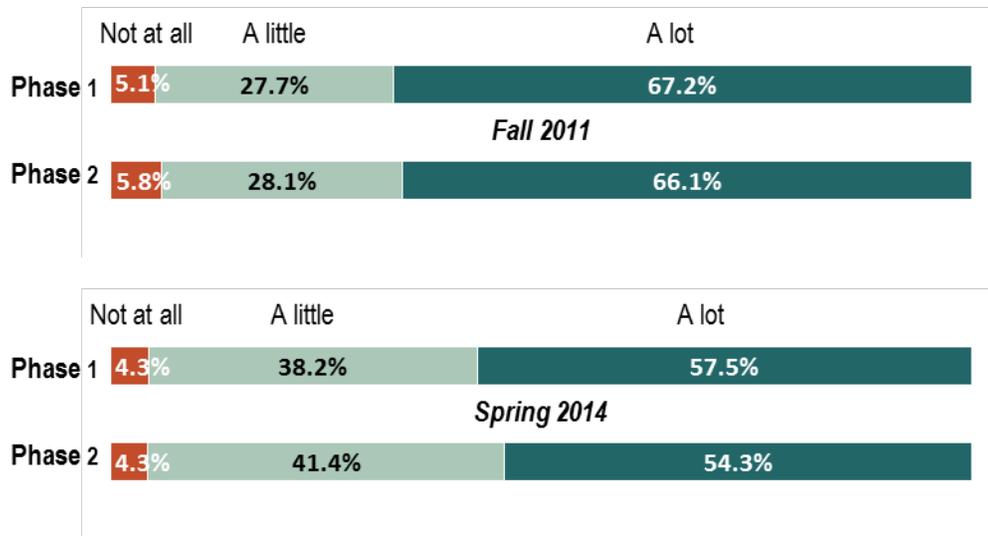
Table 10. Results of Marginal Homogeneity Test: Comparison of the Distributions of Overall Middle School Cohort Students' Responses within the Phase 1 and Phase 2 Groups

	Marginal Homogeneity Test			
		N	Standard MH Statistic	p
Do you think science will be useful to you when you are older?	Phase 1	894	11.26	<0.001*
	Phase 2	1,011	6.92	<0.001*
Would you like to be a scientist when you are older?	Phase 1	880	9.09	<0.001*
	Phase 2	1,003	7.08	<0.001*

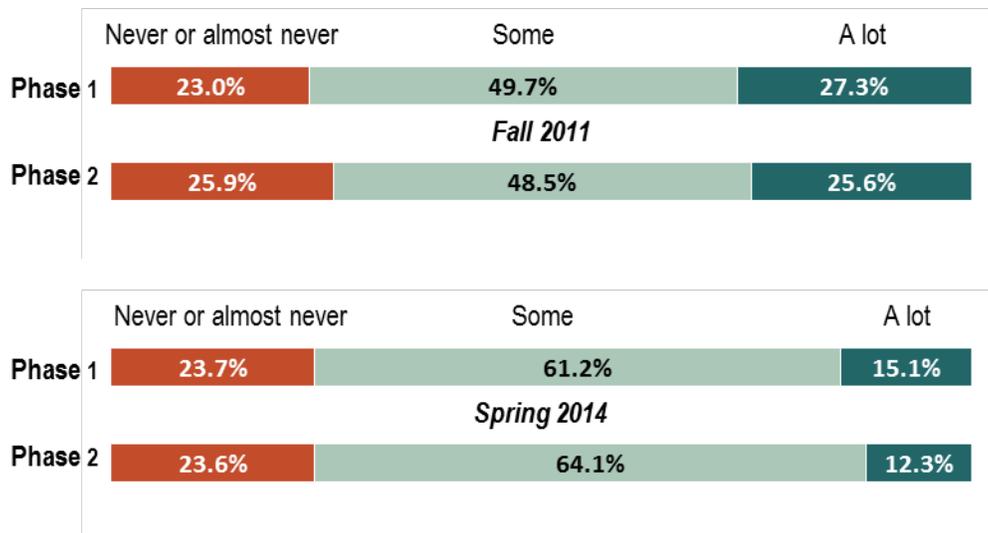
*Statistically significant at $p < 0.05$. For the Standard MH Statistic, a negative value indicates that the Spring 2014 has a higher score relative to Fall 2011.

Figure 1. Student Attitude Survey, All Regions: Fall 2011 and Spring 2014: Elementary Cohort Question Responses by Group

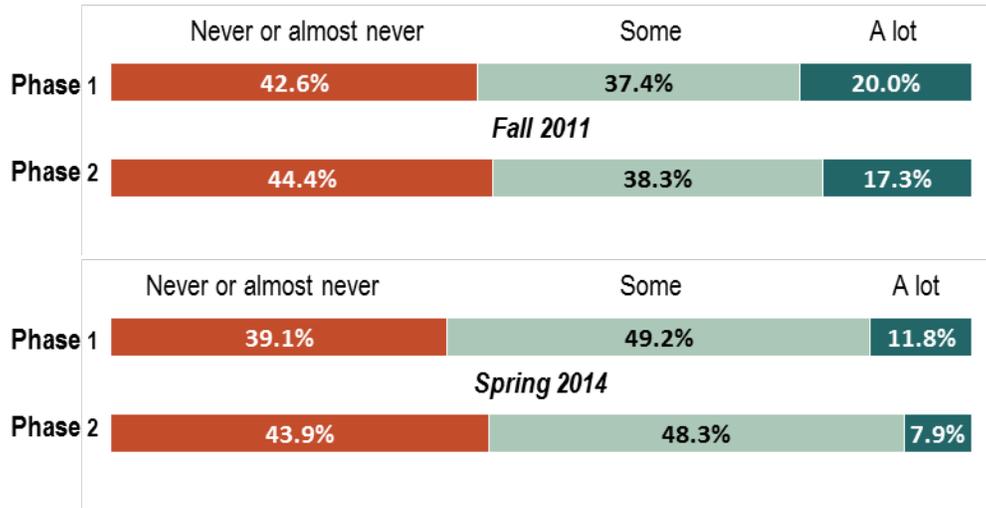
I like Science ...



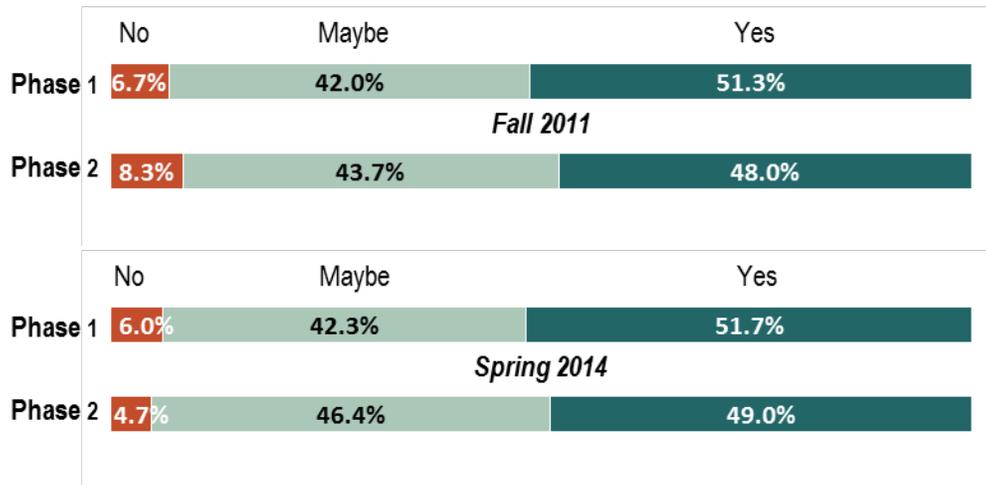
How often do you talk to your family about what you do in science class?



How often do you talk to your friends about what you do in science class?



Do you think Science will be useful to you when you get older?



Would you like to be a scientist when you are older?

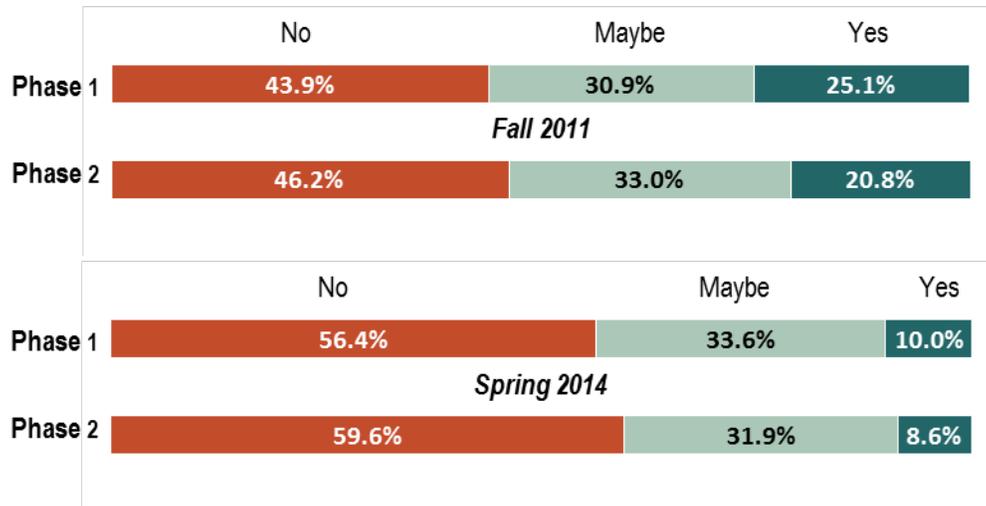
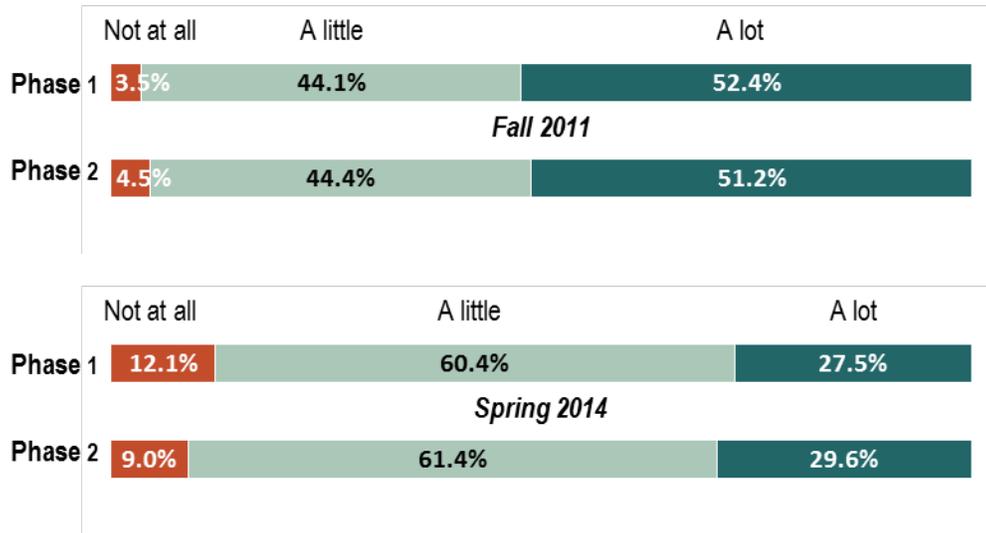
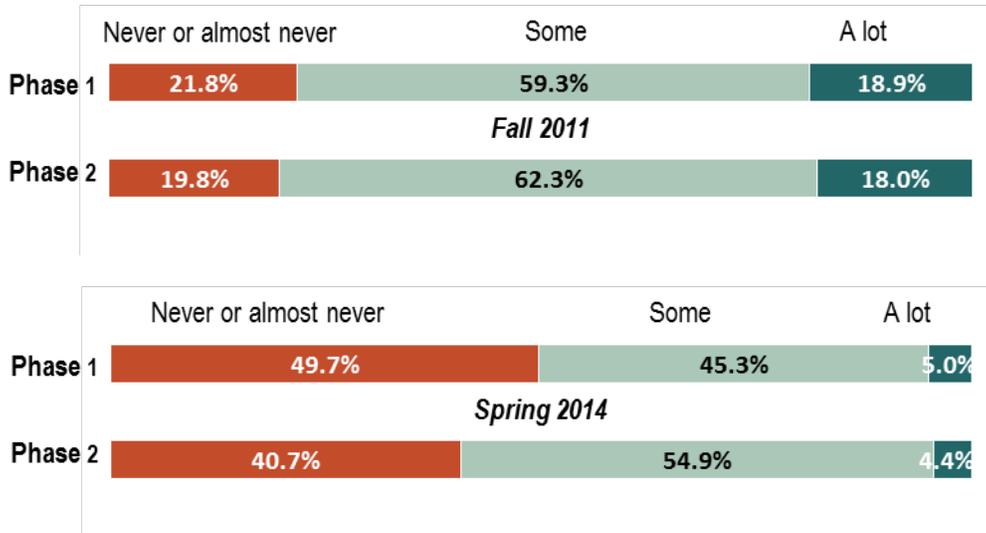


Figure 2. Student Attitude Survey, All Regions: Fall 2011 and Spring 2014: Middle School Cohort Question Responses by Group

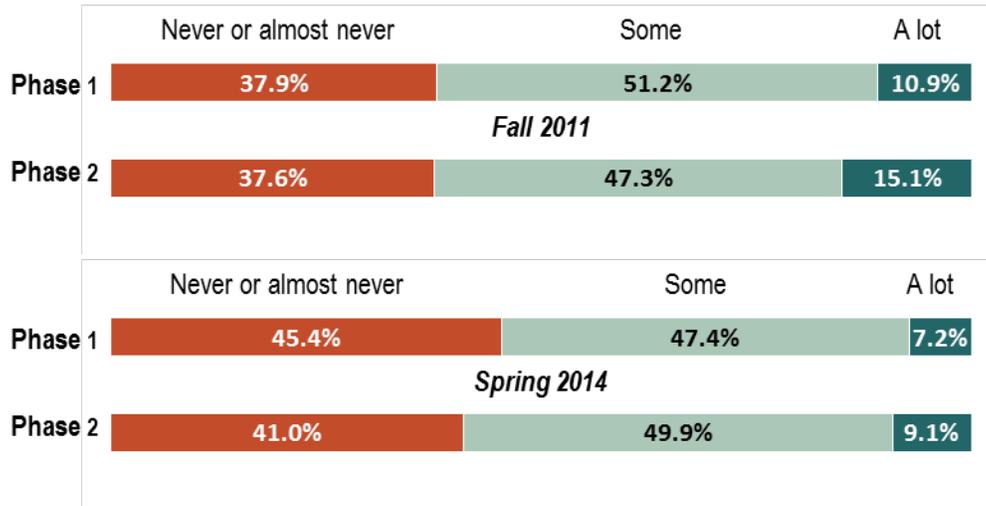
I like Science ...



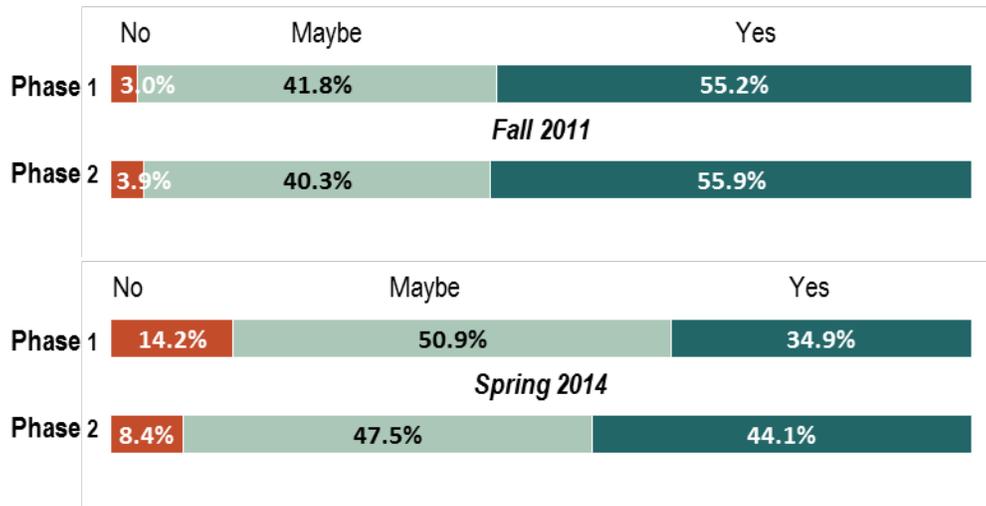
How often do you talk to your family about what you do in science class?



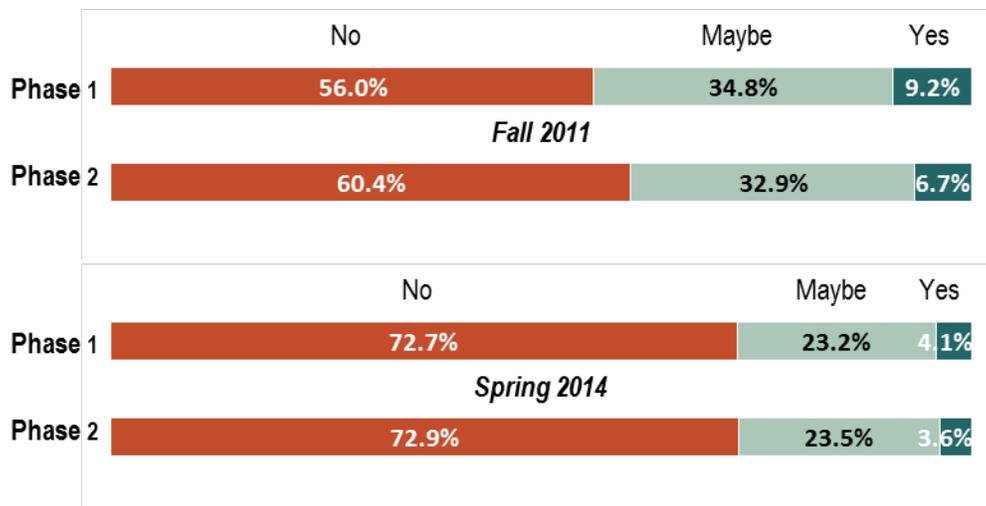
How often do you talk to your friends about what you do in science class?



Do you think Science will be useful to you when you get older?



Would you like to be a scientist when you are older?



Overall Summary of PASS Student Attitudes Results

Between-group difference

For the three Likert-scale items (“I like science”, “How often do you talk to your family about what you do in science class?”, and “How often do you talk to your friends about what you do in science class?”), for both the Elementary and Middle School cohort students across all three regions, while there were some statistically significant findings in Spring 2014, none of the three items examined exhibited meaningful differences between Phase 1 and Phase 2 students in either Fall 2011 or Spring 2014. In other words, Phase 1 and Phase 2 students in both cohorts essentially had similar attitudes toward science and talked to their families and friends about science with similar frequencies in both Fall 2011 and Spring 2014.

For the two nominal scale items (“Do you think science will be useful to you when you are older?” and “Would you like to be a scientist when you are older?”), there were statistically significant differences between Phase 1 and Phase 2 students in both cohorts on (1) the first question in Spring 2014, with Phase 1 students in the Elementary Cohort having a higher percentage of responding “Yes” (51.7% vs. 49.0%) while Phase 2 students in the Middle School Cohort had a higher percentage of responding “Yes” (44.1% vs. 34.9%), and (2) on the second question for the Elementary Cohort in Fall 2011, with Phase 1 students having a higher percentage of responding “Yes” (25.1% vs. 20.8%). However, none of the differences were substantively meaningful. In other words, Phase 1 and Phase 2 students in both cohorts essentially had similar attitudes towards these two nominal questions in both Fall 2011 and Spring 2014.

Within-group difference

When looking at results within the Phase 1 and Phase 2 groups, for the three Likert-scale items (“I like science”, “How often do you talk to your family about what you do in science class?”, and “How often do you talk to your friends about what you do in science class?”), Phase 1 and Phase 2 students in both the Elementary and Middle School Cohorts liked science more or were more likely to talk to their friends or families about science in Fall 2011 compared to Spring 2014. All differences were statistically significant, with the largest magnitude being medium for the item “How often do you talk to your family about what you do in science class?” within both the Phase 1 and Phase 2 groups in the Middle School Cohort.

For the two nominal scale items (“Do you think science will be useful to you when you are older?” and “Would you like to be a scientist when you are older?”), there were statistically significant differences in the level of agreement within both groups from Fall 2011 to Spring 2014 for both the Elementary and Middle School Cohorts except for the responses of Phase 1 students in the Elementary Cohort to the question “Do you think science will be useful to you when you are older?”. Only one of the statistically significant differences, for the Phase 2 students in the Elementary Cohort on the question “Do you think science will be useful to you when you are older?” had a higher percentage of agreement in Spring 2014. All of the remaining statistically significant differences demonstrated higher levels of agreement in Fall 2011. However, since no effect size measure for the marginal homogeneity test was available, we do not know whether or not these statistically significant differences were substantively important.

Houston Independent School District: Results for Spring 2014 PASS Student Attitudes Toward Science

Houston Independent School District (HISD)
Spring 2014 PASS Student Attitudes
Key Findings for Phase 1

For all students combined in HISD, the following outcomes favoring Phase 1 Elementary Cohort students were found on the Spring 2014 PASS Student Attitudes section.

- For the between-group differences, where there was baseline equivalence between Phase 1 and Phase 2 students, there was a statistically significant difference between groups in Spring 2014 on the question “Do you think science will be useful to you when you are older?”, with the largest percentage of Phase 1 students responding “Yes” in both Fall 2011 and Spring 2014, whereas the largest percentage of Phase 2 students responded “Yes” in Fall 2011 and “Maybe” in Spring 2014, but the difference was not substantively important. In Spring 2014, over half of Phase 1 students (54.4%) responded “Yes” compared to less than half (48.8%) of Phase 2 students.
- For the within-group differences, neither the Phase 1 nor Phase 2 Elementary or Middle School cohorts had statistically significantly better outcomes in Spring 2014 vs. the baseline (Fall 2011 or Spring 2012 respectively).

Houston: Fall 2011 or Spring 2012 to Spring 2014 PASS Student Attitudes Results

PASS student attitudes survey data results in HISD from the Fall 2011 (baseline or pre-intervention for the Elementary Cohort) or Spring 2012⁶ (baseline or pre-intervention for the Middle School Cohort) and Spring 2014 (third posttest for the Elementary Cohort and the second posttest for the Middle School Cohort) administrations are currently available and are reported below.

Survey Questions: Student Attitudes Toward Science

Of the 14 total attitude questions on the student survey, the five questions related to student attitudes towards science have been selected for discussion. See Table A - 3 and Table A - 4 in Appendix A for the outcomes on all 14 student attitudes questions. Table 11 and Table 12 show the final analytic HISD sample sizes included for the Elementary and Middle School cohorts respectively.

Table 11. PASS, Houston, Spring 2014: Samples for the Survey Analyses for Elementary Cohort

Item	Phase 1	Phase 2
Initial Samples ¹	801	614
I like science.	561	407
How often do you talk to your family about what you do in science class?	556	409
How often do you talk to your friends about what you do in science class?	557	405
Do you think science will be useful when you are older?	568	418
Would you like to be a scientist when you are older?	561	406

¹ The number of students who answered at least one Student Attitudes question in Spring 2014

Table 12. PASS, Houston, Spring 2014: Samples for the Survey Analyses for Middle School Cohort

Item	Phase 1	Phase 2
Initial Samples ¹	179	121
I like science.	146	97
How often do you talk to your family about what you do in science class?	151	99
How often do you talk to your friends about what you do in science class?	149	99
Do you think science will be useful when you are older?	150	100
Would you like to be a scientist when you are older?	149	98

¹ The number of students who answered at least one Student Attitudes question in Spring 2014

⁶ The Middle School Cohort in HISD did not take the PASS in the Fall 2011, so Spring 2012 was chosen as the baseline for the Middle School Cohort.

Fall 2011 (or Spring 2012) & Spring 2014 Houston Results: Comparison of Phase 1 and Phase 2 Student Attitudes Toward Science

The results of the Mann-Whitney *U* test for Elementary Cohort and Middle School Cohort are summarized in Table 13 and Table 15, respectively. The results of the chi-square test of independence for the Elementary and Middle School cohorts are summarized in Table 14 and Table 16 respectively.

Elementary Cohort Results (Figure 3, page 37): Between Group Comparisons

- “I like science”

As shown in Table 13, Phase 1 students had slightly higher scores (i.e., a higher level of agreement) than Phase 2 students in Spring 2014, whereas Phase 2 students had slightly higher scores in Fall 2011. However, the Mann-Whitney *U* test results revealed such differences were neither statistically significantly nor substantively importantly different in either Fall 2011 or Spring 2014.

- “How often do you talk to your family about what you do in science class?”

As shown in Table 13, Phase 1 students had slightly higher scores (i.e., a higher frequency) than Phase 2 students in both Fall 2011 and Spring 2014. However, the Mann-Whitney *U* test results revealed such differences were neither statistically significantly nor substantively importantly different in either Fall 2011 or Spring 2014.

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 13, Phase 1 students had slightly higher scores (i.e., a higher frequency) than Phase 2 students in Spring 2014, whereas Phase 2 students had higher scores in Fall 2011. However, the Mann-Whitney *U* test results revealed such differences were neither statistically significantly nor substantively importantly different in either Fall 2011 or Spring 2014.

- “Do you think science will be useful when you are older?”

As shown in the top section of Table 14, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was neither statistically significantly nor substantively importantly different in Fall 2011. In contrast, the level of agreement between two groups was statistically significantly different in Spring 2014, although the difference was not substantively important. Note that the largest percentage of Phase 1 students responded “Yes” in both Fall 2011 and Spring 2014, whereas the largest percentage of Phase 2 students responded “Yes” in Fall 2011 and “Maybe” in Spring 2014.

- “Would you like to be a scientist when you are older?”

As shown in the bottom section of Table 14, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was neither statistically significantly nor substantively importantly different in either Fall 2011 or Spring 2014. For both Phase 1 and Phase 2 students in Fall 2011, the percentage of students selecting each response category responses was almost the same, whereas in Spring 2014, the largest percentage of both Phase 1 and Phase 2 students responded “No” (49.6% for Phase 1 students and 51.5% for Phase 2 students).

Table 13. Results of Mann-Whitney U Test: Comparison of Houston Elementary Cohort Phase 1 and Phase 2 Students' Responses

	Fall 2011						Spring 2014						
	Phase 1			Phase 2			Phase 1			Phase 2			
	N	Mean	Z	N	Mean	g	N	Mean	Z	N	Mean	Z	g
I like science.	561	1.68	0.86	407	1.71	-0.06	561	1.55	-0.73	407	1.54	-0.73	0.05
How often do you talk to your family about what you do in science class?	556	1.13	-0.31	409	1.11	0.02	556	0.91	-0.70	409	0.88	-0.70	0.05
How often do you talk to your friends about what you do in science class?	557	0.93	1.21	405	0.99	-0.08	557	0.76	-1.22	405	0.69	-1.22	0.08

Note. A negative g indicates that Phase 2 has a higher score relative to Phase 1.

Table 14. Results of Chi-Square Test: Comparison of Houston Elementary Cohort Phase 1 and Phase 2 Students' Responses

Do you think science will be useful to you when you are older?												
	Fall 2011						Spring 2014					
	Phase 1			Phase 2			Phase 1			Phase 2		
	n	%	s.r.	n	%	s.r.	n	%	s.r.	n	%	s.r.
Yes	289	50.9	-0.8	238	56.9	1.0	309	54.4	0.9	202	48.3	-1.0
Maybe	247	43.5	0.9	158	37.8	-1.0	227	40.0	-1.4	204	48.8	1.6
No	32	5.6	0.2	22	5.3	-0.2	32	5.6	1.3	12	2.9	-1.5

Would you like to be a scientist when you are older?												
	Fall 2011						Spring 2014					
	Phase 1			Phase 2			Phase 1			Phase 2		
	n	%	s.r.	n	%	s.r.	n	%	s.r.	n	%	s.r.
Yes	184	32.8	0.1	131	32.3	-0.1	59	10.5	0.1	42	10.3	-0.1
Maybe	189	33.7	-0.5	149	36.7	0.6	224	39.9	0.3	155	38.2	-0.3
No	188	33.5	0.4	126	31.0	-0.5	278	49.6	-0.3	209	51.5	0.3

Note. s.r. = standardized residual.

*Statistically significant at $p < 0.05$

Middle School Cohort Results (Figure 4, page 39): Between Group Comparisons

- “I like science”

As shown in Table 15, the Mann-Whitney U test results revealed that Phase 2 students had statistically significantly and substantively higher scores (i.e., a higher level of agreement) than Phase 1 students in both Spring 2012 and Spring 2014 ($Z = 2.80$, $p = 0.005$, $g = -0.37$ and $Z = 4.23$, $p < 0.001$, $g = -0.55$, respectively).

- “How often do you talk to your family about what you do in science class?”

As shown in Table 15, the Mann-Whitney U test results revealed that Phase 2 students had higher scores (i.e., a higher frequency) than Phase 1 students in both Spring 2012 and Spring 2014, but only the difference in Spring 2014 was statistically significant and substantively important ($Z = 3.33$, $p = 0.001$, $g = -0.43$).

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 15, the Mann-Whitney U test results revealed that Phase 2 students had statistically significantly and substantively higher scores (i.e., a higher frequency) than Phase 1 students in both Spring 2012 and Spring 2014 ($Z = 2.87$, $p = 0.004$, $g = -0.37$ and $Z = 2.13$, $p = 0.034$, $g = -0.28$, respectively).

- “Do you think science will be useful when you are older?”

As shown in the top section of Table 16, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was both statistically significantly and substantively importantly different in Spring 2014 ($\chi^2(2) = 6.62$, $p = 0.036$, $g = 0.32$), whereas the level of agreement between two groups in Spring 2012 was only substantively importantly different. Examination of the cell standardized residuals (*s.r.*) showed that none of the cells individually was a major contributor to the overall statistically significant relationship between Phase and response for students at either time point. Rather, they worked jointly to contribute to the overall statistical significance, with both groups having the largest percentage of respondents give the same response at each time point, but a higher percentage of Phase 2 students responding “Yes” in Spring 2012 (61.0% vs. 54.0%) and “Maybe” in Spring 2014 (52.0% vs. 49.3%). Phase 2 (42.0%) also had a larger percentage of students respond “Yes” in Spring 2014 compared to Phase 1 (34.0%).

- “Would you like to be a scientist when you are older?”

As shown in the bottom section of Table 16, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was statistically significantly different in Spring 2012 ($\chi^2(2) = 10.69$, $p = 0.005$, $g = 0.41$), but not in Spring 2014. However, the level of agreement between two groups at both time points was substantively importantly different. Examination of the cell standardized residuals (*s.r.*) showed that none of the cells individually was a major contributor to the overall statistically significant relationship between Phase and response for students in Spring 2012. Note that the largest percentage of Phase 1 students responded “No” in both Spring 2012 and Spring 2014, whereas the largest percentage of Phase 2 students responded “Maybe” in Spring 2012 and “No” in Spring 2014. In addition, Phase 2 had a larger percentage of students respond “Yes” at both time points.

Table 15. Results of Mann-Whitney U Test: Comparison of Houston Middle School Cohort Phase 1 and Phase 2 Students' Responses

	Spring 2012						Spring 2014					
	Phase 1		Phase 2		Z	g	Phase 1		Phase 2		Z	g
	N	Mean	N	Mean			N	Mean	N	Mean		
I like science.	146	1.27	97	1.49	2.80**	-0.37	146	1.04	97	1.37	4.23***	-0.55
How often do you talk to your family about what you do in science class?	151	0.79	99	0.89	1.26	-0.16	151	0.42	99	0.66	3.33**	-0.43
How often do you talk to your friends about what you do in science class?	149	0.68	99	0.92	2.87**	-0.37	149	0.54	99	0.71	2.13*	-0.28

* $p < 0.05$, two-tailed; ** $p < 0.01$, two-tailed; *** $p < 0.001$, two-tailed. A negative g indicates that Phase 2 has a higher score relative to Phase 1.

Table 16. Results of Chi-Square Test: Comparison of Houston Middle School Cohort Phase 1 and Phase 2 Students' Responses

Do you think science will be useful to you when you are older?												
	Spring 2012						Spring 2014					
	$(X^2(2) = 5.27, p^a = 0.072, \text{Cramer's } V = 0.15, g = 0.29)$						$(X^2(2) = 6.62, p = 0.036^*, \text{Cramer's } V = 0.16, g = 0.32)$					
	Phase 1			Phase 2			Phase 1			Phase 2		
	n	%	s.r.	n	%	s.r.	n	%	s.r.	n	%	s.r.
Yes	81	54.0	-0.5	61	61.0	0.6	51	34.0	-0.6	42	42.0	0.8
Maybe	62	41.3	0.2	39	39.0	-0.2	74	49.3	-0.2	52	52.0	0.2
No	7	4.7	1.4	0	0.0	-1.7	25	16.7	1.5	6	6.0	-1.8

Would you like to be a scientist when you are older?												
	Spring 2012						Spring 2014					
	$(X^2(2) = 10.69, p = 0.005^*, \text{Cramer's } V = 0.21, g = 0.41)$						$(X^2(2) = 5.36, p = 0.068, \text{Cramer's } V = 0.15, g = 0.29)$					
	Phase 1			Phase 2			Phase 1			Phase 2		
	n	%	s.r.	n	%	s.r.	n	%	s.r.	n	%	s.r.
Yes	7	4.7	-0.9	9	9.2	1.1	4	2.7	-1.0	7	7.1	1.3
Maybe	53	35.6	-1.2	51	52.0	1.5	31	20.8	-0.8	28	28.6	0.9
No	89	59.7	1.4	38	38.8	-1.7	114	76.5	0.7	63	64.3	-0.9

Note. s.r. = standardized residual.

*Statistically significant at $p < 0.05$

^a: Exact test was performed since more than 20% of the cells have expected cell counts less than 5.

Houston Results: Comparison of Student Attitudes Toward Science from Fall 2011 (or Spring 2012) to Spring 2014

The results of the Wilcoxon Signed-rank test for the Elementary and Middle School cohorts are summarized in Table 17 and Table 19, respectively. The results of the marginal homogeneity test for the Elementary and Middle School cohorts are summarized in Table 18 and Table 20, respectively.

Elementary Cohort Results (Figure 3, page 37): Within Group Comparisons

- “I like science”

As shown in Table 17, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores (i.e., a higher level of agreement) in Fall 2011 than in Spring 2014 ($Z = 3.91, p < 0.001, r = -0.12$ and $Z = 4.96, p < 0.001, r = -0.17$, respectively). However, the associated effects were small.

- “How often do you talk to your family about what you do in science class?”

As shown in Table 17, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores (i.e., a higher frequency) in Fall 2011 than in Spring 2014 ($Z = 5.67, p < 0.001, r = -0.17$ and $Z = 5.57, p < 0.001, r = -0.19$, respectively). However, the associated effects were small.

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 17, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores (i.e., a higher frequency) in Fall 2011 than in Spring 2014 ($Z = 4.19, p < 0.001, r = -0.13$ and $Z = 6.13, p < 0.001, r = -0.2$, respectively). However, the associated effects were small.

- “Do you think science will be useful when you are older?”

As shown in Table 18, the marginal homogeneity tests showed that there were no statistically significant differences between Fall 2011 and Spring 2014 in the level of agreement for this question within both Phase 1 and Phase 2 student groups. The level of agreement for Phase 2 students was higher in Spring 2014, whereas the level of agreement was the higher for Phase 1 students in Fall 2011.

- “Would you like to be a scientist when you are older?”

As shown in Table 18, the marginal homogeneity tests showed that there were statistically significant differences in the level of agreement for this question within both Phase 1 and Phase 2 groups from Fall 2011 to Spring 2014 ($MH = 8.84, p < 0.001$ and $MH = 8.30, p < 0.001$, respectively), with the level of agreement being higher in Fall 2011 for both groups.

Table 17. Comparison of the Distributions of Houston Elementary Cohort Phase 1 and Phase 2 Students' Responses with the Wilcoxon Signed-Rank Test

	Phase 1						Phase 2					
	Fall 2011		Spring 2014		Z	r	Fall 2011		Spring 2014		Z	r
	N	Mean	N	Mean			N	Mean	N	Mean		
I like science.	561	1.68	561	1.55	3.91***	-0.12	407	1.71	407	1.54	4.96***	-0.17
How often do you talk to your family about what you do in science class?	556	1.13	556	0.91	5.67***	-0.17	409	1.11	409	0.88	5.57***	-0.19
How often do you talk to your friends about what you do in science class?	557	0.93	557	0.76	4.19***	-0.13	405	0.99	405	0.69	6.13***	-0.22

*** $p < 0.001$, two-tailed. A negative r indicates that Fall 2011 has a higher score relative to Spring 2014.

Table 18. Results of Marginal Homogeneity Test: Comparison of the Distributions of Houston Elementary Cohort Students' Responses within the Phase 1 and Phase 2 Groups

	Marginal Homogeneity Test			
	N	Standard MH Statistic	p	
Do you think science will be useful to you when you are older?	Phase 1	568	1.03	0.302
	Phase 2	418	-1.60	0.110
Would you like to be a scientist when you are older?	Phase 1	561	8.84	<0.001*
	Phase 2	406	8.30	<0.001*

*Statistically significant at $p < 0.05$. For the Standard MH Statistic, a negative value indicates that the Spring 2014 has a higher score relative to Fall 2011.

Middle School Cohort Results (Figure 4, page 39): Within Group Comparisons

- “I like science”

As shown in Table 19, both Phase 1 and Phase 2 students had slightly higher scores (i.e., a higher level of agreement) in Spring 2012 than in Spring 2014. The Wilcoxon Signed-rank test revealed that the within-group difference for Phase 1 students was statistically significant ($Z = 3.66$, $p < 0.001$, $r = -0.21$), but not for Phase 2 students. However, the associated effect sizes for both Phase 1 and Phase within-group differences were small.

- “How often do you talk to your family about what you do in science class?”

As shown in Table 19, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores (i.e., a higher frequency) in Spring 2012 than in Spring 2014 ($Z = 5.27$, $p < 0.001$, $r = -0.30$ and $Z = 3.36$, $p = 0.001$, $r = -0.24$, respectively). The associated effect size was medium for the Phase 1 within-group difference and small for the Phase 2 within-group difference.

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 19, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores (i.e., a higher frequency) in Spring 2012 than in Spring 2014 ($Z = 2.09$, $p = 0.036$, $r = -0.12$ and $Z = 2.68$, $p = 0.007$, $r = -0.19$, respectively). However, the associated effect sizes for both the Phase 1 and Phase 2 within-group differences were small.

- “Do you think science will be useful when you are older?”

As shown in Table 20, the marginal homogeneity tests showed that there were statistically significant differences in the level of agreement for this question within both Phase 1 and Phase 2 student groups between Spring 2012 and Spring 2014 ($MH = 4.58$, $p < 0.001$ and $MH = 3.57$, $p < 0.001$, respectively), with the level of agreement being higher in Spring 2012 for both groups.

- “Would you like to be a scientist when you are older?”

As shown in Table 20, the marginal homogeneity tests showed that there were statistically significant differences in the level of agreement for this question within both Phase 1 and Phase 2 student groups between Spring 2012 and Spring 2014 ($MH = 3.56$, $p < 0.001$ and $MH = 3.64$, $p < 0.001$, respectively), with the level of agreement being higher in Spring 2012 for both groups.

Table 19. Comparison of the Distributions of Houston Middle School Cohort Phase 1 and Phase 2 Students' Responses with the Wilcoxon Signed-Rank Test

	Phase 1						Phase 2					
	Spring 2012		Spring 2014		Z	r	Spring 2012		Spring 2014		Z	r
	N	Mean	N	Mean			N	Mean	N	Mean		
I like science.	146	1.27	146	1.04	3.66***	-0.21	97	1.49	97	1.37	1.90	-0.14
How often do you talk to your family about what you do in science class?	151	0.79	151	0.42	5.27***	-0.30	99	0.89	99	0.66	3.36**	-0.24
How often do you talk to your friends about what you do in science class?	149	0.68	149	0.54	2.09*	-0.12	99	0.92	99	0.71	2.68**	-0.19

* $p < 0.05$, two-tailed; ** $p < 0.01$, two-tailed; *** $p < 0.001$, two-tailed. A negative r indicates that Fall 2011 has a higher score relative to Spring 2014.

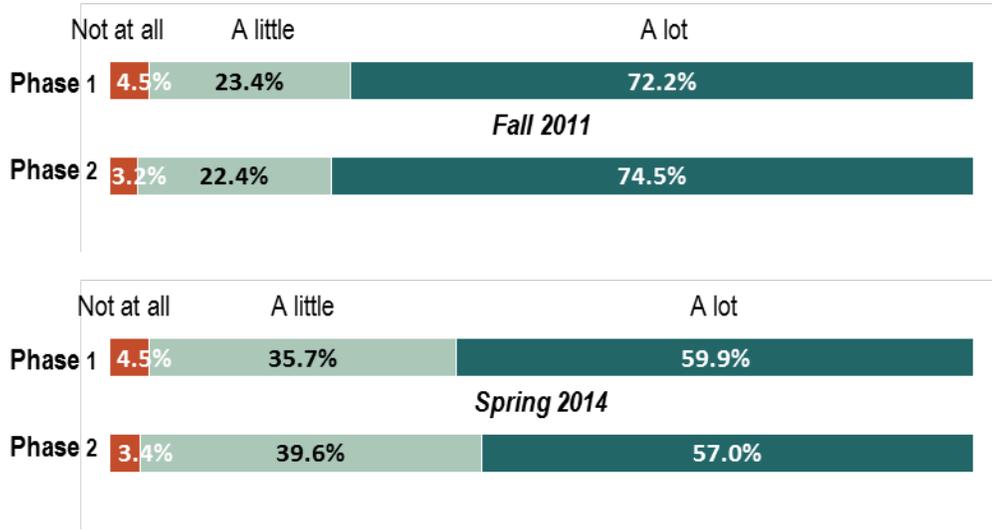
Table 20. Results of Marginal Homogeneity Test: Comparison of the Distributions of Houston Middle School Cohort Students' Responses within the Phase 1 and Phase 2 Groups

		Marginal Homogeneity Test		
		N	Standard MH Statistic	p
Do you think science will be useful to you when you are older?	Phase 1	150	4.58	<0.001*
	Phase 2	100	3.57	<0.001*
Would you like to be a scientist when you are older?	Phase 1	149	3.56	<0.001*
	Phase 2	98	3.64	<0.001*

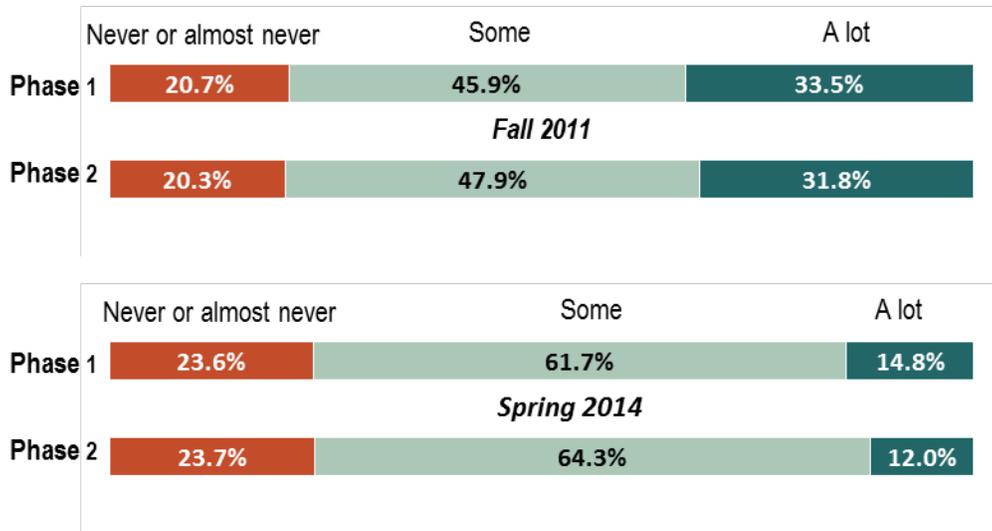
*Statistically significant at $p < 0.05$. For the Standard MH Statistic, a negative value indicates that the Spring 2014 has a higher score relative to Fall 2011.

Figure 3. Student Attitude Survey, Houston: Fall 2011 and Spring 2014: Elementary Cohort Question Responses by Group

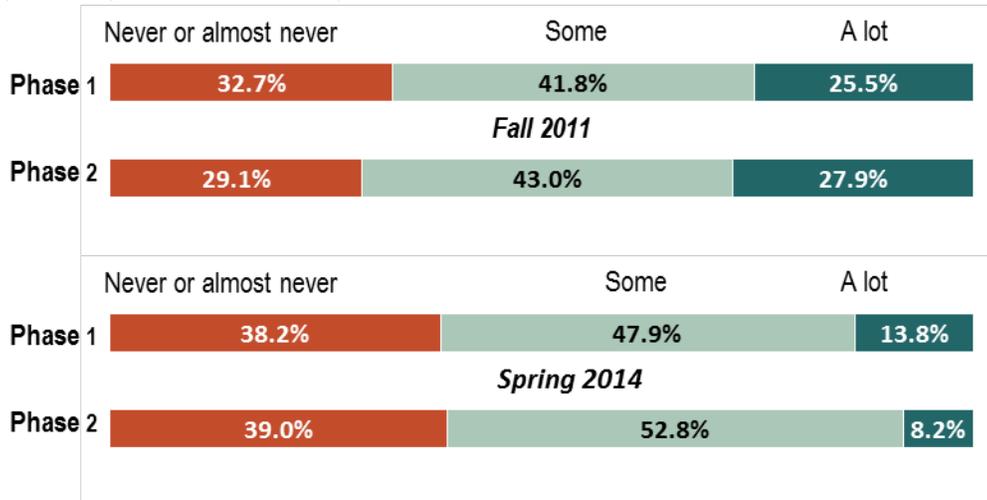
I like Science ...



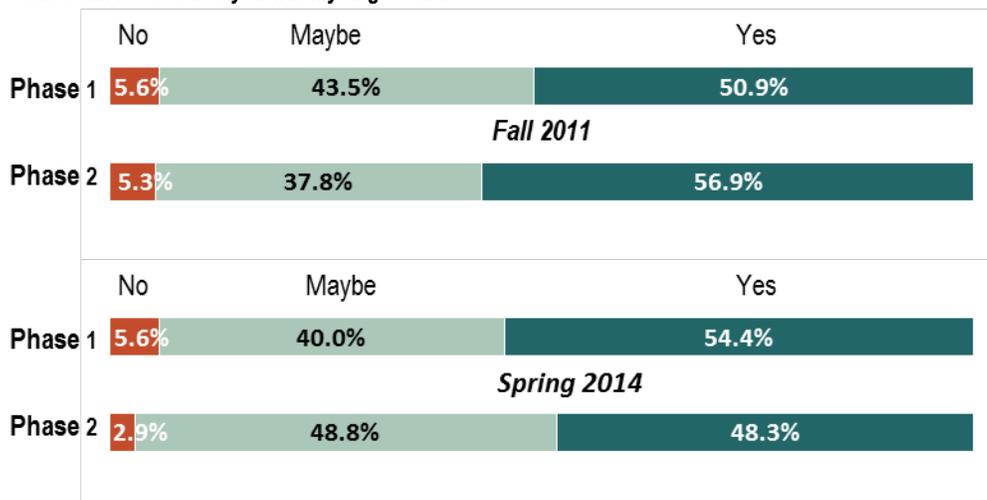
How often do you talk to your family about what you do in science class?



How often do you talk to your friends about what you do in science class?



Do you think Science will be useful to you when you get older?



Would you like to be a scientist when you are older?

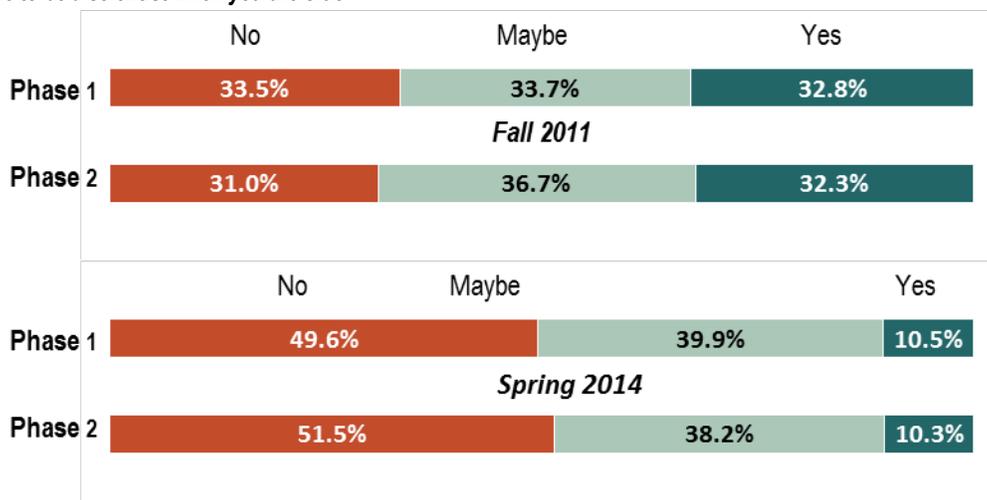
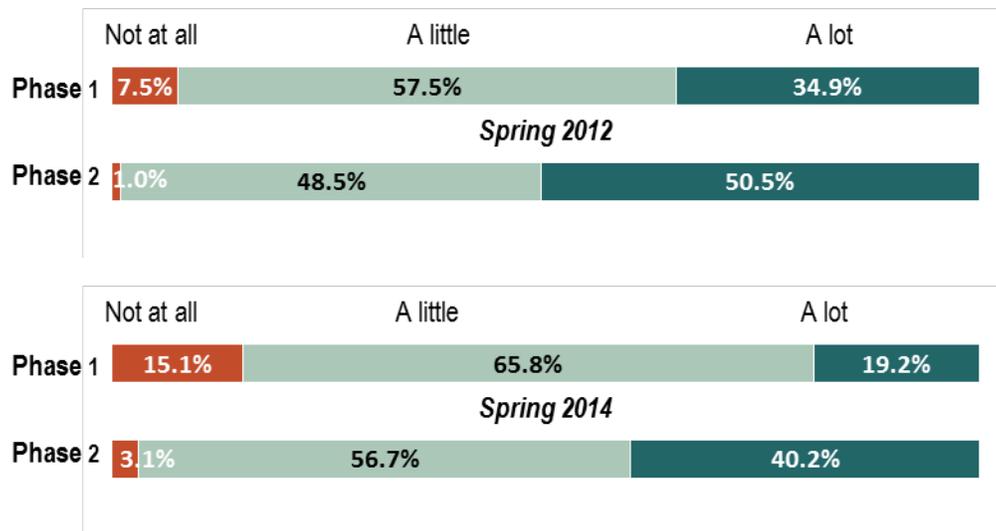
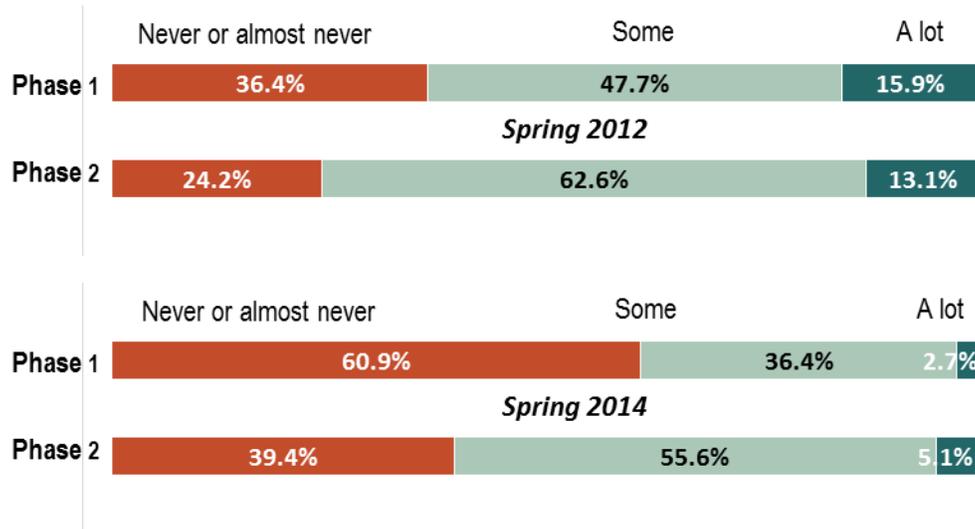


Figure 4. Student Attitude Survey, Houston: Fall 2011 and Spring 2014: Middle School Cohort Question Responses by Group

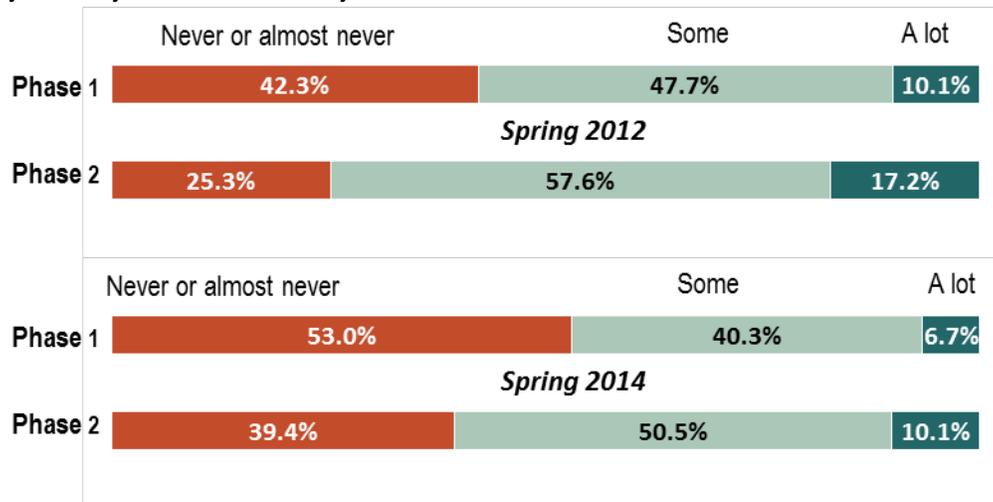
I like Science ...



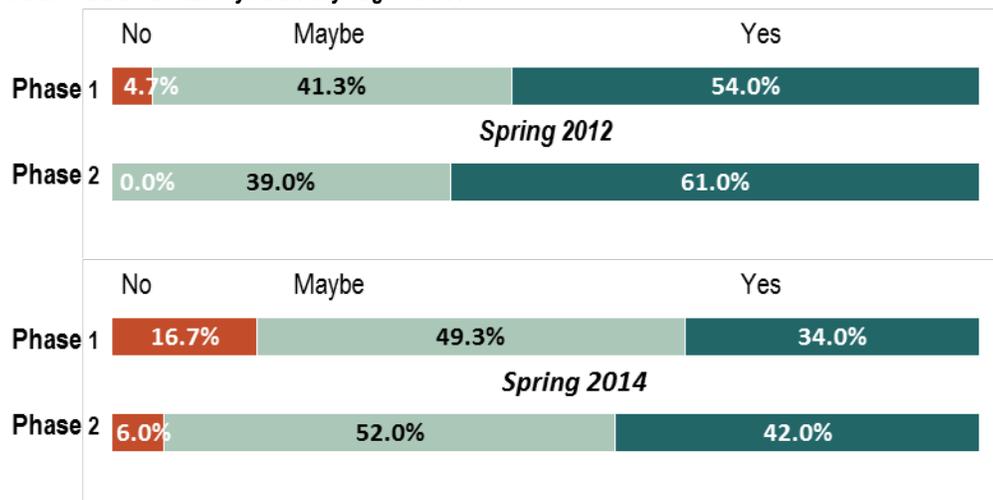
How often do you talk to your family about what you do in science class?



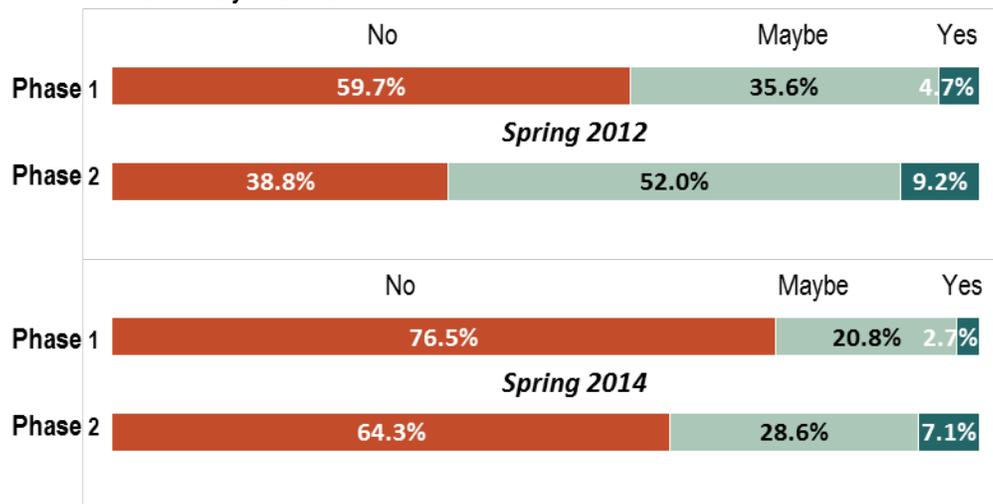
How often do you talk to your friends about what you do in science class?



Do you think Science will be useful to you when you get older?



Would you like to be a scientist when you are older?



Overall Summary of Houston PASS Student Attitudes Results

Between-group difference

For the Elementary Cohort in HISD, on the three Likert-scale items (“I like science”, “How often do you talk to your family about what you do in science class?”, and “How often do you talk to your friends about what you do in science class?”), none of the items examined exhibited either statistically significant or substantively meaningful differences between Phase 1 and Phase 2 students either at the baseline (Fall 2011) or in Spring 2014. However, for the Middle School Cohort, statistically significant and substantively meaningful differences between Phase 1 and Phase 2 students were found on two of the items in both Spring 2012 and Spring 2014: “I like science” and “How often do you talk to your friends about what you do in science class?”, both of which favored Phase 2 at both time points. Meanwhile, while there was no statistically or substantively meaningful difference between the groups in Spring 2012 on the item “How often do you talk to your family about what you do in science class?”, there was both a statistically significant and substantively meaningful difference in Spring 2014 that favored Phase 2 ($g = -0.43$).

For the two nominal scale items (“Do you think science will be useful to you when you are older?” and “Would you like to be a scientist when you are older?”), both groups in the Elementary Cohort had similar attitudes at both time points: neither statistically significant nor substantively meaningful differences between Phase 1 and Phase 2 students were found except for the difference on the first question in Spring 2014. For this question, there was a statistically significant difference between the two groups, but the difference was not substantively meaningful, with Phase 1 having a higher percentage of students responding “Yes” (54.4% vs. 48.8%). Unlike the Elementary Cohort, there were substantively meaningful differences between Phase 1 and Phase 2 students in the Middle School Cohort for these two questions at both time points, although the differences were statistically significant only for the first question in Spring 2014 and the second question in Spring 2012.

In summary, where there was baseline equivalence between Phase 1 and Phase 2 students, there were only two statistically significant outcomes. For the first, Phase 1 Elementary Cohort students had a higher percentage of students respond “Yes” (54.4% vs. 48.8%) to the question “Do you think science will be useful to you when you are older?”, but the difference was not substantively important. For the second, Phase 2 Middle School Cohort students scored statistically significantly higher than Phase 1 students on the question “How often do you talk to your family about what you do in science class?”, with an effect size ($g = 0.43$) that was substantively important.

Within-group difference

For the three Likert-scale items, both Phase 1 and Phase 2 students in the Elementary Cohort liked science more or were more likely to talk to their friends or families about science in Fall 2011 compared to Spring 2014, with the changes within both groups being statistically significant. However, all of the changes were considered to be small. For the Middle School Cohort, both groups liked science more or were more likely to talk to their friends or families about science in Spring 2012 compared to Spring 2014. All differences were statistically significant except for the responses of Phase 2 students to the item “I like science”. However, the only meaningful change was found for Phase 1 students on the item “How often do you talk to your family about what you do in science class?”, which had a medium effect size.

For the nominal scale item “Do you think science will be useful to you when you are older?”, only Phase 1 and Phase 2 students in the Middle School Cohort demonstrated statistically significant differences from Spring 2012 to Spring 2014, with a higher percentage of agreement in Spring 2012 for both groups. For the other nominal scale item “Would you like to be a scientist when you are older?”, both groups had a

statistically significantly higher percentage of agreement at the baseline (Fall 2011 or Spring 2012). However, since no effect size measure for the marginal homogeneity test was available, we do not know whether these statistically significant differences were substantively important.

New Mexico Region: Results for Spring 2014 PASS Student Attitudes Toward Science

New Mexico Spring 2014 PASS Student Attitudes Key Findings for Phase 1

For all students combined in the New Mexico region, the following outcomes favoring Phase 1 students were found on the Spring 2014 PASS Student Attitudes section.

- For the between-group differences, on the two nominal questions (“Do you think science will be useful to you when you are older?” and “Would you like to be a scientist when you are older?”), the only meaningful difference between Phase 1 and Phase 2 students was found for the Middle School Cohort in Spring 2014 on the item “Would you like to be a scientist when you are older?”, where Phase 1 students were more likely to respond “Yes” or “Maybe” (29% total) compared to Phase 2 (15.2% total). In addition, while the difference did not reach a substantively meaningful level, there was a statistically significant difference for the Elementary Cohort in Spring 2014 on the item “Do you think science will be useful when you are older?”, with a higher percentage of Phase 1 students responding “Yes” (57.2% vs. 47.5%). Furthermore, while the largest percentage of Phase 1 students responded “Yes” at both time points to this question, the largest percentage of Phase 2 students responded “Yes” in Fall 2011 and “Maybe” in Spring 2014.

New Mexico: Fall 2011 to Spring 2014 PASS Student Attitudes Results

PASS student attitudes survey data results in the New Mexico region from the Fall 2011 (baseline or pre-intervention) and Spring 2014 (third posttest) administrations are currently available and are reported below.

Survey Questions: Student Attitudes Toward Science

Of the 14 total attitude questions on the student survey, the five questions related to student attitudes towards science have been selected for discussion. See Table A - 5 and Table A - 6 in Appendix A for the outcomes on all 14 student attitudes questions. Table 21 and Table 22 show the final analytic sample sizes included for the New Mexico region for the Elementary Cohort and Middle School Cohort respectively.

Table 21. PASS-Basic, New Mexico, Spring 2014: Samples for the Survey Analyses for Elementary Cohort

Sample	Phase 1	Phase 2
Initial Samples ¹	511	426
I like science.	474	280
How often do you talk to your family about what you do in science class?	462	280
How often do you talk to your friends about what you do in science class?	452	277
Do you think science will be useful when you are older?	481	284
Would you like to be a scientist when you are older?	470	278

¹ The number of students who answered at least one Student Attitudes question in Spring 2014

Table 22. PASS-Basic, New Mexico, Spring 2014: Samples for the Survey Analyses for Middle School Cohort

Sample	Phase 1	Phase 2
Initial Samples ¹	502	145
I like science.	373	84
How often do you talk to your family about what you do in science class?	376	79
How often do you talk to your friends about what you do in science class?	377	77
Do you think science will be useful when you are older?	376	82
Would you like to be a scientist when you are older?	372	79

¹ The number of students who answered at least one Student Attitudes question in Spring 2014

Fall 2011 & Spring 2014 New Mexico Results: Comparison of Phase 1 and Phase 2 Student Attitudes Toward Science

The results of the Mann-Whitney U test for the Elementary Cohort and the Middle School Cohort are summarized in Table 23 and Table 25, respectively. The results of the chi-square test of independence for the Elementary Cohort and the Middle School Cohort are summarized in Table 24 and Table 26 respectively.

Elementary Cohort Results (Figure 5, page 57): Between Group Comparisons)

- “I like science”

As shown in Table 23, the Mann-Whitney U test results revealed that Phase 1 students had statistically significantly and substantively importantly higher scores (i.e., a higher level of agreement) than Phase 2 students in Fall 2011 ($Z = -3.59$, $p < 0.001$, $g = 0.27$). In contrast, although Phase 1 students had higher scores than Phase 2 students in Spring 2014, the difference was neither statistically significant nor substantively important.

- “How often do you talk to your family about what you do in science class?”

As shown in Table 23, the Mann-Whitney U test results revealed that Phase 1 students had statistically significantly and substantively higher scores (i.e., a higher level of agreement) than Phase 2 students in Fall 2011 ($Z = -3.32$, $p = 0.001$, $g = 0.25$). Meanwhile although Phase 1 students had higher scores than Phase 2 students in Spring 2014, the difference was neither statistically significant nor substantively important.

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 23, the Mann-Whitney U test results revealed that Phase 1 students had higher scores (i.e., a higher frequency) than Phase 2 students in both Fall 2011 and Spring 2014, with the difference in Spring 2014 being statistically significant ($Z = -2.34$, $p = 0.019$, $g = 0.18$). However, neither of the associated effect sizes was substantively important.

- “Do you think science will be useful when you are older?”

As shown in the top section of Table 24, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was statistically significantly different in both Fall 2011 and Spring 2014 ($\chi^2(2) = 10.32$, $p = 0.006$, $g = 0.23$ and $\chi^2(2) = 7.16$, $p = 0.028$, $g = 0.19$, respectively). However, neither difference was substantively important. Examination of the cell standardized residuals (*s.r.*) showed that none of the cells individually was a major contributor to the overall statistically significant relationship between Phase and response for students at either time point. Rather, they worked jointly to contribute to the overall statistical significance, with a higher percentage of Phase 1 students responding “Yes” in both Fall 2011 (61.3% vs. 50.7%) and Spring 2014 (57.2% vs. 47.5%). In addition, while the largest percentage of Phase 1 students responded “Yes” at both time points, the largest percentage of Phase 2 students responded “Yes” in Fall 2011 and “Maybe” in Spring 2014.

- “Would you like to be a scientist when you are older?”

As shown in the bottom section of Table 24, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was not statistically significantly

different in Spring 2014, whereas the difference was statistically significant in Fall 2011 ($\chi^2(2) = 8.98, p = 0.011, g = 0.22$). However, neither difference was substantively important. Examination of the cell standardized residuals (*s.r.*) showed that none of the cells individually was a major contributor to the overall statistically significant relationship between Phase and response for students in Fall 2011. Rather, they worked jointly to contribute to the overall statistical significance, with a higher percentage of Phase 1 students responding “Yes” (24.9% vs. 19.1%). Note that in Fall 2011, the largest percentage of Phase 1 students responded “Maybe”, while the largest percentage of Phase 2 students responded “No”. In Spring 2014, the largest percentage of both Phase 1 and Phase 2 students responded “No” (50.2% vs. 53.2%).

Table 23. Results of Mann-Whitney U Test: Comparison of New Mexico Elementary Cohort Phase 1 and Phase 2 Students' Responses

	Fall 2011						Spring 2014					
	Phase 1		Phase 2		Z	g	Phase 1		Phase 2		Z	g
	N	Mean	N	Mean			N	Mean	N	Mean		
I like science.	474	1.74	280	1.62	-3.59***	0.27	474	1.54	280	1.51	-0.89	0.07
How often do you talk to your family about what you do in science class?	462	1.07	280	0.89	-3.32**	0.25	462	0.90	280	0.87	-0.70	0.05
How often do you talk to your friends about what you do in science class?	452	0.70	277	0.64	-0.96	0.07	452	0.70	277	0.59	2.34*	0.18

** $p < 0.05$, two-tailed; *** $p < 0.001$, two-tailed. A negative *g* indicates that Phase 2 has a higher score relative to Phase 1.

Table 24. Results of Chi-Square Test: Comparison of New Mexico Elementary Cohort Phase 1 and Phase 2 Students' Responses

Do you think science will be useful to you when you are older?												
	Fall 2011						Spring 2014					
	$(\chi^2(2) = 10.32, p = 0.006^*, \text{Cramer's } V = 0.12, g = 0.23)$						$(\chi^2(2) = 7.16, p = 0.028^*, \text{Cramer's } V = 0.10, g = 0.19)$					
	Phase 1		Phase 2		<i>s.r.</i>		Phase 1		Phase 2		<i>s.r.</i>	
<i>n</i>	%	<i>n</i>	%	<i>n</i>			%	<i>n</i>	%			
Yes	295	61.3	1.1	144	50.7	-1.5	275	57.2	1.1	135	47.5	-1.4
Maybe	172	35.8	-1.0	123	43.3	1.3	185	38.5	-1.2	137	48.2	1.6
No	14	2.9	-1.2	17	6.0	1.6	21	4.4	0.1	12	4.2	-0.1

Would you like to be a scientist when you are older?												
	Fall 2011						Spring 2014					
	$(\chi^2(2) = 8.98, p = 0.011^*, \text{Cramer's } V = 0.11, g = 0.22)$						$(\chi^2(2) = 1.44, p = 0.487, \text{Cramer's } V = 0.04, g = 0.09)$					
	Phase 1		Phase 2		<i>s.r.</i>		Phase 1		Phase 2		<i>s.r.</i>	
<i>n</i>	%	<i>n</i>	%	<i>n</i>			%	<i>n</i>	%			
Yes	117	24.9	1.0	53	19.1	-1.3	66	14.0	0.6	31	11.2	-0.8
Maybe	178	37.9	0.7	91	32.7	-0.9	168	35.7	0.0	99	35.6	0.0
No	175	37.2	-1.4	134	48.2	1.8	236	50.2	-0.3	148	53.2	0.4

Note. *s.r.* = standardized residual.
*Statistically significant at $p < 0.05$

Middle School Cohort Results (Figure 6, page 59): Between Group Comparisons)

- “I like science”

As shown in Table 25, the Mann-Whitney U test results revealed that Phase 1 students had both statistically significantly and substantively higher scores (i.e., a higher level of agreement) than Phase 2 students in both Fall 2011 and Spring 2014 ($Z = -2.27, p = 0.023, g = 0.27$ and $Z = -2.04, p = 0.042, g = 0.25$, respectively).

- “How often do you talk to your family about what you do in science class?”

As shown in Table 25, Phase 1 students had slightly higher scores (i.e., a higher frequency) than Phase 2 students in Spring 2014, whereas Phase 1 and Phase 2 students had almost the same scores in Fall 2011. However, the Mann-Whitney U test results revealed such differences were neither statistically significantly different nor substantively important in either Fall 2011 or Spring 2014.

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 25, Phase 1 students had higher scores (i.e., a higher frequency) than Phase 2 students in Spring 2014, whereas Phase 2 students had slightly higher scores in Fall 2011. However, the Mann-Whitney U test results revealed such differences were neither statistically significantly different nor substantively important in either Fall 2011 or Spring 2014.

- “Do you think science will be useful when you are older?”

As shown in the top section of Table 26, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was neither statistically significant nor substantively important in either Fall 2011 or Spring 2014. The largest percentage of Phase 1 and Phase 2 students in Fall 2011 responded “Yes”, whereas the largest percentage of Phase 1 and Phase 2 students in Spring 2014 responded “Maybe”.

- “Would you like to be a scientist when you are older?”

As shown in the bottom section of Table 26, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was neither statistically significant nor substantively important in Fall 2011; however, the level of agreement was both statistically significant and substantively important in Spring 2014 ($\chi^2(2) = 8.06, p = 0.018, g = 0.27$). Examination of the cell standardized residuals (*s.r.*) showed that “Maybe” response by Phase 2 students was a major contributor to the overall significant relationship between Phase and students’ response in Spring 2014, with Phase 2 having fewer than expected “Maybe” responses. The largest percentage of Phase 1 and Phase 2 students at both time points responded “No”, with the percentage choosing “No” being higher in Spring 2014.

Table 25. Results of Mann-Whitney U Test: Comparison of New Mexico Middle School Cohort Phase 1 and Phase 2 Students' Responses

	Fall 2011						Spring 2014					
	Phase 1		Phase 2		Z	g	Phase 1		Phase 2		Z	g
	N	Mean	N	Mean			N	Mean	N	Mean		
I like science.	373	1.54	84	1.39	-2.27*	0.27	373	1.16	84	1.01	-2.04*	0.25
How often do you talk to your family about what you do in science class?	376	0.99	79	0.99	-0.09	0.01	376	0.57	79	0.44	-1.49	0.18
How often do you talk to your friends about what you do in science class?	377	0.72	77	0.74	0.30	-0.04	377	0.59	77	0.48	-1.41	0.18

* $p < 0.05$, two-tailed. A negative g indicates that Phase 2 has a higher score relative to Phase 1.

Table 26. Results of Chi-Square Test: Comparison of New Mexico Middle School Cohort Phase 1 and Phase 2 Students' Responses

Do you think science will be useful to you when you are older?												
	Fall 2011						Spring 2014					
	$(\chi^2(2) = 0.43, p = 0.809, \text{Cramer's } V = 0.03, g = 0.06)$						$(\chi^2(2) = 4.40, p = 0.111, \text{Cramer's } V = 0.10, g = 0.20)$					
	Phase 1		Phase 2		s.r.		Phase 1		Phase 2		s.r.	
n	%	n	%	n			%	n	%			
Yes	212	56.4	0.2	43	52.4	-0.4	125	33.2	0.5	21	25.6	-1.0
Maybe	147	39.1	-0.2	35	42.7	0.4	186	49.5	-0.6	51	62.2	1.3
No	17	4.5	-0.1	4	4.9	0.1	65	17.3	0.4	10	12.2	-0.9

Would you like to be a scientist when you are older?												
	Fall 2011						Spring 2014					
	$(\chi^2(2) = 2.08, p = 0.354, \text{Cramer's } V = 0.07, g = 0.14)$						$(\chi^2(2) = 8.06, p = 0.018^*, \text{Cramer's } V = 0.13, g = 0.27)$					
	Phase 1		Phase 2		s.r.		Phase 1		Phase 2		s.r.	
n	%	n	%	n			%	n	%			
Yes	34	9.1	0.5	4	5.1	-1.0	16	4.3	-0.1	4	5.1	0.3
Maybe	148	39.8	0.2	29	36.7	-0.4	92	24.7	1.0	8	10.1	-2.3
No	190	51.1	-0.3	46	58.2	0.7	264	71.0	-0.5	67	84.8	1.2

Note. s.r. = standardized residual.

*Statistically significant at $p < 0.05$

New Mexico Results: Comparison of Student Attitude Toward Science from Fall 2011 to Spring 2014

The results of the Wilcoxon Signed-rank test for the Elementary Cohort and Middle School Cohort are summarized in Table 27 and Table 29, respectively. The results of the marginal homogeneity test for the Elementary Cohort and Middle School Cohort are summarized in Table 28 and Table 30, respectively.

Elementary Cohort Results (Figure 5, page 57): Within Group Comparisons

- “I like science”

As shown in Table 27, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores in Fall 2011 than in Spring 2014 ($Z = 6.14$, $p < 0.001$, $r = -0.20$ and $Z = 2.67$, $p = 0.008$, $r = -0.11$, respectively). Furthermore, the associated effect size for both Phase 1 and Phase 2 within-group difference were small in magnitude.

- “How often do you talk to your family about what you do in science class?”

As shown in Table 27, both Phase 1 and Phase 2 students had higher scores (i.e., a higher frequency) in Fall 2011 than in Spring 2014. The Wilcoxon Signed-rank test revealed that the within-group difference was not statistically significant for Phase 2 students, but was statistically significant for Phase 1 students ($Z = 4.13$, $p < 0.001$, $r = -0.14$). Furthermore, the associated effect size for the Phase 1 within-group difference was small in magnitude, while the difference for Phase 2 was Negligible.

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 27, Phase 2 students had slightly higher scores (i.e., a higher frequency) in Fall 2011 than in Spring 2014. Phase 1 students had almost the same scores at both time points. The Wilcoxon Signed-rank test suggested that the within-group differences for both Phase 1 and Phase 2 students were not statistically significant. Furthermore, the associated effect sizes for both the Phase 1 and Phase 2 within-group differences were Negligible in magnitude.

- “Do you think science will be useful when you are older?”

As shown in Table 28, the marginal homogeneity tests showed that there were no statistically significant differences in the level of agreement for this question within either the Phase 1 or Phase 2 student groups from Fall 2011 to Spring 2014. The level of agreement was higher in Fall 2011 for both groups.

- “Would you like to be a scientist when you are older?”

As shown in Table 28, the marginal homogeneity tests showed that there were statistically significant differences in the level of agreement for this question within both the Phase 1 and Phase 2 groups from Fall 2011 to Spring 2014 ($MH = 5.61$, $p < 0.001$ and $MH = 2.55$, $p = 0.011$, respectively), with the level of agreement being higher in Fall 2011 for both groups.

Table 27. Results of Wilcoxon Signed-Rank Test: Comparison of New Mexico Elementary Cohort Students' Responses within the Phase 1 and Phase 2 Groups

	Phase 1						Phase 2					
	Fall 2011		Spring 2014		Z	r	Fall 2011		Spring 2014		Z	r
	N	Mean	N	Mean			N	Mean	N	Mean		
I like science.	474	1.74	474	1.54	6.14***	-0.20	280	1.62	280	1.51	2.67**	-0.11
How often do you talk to your family about what you do in science class?	462	1.07	462	0.90	4.13***	-0.14	280	0.89	280	0.87	0.47	-0.02
How often do you talk to your friends about what you do in science class?	452	0.70	452	0.70	-0.01	0.00	277	0.64	277	0.59	1.03	-0.04

** $p < 0.01$; *** $p < 0.001$, two-tailed. A negative r indicates that Fall 2011 has a higher score relative to Spring 2014.

Table 28. Results of Marginal Homogeneity Test: Comparison of the Distributions of New Mexico Elementary Cohort Students' Responses within the Phase 1 and Phase 2 Groups

		Marginal Homogeneity Test		
		N	Standard MH Statistic	p
Do you think science will be useful to you when you are older?	Phase 1	481	1.62	0.105
	Phase 2	284	0.30	0.762
Would you like to be a scientist when you are older?	Phase 1	470	5.61	<0.001*
	Phase 2	278	2.55	0.011*

*Statistically significant at $p < 0.05$. For the Standard MH Statistic, a negative value indicates that the Spring 2014 has a higher score relative to Fall 2011.

Middle School Cohort Results (Figure 6, page 59): Within Group Comparisons

- “I like science”

As shown in Table 29, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores in Fall 2011 than in Spring 2014 ($Z = 8.46, p < 0.001, r = -0.31$ and $Z = 4.26, p < 0.001, r = -0.33$, respectively). The associated effect size for both the Phase 1 and Phase 2 within-group difference was medium in magnitude.

- “How often do you talk to your family about what you do in science class?”

As shown in Table 29, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores (i.e., a higher frequency) in Fall 2011 than in Spring 2014 ($Z = 8.95, p < 0.001, r = -0.33$ and $Z = 5.48, p < 0.001, r = -0.44$, respectively). The associated effect size for both the Phase 1 and Phase 2 within-group difference was medium in magnitude.

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 29, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores (i.e., a higher frequency) in Fall 2011 than in Spring 2014 ($Z = 3.11, p = 0.002, r = -0.11$ and $Z = 2.40, p = 0.016, r = -0.19$, respectively). The associated effect size for both the Phase 1 and Phase 2 within-group difference was small in magnitude.

- “Do you think science will be useful when you are older?”

As shown in Table 30, the marginal homogeneity tests showed that there were statistically significant differences in the level of agreement for this question within both the Phase 1 and Phase 2 groups from Fall 2011 to Spring 2014 ($MH = 7.76, p < 0.001$ and $MH = 3.88, p < 0.001$, respectively), with the level of agreement being higher in Fall 2011 for both groups.

- “Would you like to be a scientist when you are older?”

As shown in Table 30, the marginal homogeneity tests showed that there were statistically significant differences in the level of agreement for this question within both the Phase 1 and Phase 2 groups from Fall 2011 to Spring 2014 ($MH = 6.32, p < 0.001$ and $MH = 3.20, p = 0.001$, respectively), with the level of agreement being higher in Fall 2011 for both groups.

Table 29. Results of Wilcoxon Signed-Rank Test: Comparison of New Mexico Middle School Cohort Students' Responses within the Phase 1 and Phase 2 Groups

	Phase 1						Phase 2					
	Fall 2011		Spring 2014		Z	r	Fall 2011		Spring 2014		Z	r
	N	Mean	N	Mean			N	Mean	N	Mean		
I like science.	373	1.54	373	1.16	8.46***	-0.31	84	1.39	84	1.01	4.26***	-0.33
How often do you talk to your family about what you do in science class?	376	0.99	376	0.57	8.95***	-0.33	79	0.99	79	0.44	5.48***	-0.44
How often do you talk to your friends about what you do in science class?	377	0.72	377	0.59	3.11**	-0.11	77	0.74	77	0.48	2.40*	-0.19

* $p < 0.05$, two-tailed; ** $p < 0.01$; *** $p < 0.001$, two-tailed. A negative r indicates that Fall 2011 has a higher score relative to Spring 2014.

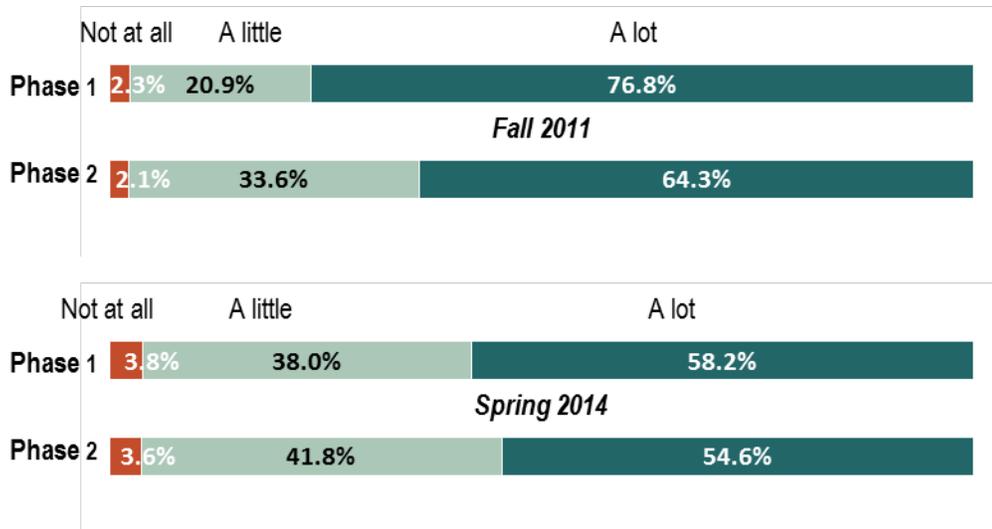
Table 30. Results of Marginal Homogeneity Test: Comparison of the Distributions of New Mexico Middle School Cohort Students' Responses within the Phase 1 and Phase 2 Groups

	Marginal Homogeneity Test			
		N	Standard MH Statistic	p
Do you think science will be useful to you when you are older?	Phase 1	376	7.76	<0.001*
	Phase 2	82	3.88	<0.001*
Would you like to be a scientist when you are older?	Phase 1	372	6.32	<0.001*
	Phase 2	79	3.20	0.001*

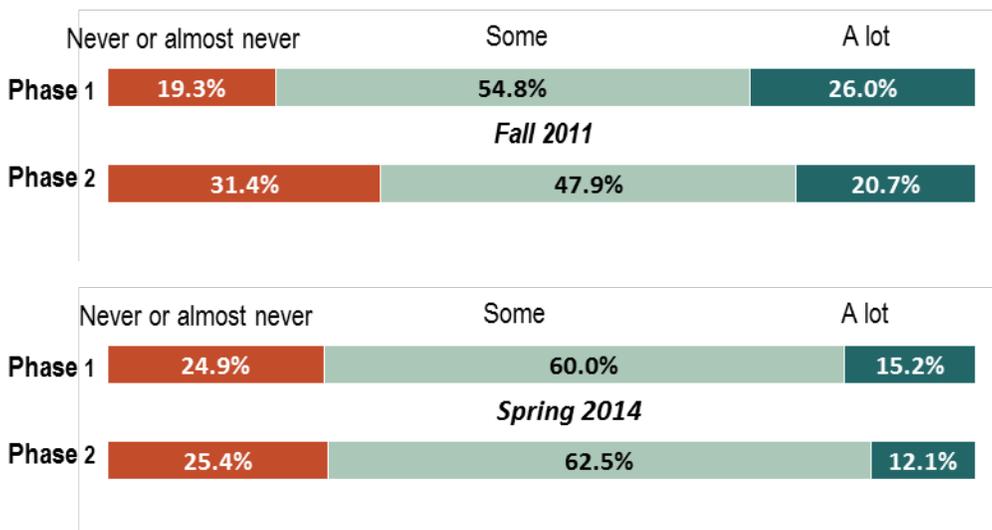
*Statistically significant at $p < 0.05$. For the Standard MH Statistic, a negative value indicates that the Spring 2014 has a higher score relative to Fall 2011.

Figure 5. Student Attitude Survey, New Mexico: Fall 2011 and Spring 2014: Elementary Cohort Question Responses by Group

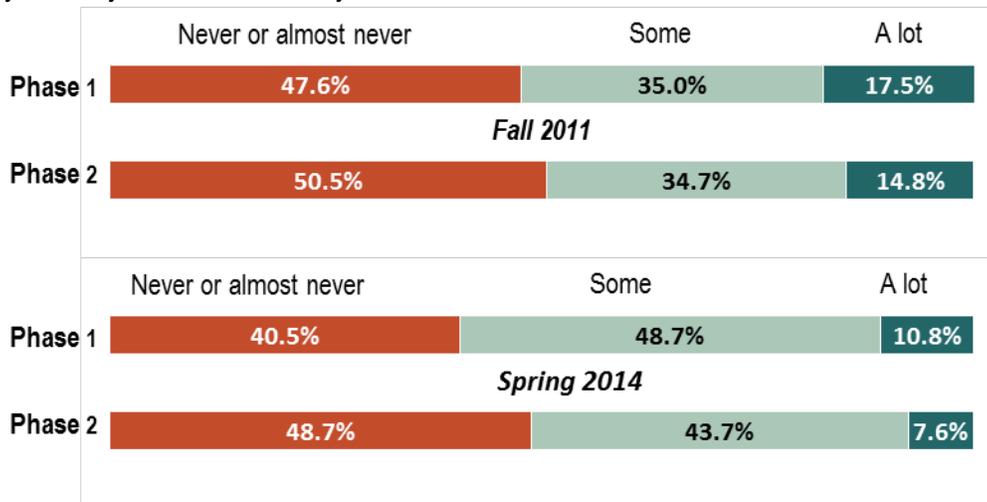
I like Science ...



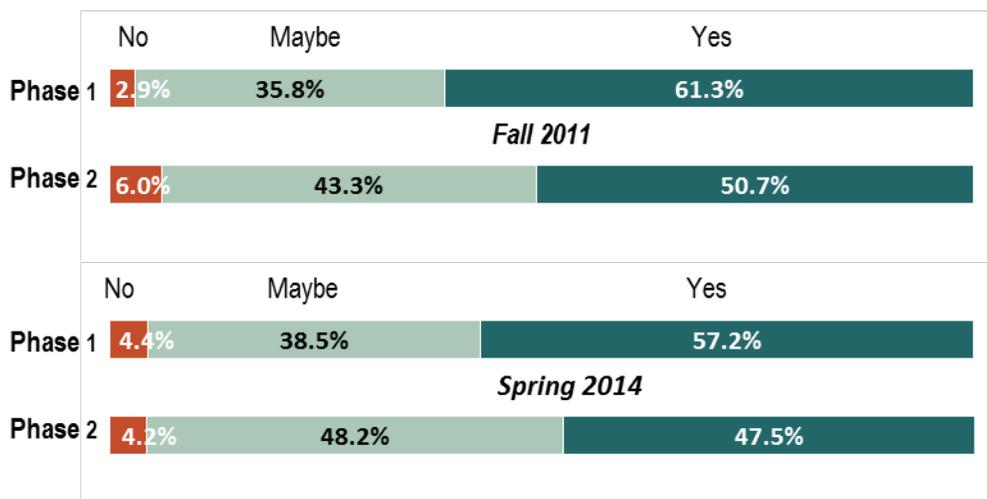
How often do you talk to your family about what you do in science class?



How often do you talk to your friends about what you do in science class?



Do you think Science will be useful to you when you get older?



Would you like to be a scientist when you are older?

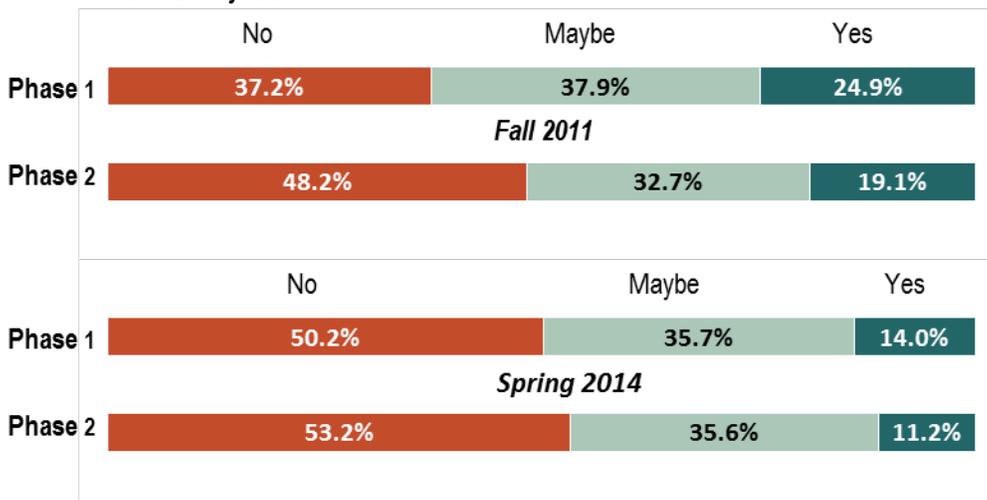
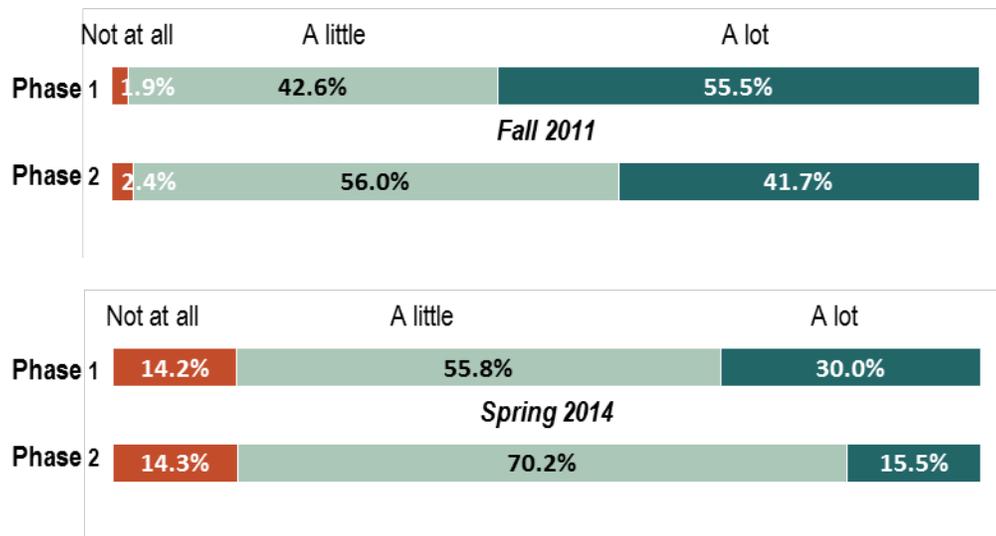
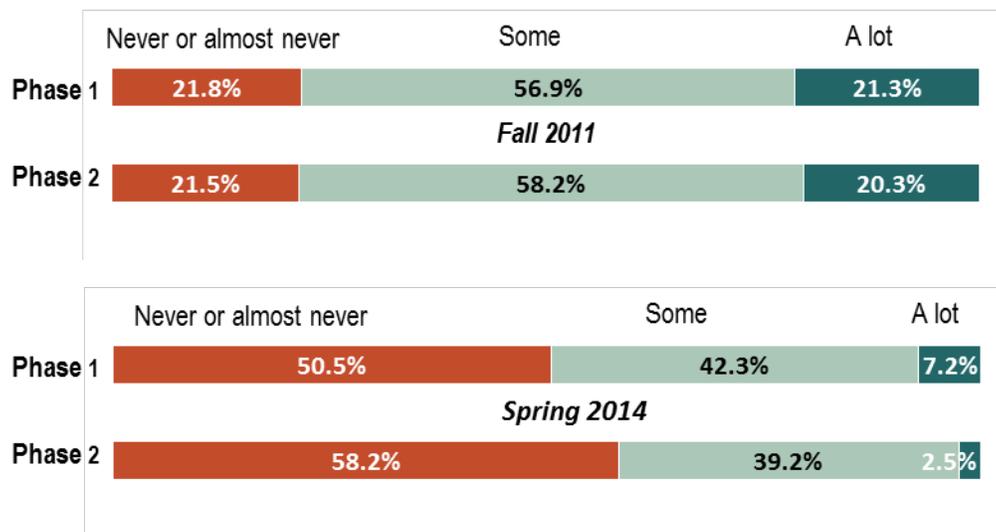


Figure 6. Student Attitude Survey, New Mexico: Fall 2011 and Spring 2014: Middle School Cohort Question Responses by Group

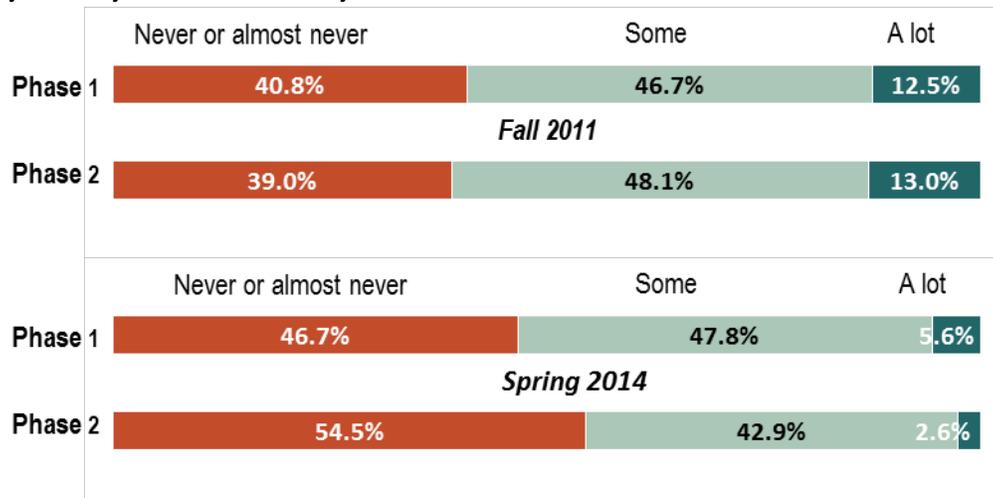
I like Science ...



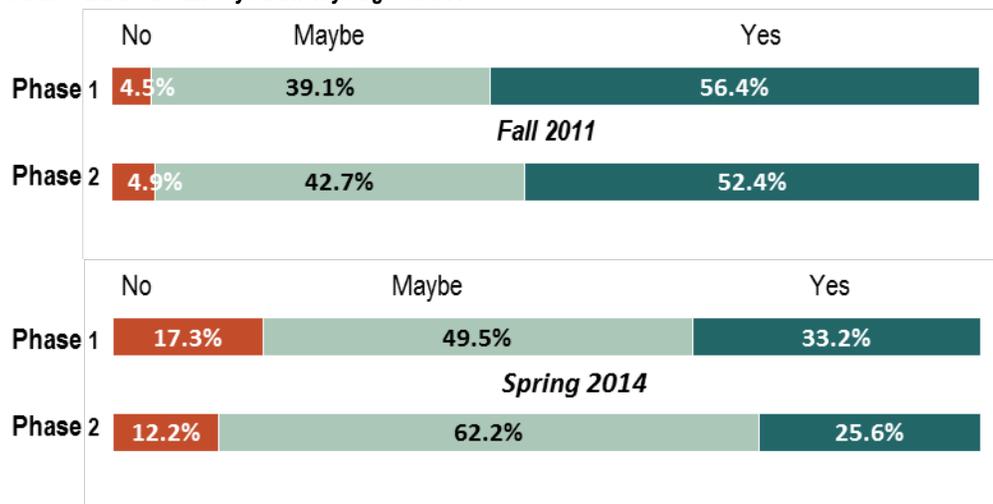
How often do you talk to your family about what you do in science class?



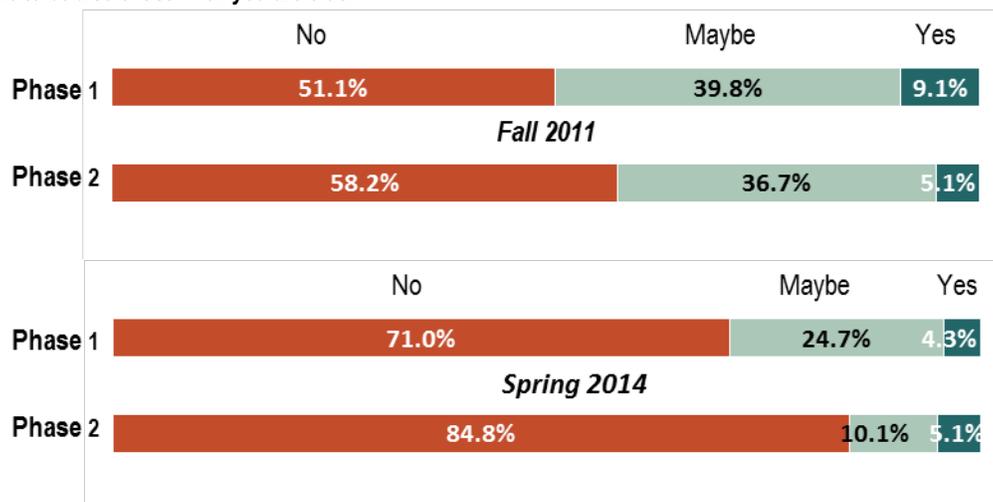
How often do you talk to your friends about what you do in science class?



Do you think Science will be useful to you when you get older?



Would you like to be a scientist when you are older?



Overall Summary of New Mexico PASS Student Attitudes Results

Between-group difference

For two of the three Likert-scale items (“I like science” and “How often do you talk to your family about what you do in science class?”), Phase 1 students in both the Elementary and Middle School cohorts in the New Mexico region had higher levels of agreement at both time points compared to Phase 2 students. On the third Likert-scale item (“How often do you talk to your friends about what you do in science class?”), while Phase 1 students in the Elementary Cohort also had higher levels of agreement in both Fall 2011 and Spring 2014, Phase 2 students in the Middle School Cohort were more likely to talk to their friends in Fall 2011 relative to Phase 1 students, but not in Spring 2014. Furthermore, for the Elementary Cohort, the first two items exhibited meaningful differences between Phase 1 and Phase 2 students at the baseline (Fall 2011), but not in Spring 2014. However, for the Middle School Cohort, the item “I like science” revealed meaningful differences favoring Phase 1 students at both the baseline (Fall 2011) and in Spring 2014.

For the two nominal questions (“Do you think science will be useful to you when you are older?” and “Would you like to be a scientist when you are older?”), the only meaningful difference between Phase 1 and Phase 2 students was found for the Middle School Cohort in Spring 2014 on the item “Would you like to be a scientist when you are older?”, where Phase 1 students were more likely to respond “Yes” or “Maybe” (29% total) compared to Phase 2 (15.2% total). While the difference did not reach a substantively meaningful level, there was a statistically significant difference for the Elementary Cohort in Spring 2014 on the item “Do you think science will be useful when you are older?”, with a higher percentage of Phase 1 students responding “Yes” (57.2% vs. 47.5%). In addition, while the largest percentage of Phase 1 students responded “Yes” at both time points to this question, the largest percentage of Phase 2 students responded “Yes” in Fall 2011 and “Maybe” in Spring 2014.

Within-group difference

For the three Likert-scale items (“I like science”, “How often do you talk to your family about what you do in science class?”, and “How often do you talk to your friends about what you do in science class?”), Phase 1 and Phase 2 students in both the Elementary and Middle School cohorts had higher levels of agreement in Fall 2011 compared to Spring 2014, except for the Elementary Cohort on the item “How often do you talk to your friends about what you do in science class?”, where the levels were essentially the same at both time points. For the Elementary Cohort, the attitudinal change within both groups from Fall 2011 to Spring 2014 was statistically significant only for the item “I like science”, with the level of agreement towards this item dropping for both groups. However, the magnitudes of these changes were small. In addition, the attitude change from Fall 2011 to Spring 2014 on the item “How often do you talk to your family about what you do in science class?” within Phase 1 group was statistically significant, being higher in Fall 2011, but was small and not substantively meaningful. The attitudinal changes from Fall 2011 to Spring 2014 within both groups in the Middle School Cohort were statistically significant on all three questions. However, the magnitudes of these changes within both groups were only meaningful, with Medium effect sizes, for questions “I like science” and “How often do you talk to your family about what you do in science class?”

For the two nominal scale items (“Do you think science will be useful to you when you are older?” and “Would you like to be a scientist when you are older?”), both cohorts on both questions had higher levels of agreement in Fall 2011 vs. Spring 2014. The differences were all statistically significant except for both Phase 1 and Phase 2 students in the Elementary Cohort on the question “Do you think science will be useful to you when you are older?”. However, since no effect size measure for the marginal homogeneity

test was available, we do not know whether these statistically significant differences were substantively important.

North Carolina Region: Results for Spring 2014 PASS Student Attitudes Toward Science

North Carolina Spring 2014 PASS Student Attitudes Key Findings for Phase 1

For all students combined in the North Carolina region, the following outcomes favoring Phase 1 students were found on the Spring 2014 PASS Student Attitudes section.

- For the between-group differences, where there was baseline equivalence between Phase 1 and Phase 2 students, there was only one statistically significant difference between groups in Spring 2014 for the Elementary Cohort on the question “How often do you talk to your friends about what you do in science class?”, but the difference was not substantively important.

- For the within-group differences, while not statistically significant, the Phase1 Elementary Cohort had higher level of agreement in Spring 2014 vs. the baseline (Fall 2011) on the item “Do you think science will be useful to you when you are older?”

North Carolina: Fall 2011 to Spring 2014 PASS Student Attitudes Results

PASS student attitudes survey data results in the North Carolina region from the Fall 2011 (baseline or pre-intervention) and Spring 2014 (third posttest) administrations are currently available and are reported below.

Survey Questions: Student Attitudes Toward Science

Of the 14 total attitude questions on the student survey, the five questions related to student attitudes towards science have been selected for discussion. See Table A - 7 and Table A - 8 in Appendix A for the outcomes on all 14 student attitudes questions. Table 31 and Table 32 show the final analytic sample sizes included in the North Carolina region for the Elementary Cohort and Middle School Cohort respectively.

Table 31. PASS-Basic, North Carolina, Spring 2014: Samples for the Survey Analyses for the Elementary Cohort

Sample	Phase 1	Phase 2
Initial Samples ¹	1,138	975
I like science.	1,029	871
How often do you talk to your family about what you do in science class?	1,049	870
How often do you talk to your friends about what you do in science class?	1,029	870
Do you think science will be useful when you are older?	1,050	883
Would you like to be a scientist when you are older?	1,037	867

¹ The number of students who answered at least one Student Attitudes question in Spring 2014

Table 32. PASS-Basic, North Carolina, Spring 2014: Samples for the Survey Analyses for the Middle School Cohort

Sample	Phase 1	Phase 2
Initial Samples ¹	552	1,031
I like science.	510	899
How often do you talk to your family about what you do in science class?	513	928
How often do you talk to your friends about what you do in science class?	510	923
Do you think science will be useful when you are older?	518	929
Would you like to be a scientist when you are older?	508	924

¹ The number of students who answered at least one Student Attitudes question in Spring 2014

Fall 2011 & Spring 2014 North Carolina Results: Comparison of Phase 1 and Phase 2 Student Attitudes Toward Science

The results of the Mann-Whitney *U* test for the Elementary Cohort and Middle School Cohort are summarized in Table 33 and Table 35, respectively. The results of the chi-square test of independence for the Elementary Cohort and Middle School Cohort are summarized in Table 34 and Table 36, respectively.

Elementary Cohort Results (Figure 7, page 77): Between Group Comparisons

- “I like science”

As shown in Table 33, Phase 1 students had higher scores (i.e., a higher level of agreement) than Phase 2 students in Spring 2014, whereas Phase 2 students had higher scores in Fall 2011. However, the Mann-Whitney *U* test results revealed such differences were neither statistically significantly different nor substantively important in either Fall 2011 or Spring 2014.

- “How often do you talk to your family about what you do in science class?”

As shown in Table 33, Phase 1 students had slightly higher scores (i.e., a higher frequency) than Phase 2 students in both Fall 2011 and Spring 2014. However, Mann-Whitney *U* test results revealed such differences were neither statistically significantly different nor substantively important at either time point.

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 33, the Mann-Whitney *U* test results revealed that Phase 1 students had statistically significantly higher scores (i.e., a higher frequency) than Phase 2 students in both Fall 2011 and Spring 2014 ($Z = -2.31, p = 0.021, g = 0.11$ and $Z = -2.96, p = 0.003, g = 0.14$, respectively). However, neither of the associated effect sizes was substantively important.

- “Do you think science will be useful when you are older?”

As shown in the top section of Table 34, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was neither statistically significantly different nor substantively important in either Fall 2011 or Spring 2014. Note that the largest percentage of Phase 1 students responded “Yes” in both Fall 2011 and Spring 2014, whereas the largest percentage of Phase 2 students responded “Maybe” in Fall 2011 and “Yes” in Spring 2014.

- “Would you like to be a scientist when you are older?”

As shown in the bottom section of Table 34, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was not statistically significantly different in Spring 2014, whereas the difference was statistically significant in Fall 2011 ($\chi^2(2) = 10.52, p = 0.005, g = 0.15$). However, neither difference was substantively important. Examination of the cell standardized residuals (*s.r.*) showed that none of the cells individually was a major contributor to the overall statistically significant relationship between Phase and response for students in Fall 2011. Rather, they worked jointly to contribute to the overall statistical significance, with a higher percentage of Phase 1 students responding “Yes” (21.1% vs. 16.0%). Note that more than half of Phase 1 and Phase 2 students responded “No” at both time points.

Table 33. Results of Mann-Whitney U Test: Comparison of North Carolina Elementary Cohort Phase 1 and Phase 2 Students' Responses

	Fall 2011						Spring 2014					
	Phase 1		Phase 2		Z	g	Phase 1		Phase 2		Z	g
	N	Mean	N	Mean			N	Mean	N	Mean		
I like science.	1,029	1.53	871	1.55	0.85	-0.04	1,029	1.51	871	1.48	-1.26	0.06
How often do you talk to your family about what you do in science class?	1,049	0.99	870	0.97	-0.37	0.02	1,049	0.92	870	0.90	-0.89	0.04
How often do you talk to your friends about what you do in science class?	1,029	0.72	870	0.64	-2.31*	0.11	1,029	0.72	870	0.63	-2.96**	0.14

* $p < 0.05$, two-tailed; ** $p < 0.01$, two-tailed. A negative g indicates that Phase 2 has a higher score relative to Phase 1.

Table 34. Results of Chi-Square Test: Comparison of North Carolina Elementary Cohort Phase 1 and Phase 2 Students' Responses

Do you think science will be useful to you when you are older?												
	Fall 2011						Spring 2014					
	$(X^2(2) = 3.50, p = 0.174, \text{Cramer's } V = 0.04, g = 0.09)$						$(X^2(2) = 1.50, p = 0.473, \text{Cramer's } V = 0.03, g = 0.06)$					
	Phase 1			Phase 2			Phase 1			Phase 2		
	n	%	s.r.	n	%	s.r.	n	%	s.r.	n	%	s.r.
Yes	493	47.0	0.9	379	42.9	-1.0	502	47.8	-0.4	439	49.7	0.4
Maybe	462	44.0	-0.6	411	46.6	0.6	476	45.3	0.2	394	44.6	-0.2
No	95	9.0	-0.7	83	10.5	0.8	72	6.9	0.7	50	5.7	-0.8

Would you like to be a scientist when you are older?												
	Fall 2011						Spring 2014					
	$(X^2(2) = 10.52, p = 0.005^*, \text{Cramer's } V = 0.07, g = 0.15)$						$(X^2(2) = 1.48, p = 0.478, \text{Cramer's } V = 0.03, g = 0.06)$					
	Phase 1			Phase 2			Phase 1			Phase 2		
	n	%	s.r.	n	%	s.r.	n	%	s.r.	n	%	s.r.
Yes	219	21.1	1.7	139	16.0	-1.9	82	7.9	0.5	60	6.9	-0.6
Maybe	273	26.3	-1.4	271	31.3	1.5	303	29.2	0.4	240	27.7	-0.5
No	545	52.6	0.0	457	52.7	0.0	652	62.9	-0.5	567	65.4	0.5

Note. s.r. = standardized residual.

*Statistically significant at $p < 0.05$

Middle School Cohort Results (Figure 8, page 79): Between Group Comparisons

- “I like science”

As shown in Table 35, the Mann-Whitney U test results revealed that Phase 2 students had higher scores (i.e., a higher level of agreement) than Phase 1 students in both Fall 2011 and Spring 2014, but only the difference in Spring 2014 was statistically significant ($Z = 2.28$, $p = 0.023$, $g = -0.13$). However, neither of associated effect sizes was substantively important.

- “How often do you talk to your family about what you do in science class?”

As shown in Table 35, the Mann-Whitney U test results revealed that Phase 2 students had higher scores (i.e., a higher frequency) than Phase 1 students in both Fall 2011 and Spring 2014, but only the difference in Spring 2014 was statistically significant ($Z = 3.65$, $p < 0.001$, $g = -0.20$). However, neither of associated effect sizes was substantively important.

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 35, Phase 2 students had slightly higher scores (i.e., a higher frequency) than Phase 1 students in both Fall 2011 and Spring 2014. However, the differences were neither statistically significant nor substantively important.

- “Do you think science will be useful when you are older?”

As shown in the top section of Table 36, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was not statistically significant in Fall 2011, whereas the difference was statistically significant in Spring 2014 ($\chi^2(2) = 14.93$, $p = 0.001$, $g = 0.20$). However, neither difference was substantively important. Examination of the cell standardized residuals (*s.r.*) showed that a lower than expected “Yes” response by Phase 1 students was a major contributor to the overall statistically significant relationship between Phase and students’ response in Spring 2014. Note that unlike the outcomes for the Elementary Cohort, the largest percentage of both Phase 1 and Phase 2 students responded “Yes” in Fall 2011, but “Maybe” in Spring 2014.

- “Would you like to be a scientist when you are older?”

As shown in the bottom section of Table 36, the chi-square test results revealed that the level of agreement between Phase 1 and Phase 2 students for this question was neither statistically significant nor substantively important in either Fall 2011 or Spring 2014. Like the outcomes for the Elementary Cohort, the largest percentage of Phase 1 and Phase 2 students at both time points responded “No”, with the percentage choosing “No” being higher in Spring 2014.

Table 35. Results of Mann-Whitney U Test: Comparison of North Carolina Middle School Cohort Phase 1 and Phase 2 Students' Responses

	Fall 2011						Spring 2014					
	Phase 1		Phase 2		Z	g	Phase 1		Phase 2		Z	g
	N	Mean	N	Mean			N	Mean	N	Mean		
I like science.	510	1.45	899	1.47	0.63	-0.04	510	1.15	899	1.22	2.28*	-0.13
How often do you talk to your family about what you do in science class?	513	0.95	928	0.98	0.85	-0.05	513	0.54	928	0.65	3.65***	-0.20
How often do you talk to your friends about what you do in science class?	510	0.74	923	0.78	0.66	-0.04	510	0.64	923	0.70	1.72	-0.10

* $p < 0.05$, two-tailed; *** $p < 0.001$, two-tailed. A negative g indicates that Phase 2 has a higher score relative to Phase 1.

Table 36. Results of Chi-Square Test: Comparison of North Carolina Middle School Cohort Phase 1 and Phase 2 Students' Responses

Do you think science will be useful to you when you are older?												
	Fall 2011 ($\chi^2(2) = 4.98, p = 0.083, \text{Cramer's } V = 0.06, g = 0.12$)						Spring 2014 ($\chi^2(2) = 14.93, p = 0.001^*, \text{Cramer's } V = 0.10, g = 0.20$)					
	Phase 1			Phase 2			Phase 1			Phase 2		
	n	%	s.r.	n	%	s.r.	n	%	s.r.	n	%	s.r.
Yes	281	54.3	-0.4	522	56.2	0.3	187	36.1	-2.2	425	45.7	1.6
Maybe	227	43.8	0.9	372	40.0	-0.6	269	51.9	1.2	429	46.2	-0.9
No	10	1.9	-1.5	35	3.8	1.1	62	12.0	1.9	75	8.1	-1.4

Would you like to be a scientist when you are older?												
	Fall 2011 ($\chi^2(2) = 2.80, p = 0.247, \text{Cramer's } V = 0.04, g = 0.09$)						Spring 2014 ($\chi^2(2) = 1.37, p = 0.505, \text{Cramer's } V = 0.03, g = 0.06$)					
	Phase 1			Phase 2			Phase 1			Phase 2		
	n	%	s.r.	n	%	s.r.	n	%	s.r.	n	%	s.r.
Yes	47	9.3	1.3	63	6.8	-0.9	20	3.9	0.4	32	3.5	-0.3
Maybe	158	31.1	-0.4	301	32.6	0.3	112	22.1	-0.8	228	24.7	0.6
No	303	59.6	-0.2	560	60.6	0.1	376	74.0	0.4	664	71.9	-0.3

Note. s.r. = standardized residual.

*Statistically significant at $p < 0.05$

North Carolina Results: Comparison of Student Attitude Toward Science from Fall 2011 to Spring 2014

The results of the Wilcoxon Signed-rank test for the Elementary Cohort and Middle School Cohort are summarized in Table 37 and Table 39, respectively. The results of the marginal homogeneity test for the Elementary Cohort and Middle School Cohort are summarized in Table 38 and Table 40, respectively.

Elementary Cohort Results (Figure 7, page 77): Within Group Comparisons

- “I like science”

As shown in Table 37, both Phase 1 and Phase 2 students had higher scores (i.e., a higher level of agreement) in Fall 2011 than in Spring 2014. The Wilcoxon Signed-rank test suggested that the within-group differences for Phase 1 students were not statistically significant. However, Phase 2 students had statistically significantly higher scores in Fall 2011 than in Spring 2014 ($Z = 2.40$, $p = 0.017$, $r = -0.06$). The associated effects for both groups were negligible.

- “How often do you talk to your family about what you do in science class?”

As shown in Table 37, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores (i.e., a higher frequency) in Fall 2011 than in Spring 2014 ($Z = 2.52$, $p = 0.012$, $r = -0.06$ and $Z = 2.77$, $p = 0.006$, $r = -0.07$, respectively). The associated effects for both groups were negligible.

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 37, both Phase 1 and Phase 2 students had almost exactly the same scores in both Fall 2011 and Spring 2014. The Wilcoxon Signed-rank test suggested that the within-group differences for both Phase 1 and Phase 2 students were not statistically significant, and the associated effects for both groups were essentially zero.

- “Do you think science will be useful when you are older?”

As shown in Table 38, the marginal homogeneity tests showed that there was a statistically significant difference in the level of agreement for this question within the Phase 2 student group from Fall 2011 to Spring 2014 ($MH = -4.10$, $p < 0.001$), with the level of agreement being higher in Spring 2014, whereas the difference within the Phase 1 student group, which also had a higher level of agreement in Spring 2014, was not statistically significant.

- “Would you like to be a scientist when you are older?”

As shown in Table 38, the marginal homogeneity tests showed that there were statistically significant differences in the level of agreement for this question within both the Phase 1 and Phase 2 groups from Fall 2011 to Spring 2014 ($MH = 7.97$, $p < 0.001$ and $MH = 7.07$, $p < 0.001$, respectively), with the level of agreement being higher in Fall 2011 for both groups.

Table 37. Results of Wilcoxon Signed-Rank Test: Comparison of North Carolina Elementary Cohort Students' Responses within the Phase 1 and Phase 2 Groups

	Phase 1						Phase 2					
	Fall 2011		Spring 2014		Z	r	Fall 2011		Spring 2014		Z	r
	N	Mean	N	Mean			N	Mean	N	Mean		
I like science.	1,029	1.53	1,029	1.51	0.76	-0.02	871	1.55	871	1.48	2.40*	-0.06
How often do you talk to your family about what you do in science class?	1,049	0.99	1,049	0.92	2.52*	-0.06	870	0.97	870	0.90	2.77**	-0.07
How often do you talk to your friends about what you do in science class?	1,029	0.72	1,029	0.72	-0.02	0.00	870	0.64	870	0.63	0.28	-0.01

* $p < 0.05$, two-tailed; ** $p < 0.01$, two-tailed. A negative r indicates that Fall 2011 has a higher score relative to Spring 2014.

Table 38. Results of Marginal Homogeneity Test: Comparison of the Distributions of North Carolina Elementary Cohort Students' Responses within the Phase 1 and Phase 2 Groups

		Marginal Homogeneity Test		
		N	Standard MH Statistic	p
Do you think science will be useful to you when you are older?	Phase 1	1,050	-1.20	0.230
	Phase 2	883	-4.10	< 0.001*
Would you like to be a scientist when you are older?	Phase 1	1,037	7.97	< 0.001*
	Phase 2	867	7.07	< 0.001*

*Statistically significant at $p < 0.05$. For the Standard MH Statistic, a negative value indicates that the Spring 2014 has a higher score relative to Fall 2011.

Middle School Cohort Results (Figure 8, page 79): Within Group Comparisons

- “I like science”

As shown in Table 39, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores in Fall 2011 than in Spring 2014 ($Z = 9.17, p < 0.001, r = -0.29$ and $Z = 10.27, p < 0.001, r = -0.24$, respectively). The associated effects for both groups were small.

- “How often do you talk to your family about what you do in science class?”

As shown in Table 39, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores in Fall 2011 than in Spring 2014 ($Z = 11.14, p < 0.001, r = -0.35$ and $Z = 12.44, p < 0.001, r = -0.29$, respectively). The associated effect for the Phase 1 within-group difference was medium in magnitude while the effect for the Phase 2 within-group difference was small in magnitude.

- “How often do you talk to your friends about what you do in science class?”

As shown in Table 39, the Wilcoxon Signed-rank test suggested that both Phase 1 and Phase 2 students had statistically significantly higher scores in Fall 2011 than in Spring 2014 ($Z = 2.87, p = 0.004, r = -0.09$ and $Z = 2.86, p = 0.004, r = -0.07$, respectively). However, the associated effects for both groups were negligible.

- “Do you think science will be useful when you are older?”

As shown in Table 40, the marginal homogeneity tests showed that there were statistically significant differences in the level of agreement for this question within both the Phase 1 and Phase 2 groups from Fall 2011 to Spring 2014 ($MH = 8.16, p < 0.001$ and $MH = 6.03, p < 0.001$, respectively), with the level of agreement being higher in Fall 2011 for both groups.

- “Would you like to be a scientist when you are older?”

As shown in Table 40, the marginal homogeneity tests showed that there were statistically significant differences in the level of agreement for this question within both the Phase 1 and Phase 2 groups from Fall 2011 to Spring 2014 ($MH = 6.54, p < 0.001$ and $MH = 6.41, p < 0.001$, respectively), with the level of agreement being higher in Fall 2011 for both groups.

Table 39. Results of Wilcoxon Signed-Rank Test: Comparison of North Carolina Middle School Cohort Students' Responses within the Phase 1 and Phase 2 Groups

	Phase 1						Phase 2					
	Fall 2011		Spring 2014		Z	r	Fall 2011		Spring 2014		Z	r
	N	Mean	N	Mean			N	Mean	N	Mean		
I like science.	510	1.45	510	1.15	9.17***	-0.29	899	1.47	899	1.22	10.27***	-0.24
How often do you talk to your family about what you do in science class?	513	0.95	513	0.54	11.14***	-0.35	928	0.98	928	0.65	12.44***	-0.29
How often do you talk to your friends about what you do in science class?	510	0.74	510	0.64	2.87**	-0.09	923	0.78	923	0.70	2.86**	-0.07

** $p < 0.01$, two-tailed; *** $p < 0.001$, two-tailed. A negative r indicates that Fall 2011 has a higher score relative to Spring 2014.

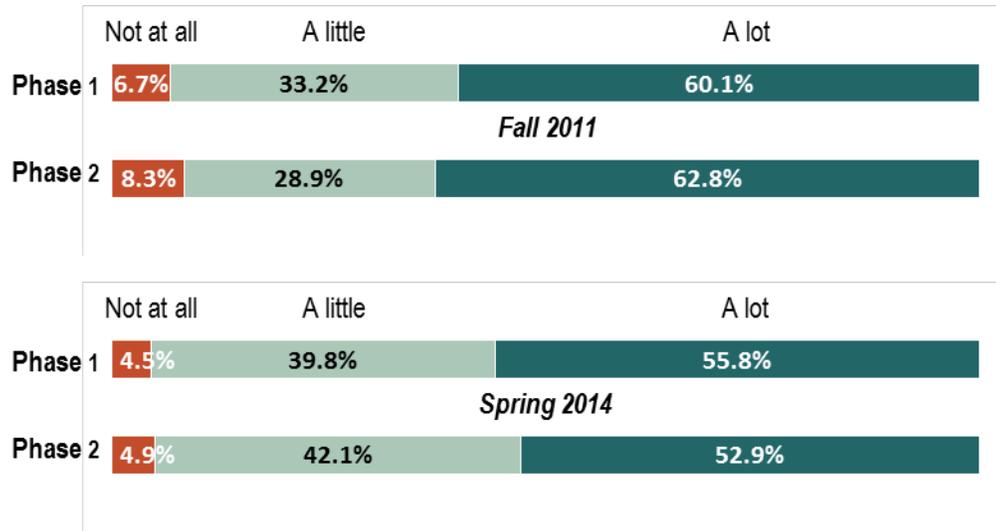
Table 40. Results of Marginal Homogeneity Test: Comparison of the Distributions of North Carolina Middle School Cohort Students' Responses within the Phase 1 and Phase 2 Groups

	Marginal Homogeneity Test			
	N	Standard MH Statistic	p	
Do you think science will be useful to you when you are older?	Phase 1	518	8.16	< 0.001*
	Phase 2	929	6.03	< 0.001*
Would you like to be a scientist when you are older?	Phase 1	508	6.54	< 0.001*
	Phase 2	924	6.41	< 0.001*

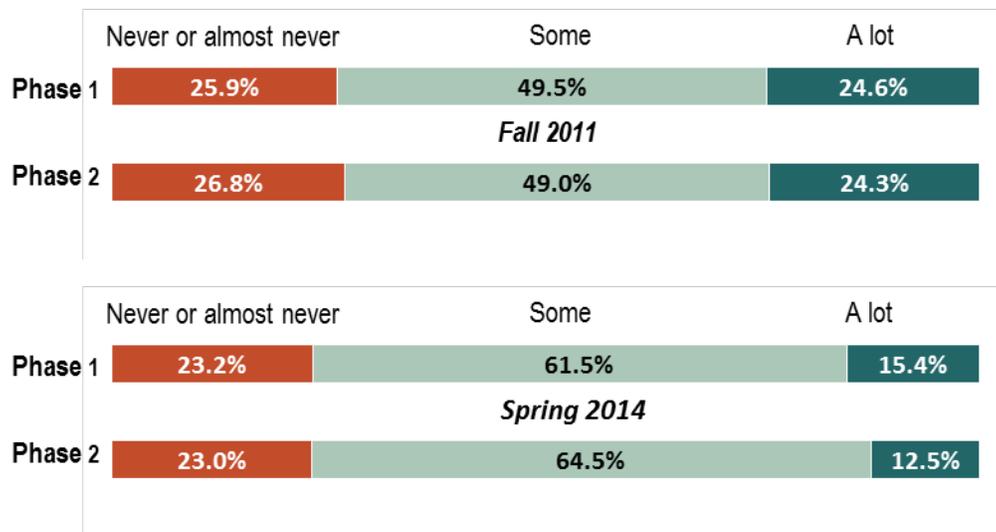
*Statistically significant at $p < 0.05$. For the Standard MH Statistic, a negative value indicates that the Spring 2014 has a higher score relative to Fall 2011.

Figure 7. Student Attitude Survey, North Carolina: Fall 2011 and Spring 2014: Elementary Cohort Question Responses by Group

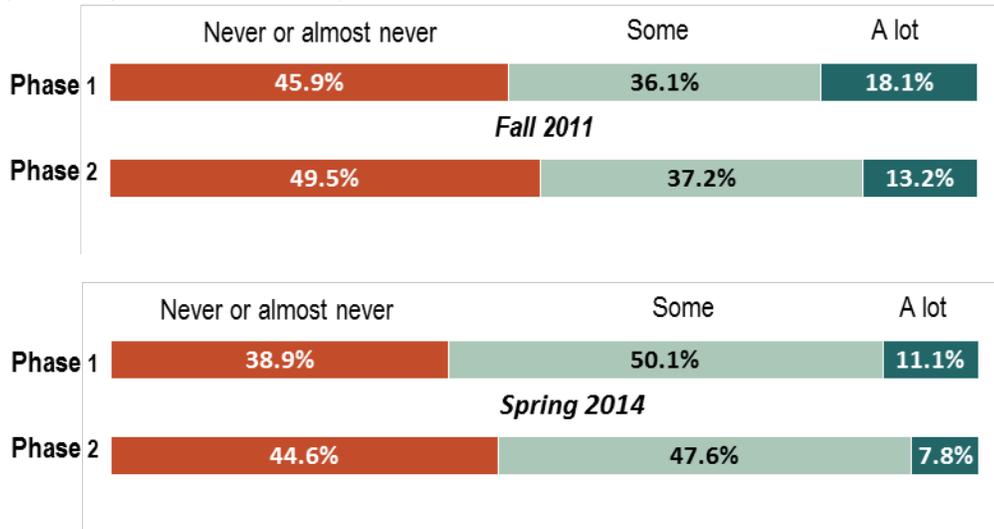
I like Science ...



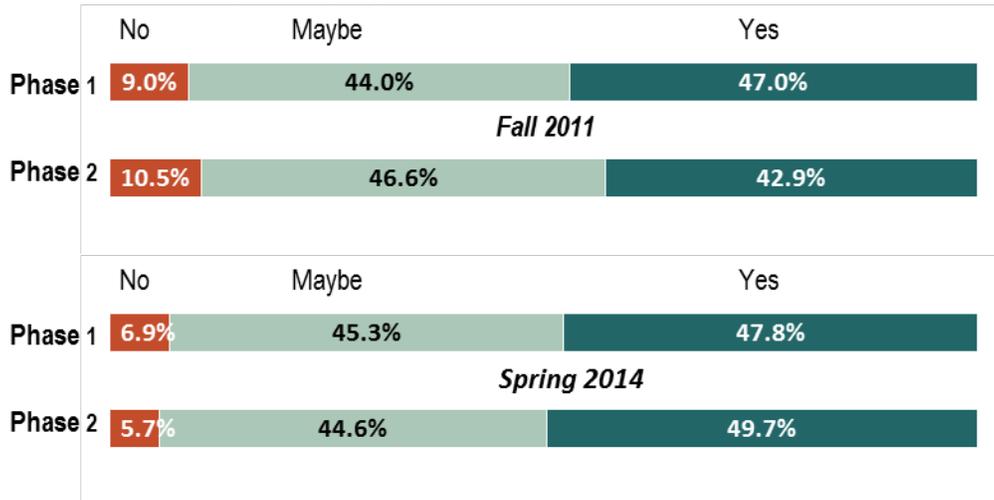
How often do you talk to your family about what you do in science class?



How often do you talk to your friends about what you do in science class?



Do you think Science will be useful to you when you get older?



Would you like to be a scientist when you are older?

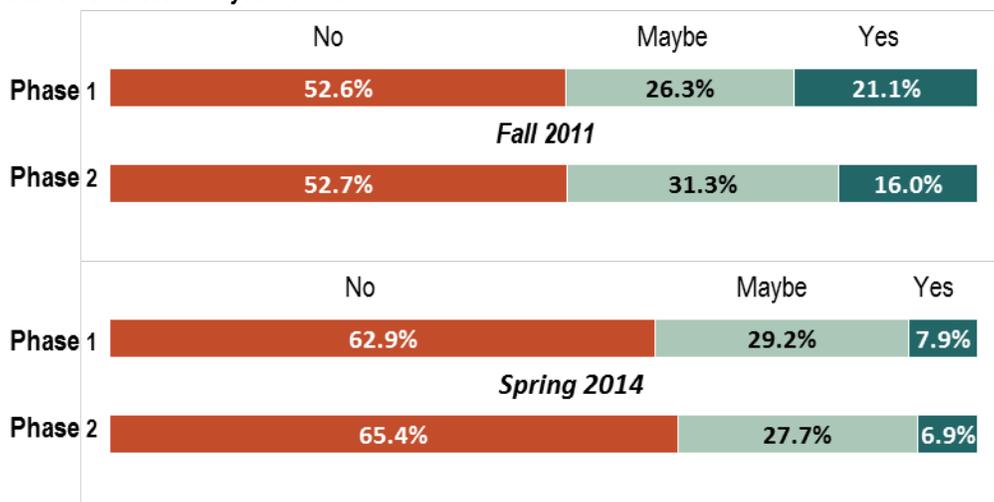
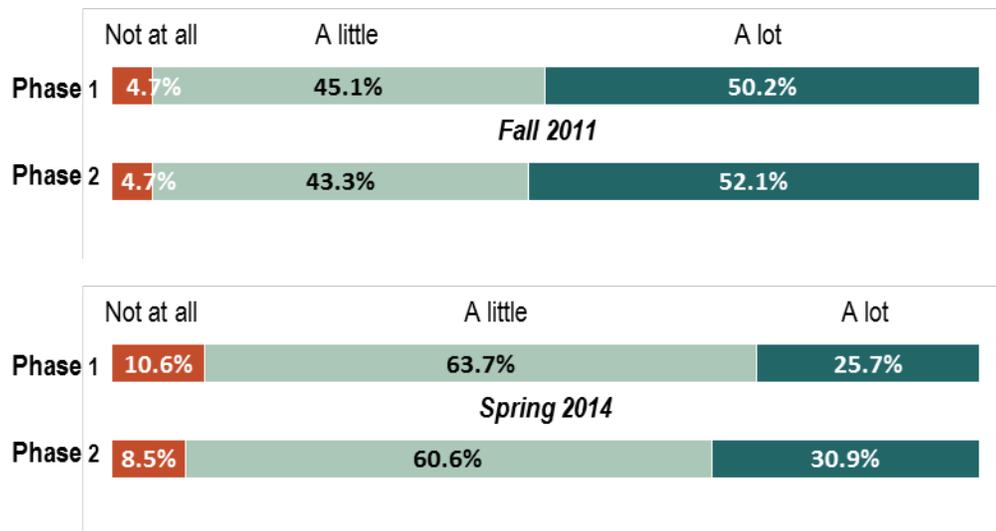
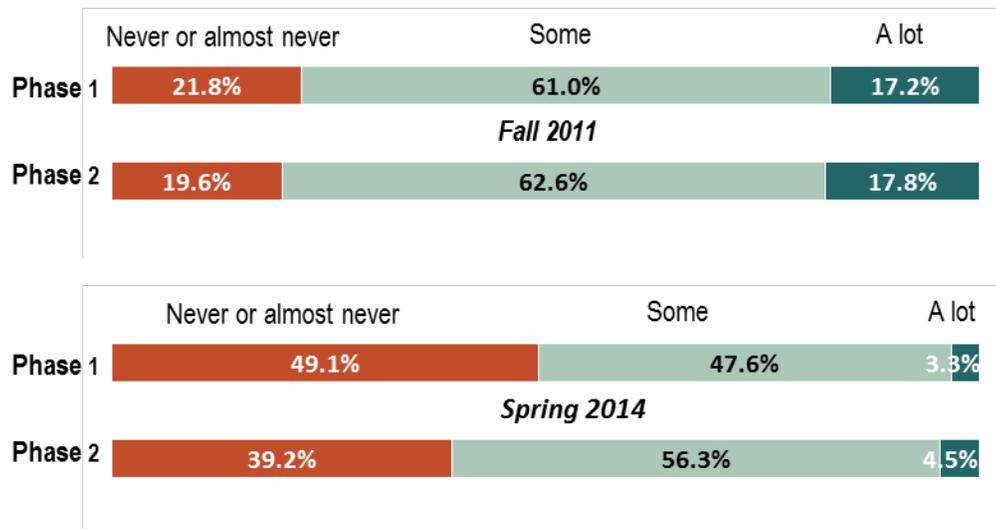


Figure 8. Student Attitude Survey, North Carolina: Fall 2011 and Spring 2014: Middle School Cohort Question Responses by Group

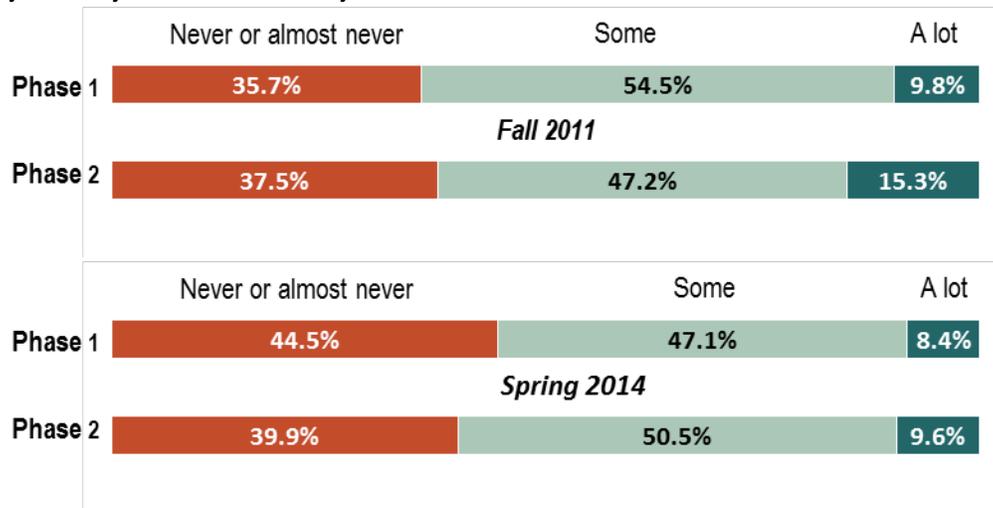
I like Science ...



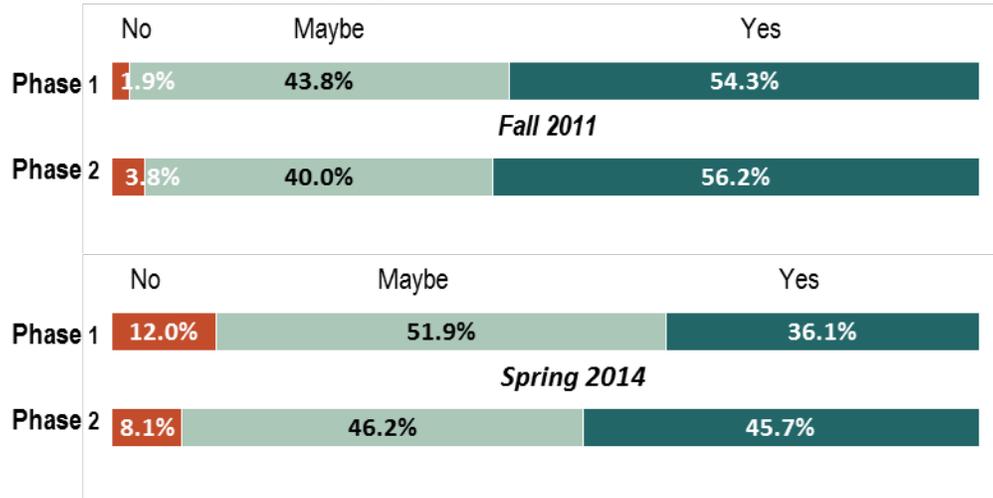
How often do you talk to your family about what you do in science class?



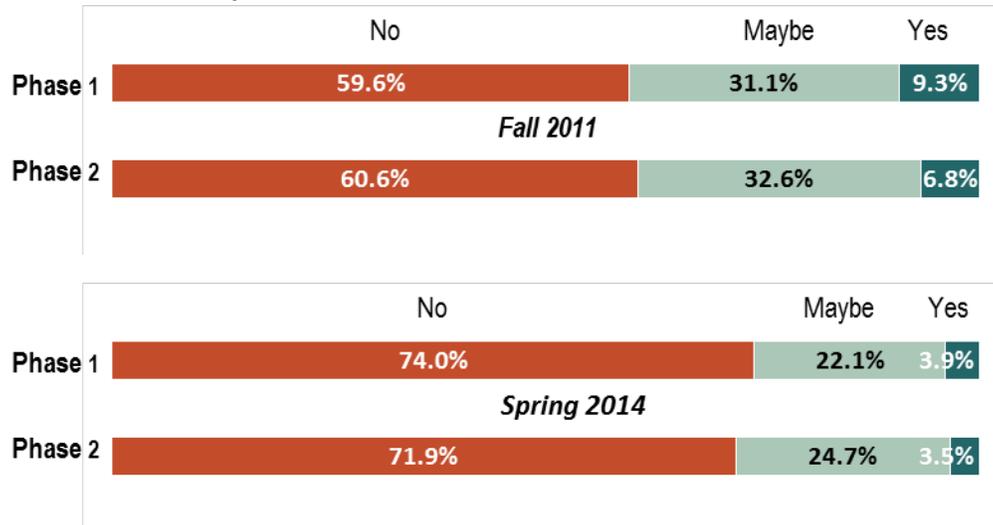
How often do you talk to your friends about what you do in science class?



Do you think Science will be useful to you when you get older?



Would you like to be a scientist when you are older?



Overall Summary of North Carolina PASS Student Attitudes Results

Between-group difference

For both the Elementary and Middle School cohorts in the North Carolina region, while there were some statistically significant findings, particularly in Spring 2014, none of the five items examined exhibited meaningful differences between Phase 1 and Phase 2 students in either Fall 2011 or Spring 2014. In other words, Phase 1 and Phase 2 students essentially had similar attitudes toward science in both Fall 2011 and Spring 2014.

Within-group difference

For the three Likert-scale items (“I like science”, “How often do you talk to your family about what you do in science class?”, and “How often do you talk to your friends about what you do in science class?”), Phase 1 and Phase 2 students in both the Elementary Cohort and the Middle School Cohort liked science more or were more likely to talk to their friends or families about science in Fall 2011 compared to Spring 2014, except for the Phase 1 Elementary Cohort on the item “How often do you talk to your friends about what you do in science class?”, where the outcomes were essentially the same at both time points. For the Elementary Cohort, the only within group statistically significant differences were found for both Phase 1 and Phase 2 students on the item “How often do you talk to your family about what you do in science class?” and for the Phase 2 students on the item “I like science”. However, the magnitudes of the differences were all negligible. In contrast, the attitudinal changes from Fall 2011 to Spring 2014 within both groups in the Middle School Cohort were statistically significant for all three questions. However, only the magnitude of the change within the Phase 1 group on the question “How often do you talk to your family about what you do in science class?” was neither Negligible nor Small, and reached a Medium level.

For the two nominal scale items (“Do you think science will be useful to you when you are older?” and “Would you like to be a scientist when you are older?”), there were statistically significant differences from Fall 2011 to Spring 2014 in the level of agreement within both groups for both the Elementary Cohort and Middle School Cohort except for the responses of Phase 1 students in the Elementary Cohort to the question “Do you think science will be useful to you when you are older?”. In addition, only one of the statistically significant differences, for the Phase 2 Elementary Cohort on the question “Do you think science will be useful to you when you are older?” had a higher percentage of agreement in Spring 2014 compared to Fall 2011. Phase 1 students also had a higher level of agreement in Spring 2014 on this question, but the difference was not statistically significant. All of the remaining statistically significant differences demonstrated higher levels of agreement in Fall 2011. However, since no effect size measure for the marginal homogeneity test was available, we do not know whether these statistically significant differences were substantively important.

References

What Works Clearinghouse (2014). Procedures and standards handbook (Version 3.0). Washington, DC: Author. Retrieved from ies.ed.gov/ncee/wwc/pdf/reference_resources/wwc_procedures_v3_0_standards_handbook.pdf

Appendix A

Responses for Fall 2011 & Spring 2014 Student Attitudes Toward Science Survey Items

Responses for Fall 2011 & Spring 2014 Student Attitudes Toward Science Survey Items: All Regions

Table A - 1. PASS, HISD, North Carolina, New Mexico, Fall 2011 & Spring 2014: Elementary Cohort Student Attitude Survey Responses

Grades	My grades in science are usually:				My grades in math are usually:				My grades in reading are usually:			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase2	Phase1	Phase 2	Phase1	Phase2	Phase 1	Phase 2	Phase1	Phase 2
A's	31.9	35.7	39.1	36.1	38.0	43.1	38.3	42.2	36.5	40.6	35.8	34.8
B's	27.6	28.0	40.8	41.2	25.2	23.3	37.1	36.3	23.7	22.0	38.9	39.8
C's	8.6	8.5	14.6	16.6	9.7	8.3	15.3	13.5	11.7	9.4	16.7	16.1
D's	1.2	2.0	3.2	3.9	2.2	2.2	5.4	4.7	3.0	3.9	5.3	5.4
F's	0.7	0.7	1.0	1.0	1.6	1.8	2.4	2.1	1.6	2.1	1.8	2.5
E's	1.1	0.8	0.0	0.0	1.0	0.6	0.0	0.0	1.6	1.4	0.0	0.0
S's	17.7	13.6	0.0	0.0	12.5	9.5	0.0	0.0	11.5	8.5	0.0	0.0
N's	4.3	4.3	0.0	0.0	2.5	3.3	0.0	0.0	2.6	3.5	0.0	0.0
Multiple responses	5.6	4.3	0.0	0.0	4.5	3.0	0.0	0.0	4.3	2.5	0.0	0.0
Missing	1.2	2.1	1.3	1.1	2.7	4.9	1.6	1.1	3.5	6.1	1.5	1.4

I like science...	Fall 2011		Spring 2014	
	Phase1	Phase2	Phase 1	Phase 2
A lot	65.1	63.8	56.6	52.6
A little	27.2	27.3	37.6	41.5
Not at all	4.6	5.5	4.0	4.0
Multiple responses	0.0	0.2	0.0	0.0
Missing	3.2	3.2	1.8	1.9

Table A - 1, continued

Science in my Future	Do you think science will be useful to you when you are older?				Would you like to be a scientist when you are older?			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Yes	50.6	47.9	51.2	49.8	23.9	21.2	9.7	9.1
Maybe	40.3	41.6	42.5	45.1	30.8	31.7	34.5	32.5
No	6.4	7.8	5.7	4.7	41.8	43.4	54.2	56.9
Multiple responses	1.3	0.7	0.0	0.0	0.4	0.2	0.0	0.0
Missing	1.5	2.0	0.6	0.4	3.1	3.5	1.6	1.5

Frequency of Science Discussion	How often do you talk to your family about what you do in science class?				How often do you talk to your friends about what you do in science class?			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
A lot	26.5	25.4	14.7	12.2	18.5	16.7	11.6	8.4
Some	47.5	45.5	61.2	64.0	35.7	36.7	48.4	46.9
Never or almost never	22.1	25.3	23.1	23.0	40.8	42.1	38.6	43.6
Multiple responses	0.3	0.6	0.0	0.0	0.4	0.4	0.0	0.0
Missing	3.6	3.3	0.9	0.8	4.6	4.1	1.3	1.0

How much effort did you put into this test?	Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
I tried really hard	84.3	84.8	85.3	82.8
I tried a little	8.4	8.5	5.4	4.3
I did not try at all	0.4	1.0	0.3	0.3
Multiple responses	0.1	0.0	0.0	0.0
Missing	6.8	5.6	8.9	12.6

Table A - 1, continued

How often do you do the following activities in science class?	Answer questions on worksheets				Read a science textbook			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	31.6	32.0	34.3	35.0	19.0	21.0	18.0	17.6
Every week	37.2	36.8	43.1	46.2	26.3	26.2	34.8	32.2
Every month	9.0	11.7	12.4	11.0	11.1	10.9	20.1	19.7
Every year	4.2	4.4	2.8	1.5	5.7	2.8	6.1	4.1
Never	12.1	10.4	5.2	4.0	32.1	34.2	18.7	23.9
Multiple responses	2.2	1.9	0.0	0.0	1.3	1.6	0.0	0.0
Missing	3.8	2.8	2.2	2.3	4.5	3.3	2.4	2.6

How often do you do the following activities in science class?	Work on experiments with a partner or group				Work on a project or written report			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	18.6	19.0	27.9	13.1	13.2	13.5	6.3	5.0
Every week	36.6	35.8	45.9	37.6	23.1	21.6	20.7	15.6
Every month	15.2	17.4	18.5	34.5	22.9	21.0	45.5	44.4
Every year	6.3	5.4	2.0	5.6	10.5	12.3	12.5	13.7
Never	16.3	17.0	2.6	7.0	23.2	25.3	12.0	18.6
Multiple responses	2.0	1.4	0.0	0.0	0.6	0.8	0.0	0.0
Missing	5.1	4.0	3.1	2.1	6.5	5.4	2.9	2.7

How often do you do the following activities in science class?	Use a science notebook			
	Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
Every day	43.0	34.8	68.2	55.0
Every week	29.3	30.2	22.7	21.8
Every month	6.8	7.6	4.1	9.1
Every year	4.3	4.0	1.4	2.7
Never	10.8	18.4	1.5	9.3
Multiple responses	0.4	0.4	0.0	0.0
Missing	5.3	4.7	2.1	2.2

Table A - 2. PASS, North Carolina, New Mexico, Fall 2011 & Spring 2014: Middle School Cohort Student Attitude Survey Responses

Grades	My grades in science are usually:				My grades in math are usually:				My grades in reading are usually:			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase2	Phase1	Phase 2	Phase1	Phase2	Phase 1	Phase 2	Phase1	Phase 2
A's	40.9	37.1	31.6	30.0	45.6	39.3	28.2	31.5	43.4	40.2	43.5	38.1
B's	37.8	41.4	32.1	34.9	31.2	38.7	35.6	41.6	33.9	36.9	35.0	40.0
C's	13.3	12.7	24.2	22.5	13.2	12.1	21.7	17.9	13.3	12.0	14.1	15.6
D's	2.6	3.6	7.3	7.8	3.1	2.3	8.6	6.1	2.9	3.1	3.9	4.2
F's	0.9	0.2	3.1	3.6	1.8	0.7	3.6	1.9	1.2	0.5	1.2	0.9
E's	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S's	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0
N's	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Multiple responses	3.9	4.2	0.0	0.0	3.4	4.1	0.0	0.0	3.2	3.7	0.0	0.0
Missing	0.5	0.7	1.7	1.1	1.6	2.7	2.3	1.0	1.8	3.5	2.2	1.4

I like science...	Fall 2011		Spring 2014	
	Phase1	Phase2	Phase 1	Phase 2
A lot	51.1	48.8	28.2	29.6
A little	43.1	43.8	58.2	59.8
Not at all	3.7	3.8	12.0	9.2
Multiple responses	0.1	0.0	0.0	0.0
Missing	2.0	3.6	1.6	1.4

Table A - 2, continued

Science in my Future	Do you think science will be useful to you when you are older?				Would you like to be a scientist when you are older?			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Yes	53.8	53.7	35.6	44.1	8.9	7.2	4.6	3.9
Maybe	41.8	40.8	49.8	47.3	34.2	31.2	22.6	24.4
No	2.6	3.5	13.8	8.1	55.0	59.3	70.3	70.5
Multiple responses	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Missing	1.5	2.1	0.9	0.5	1.8	2.2	2.5	1.2

Frequency of Science Discussion	How often do you talk to your family about what you do in science class?				How often do you talk to your friends about what you do in science class?			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
A lot	18.9	17.1	5.4	4.9	11.2	13.6	7.8	8.7
Some	57.8	60.3	44.9	54.8	50.2	47.3	45.3	49.0
Never or almost never	21.6	20.0	48.3	39.5	36.4	36.5	45.6	40.9
Multiple responses	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Missing	1.7	2.4	1.4	0.8	2.2	2.5	1.3	1.4

How much effort did you put into this test?	Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
I tried really hard	80.8	80.5	65.3	68.9
I tried a little	15.2	12.5	20.7	18.2
I did not try at all	0.3	0.4	1.7	1.0
Multiple responses	0.1	0.0	0.0	0.0
Missing	3.6	6.6	12.3	11.9

Table A - 2, continued

How often do you do the following activities in science class?	Answer questions on worksheets				Read a science textbook			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	43.8	31.1	32.8	24.7	35.0	29.7	24.7	17.3
Every week	45.0	53.8	51.6	58.2	45.9	38.2	49.5	29.8
Every month	6.3	7.1	9.8	12.1	9.1	16.2	16.7	31.7
Every year	0.9	2.0	0.5	0.6	0.8	1.5	3.1	4.8
Never	1.8	2.4	0.7	3.1	7.3	9.9	1.8	14.9
Multiple responses	0.5	0.3	0.0	0.0	0.2	0.6	0.0	0.0
Missing	1.7	3.4	4.6	1.3	1.6	3.9	4.2	1.5

How often do you do the following activities in science class?	Work on experiments with a partner or group				Work on a project or written report			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	13.8	13.0	9.6	6.0	8.4	7.7	2.3	4.8
Every week	53.6	48.1	44.9	35.8	24.5	19.9	13.7	21.3
Every month	25.4	24.8	32.4	49.6	43.0	45.2	52.8	61.6
Every year	0.9	1.4	4.3	3.0	5.6	6.6	19.0	7.4
Never	3.5	8.2	3.6	3.8	15.8	15.7	7.8	2.9
Multiple responses	0.4	0.9	0.0	0.0	0.3	0.4	0.0	0.0
Missing	2.4	3.6	5.2	1.9	2.3	4.5	4.6	2.0

How often do you do the following activities in science class?	Use a science notebook			
	Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
Every day	62.9	69.6	61.5	67.3
Every week	22.2	11.4	15.4	16.4
Every month	4.4	3.3	5.7	5.7
Every year	1.2	1.9	1.8	1.6
Never	7.8	10.1	11.7	7.7
Multiple responses	1.4	0.3	0.0	0.0
Missing	62.9	3.4	4.0	1.3

Responses for Fall 2011 & Spring 2014 Student Attitudes Toward Science Survey Items: HISD

Table A - 3. PASS, HISD, Fall 2011 & Spring 2014: Elementary Cohort Student Attitude Survey Responses

Grades	My grades in science are usually:				My grades in math are usually:				My grades in reading are usually:			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase2	Phase1	Phase 2	Phase1	Phase2	Phase 1	Phase 2	Phase1	Phase 2
A's	35.3	36.0	25.7	21.2	38.5	37.8	30.2	31.4	32.0	34.6	23.4	21.7
B's	34.5	34.1	46.1	45.9	28.7	29.4	39.4	41.6	30.4	27.7	38.4	40.7
C's	13.1	11.8	20.8	25.0	13.7	12.7	18.9	16.4	17.3	13.9	26.0	23.5
D's	2.4	3.0	5.4	5.2	3.2	3.6	7.3	7.3	4.5	5.8	8.0	7.7
F's	0.5	0.9	1.3	1.2	2.1	2.2	3.4	1.8	2.0	2.4	3.5	4.8
E's	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.4	0.0	0.0
S's	1.3	0.4	0.0	0.0	0.9	0.7	0.0	0.0	0.9	0.2	0.0	0.0
N's	1.3	0.9	0.0	0.0	0.7	0.2	0.0	0.0	0.8	0.6	0.0	0.0
Multiple responses	10.7	9.9	0.0	0.0	9.6	7.9	0.0	0.0	8.9	7.3	0.0	0.0
Missing	0.8	3.0	0.9	1.5	2.5	5.2	0.9	1.5	2.9	7.1	0.6	1.5

I like science...	Fall 2011		Spring 2014	
	Phase1	Phase2	Phase 1	Phase 2
A lot	68.7	69.5	58.8	55.9
A little	23.7	23.0	35.4	38.9
Not at all	3.5	3.0	3.4	2.5
Multiple responses	0.0	0.2	0.0	0.0
Missing	4.1	4.3	2.4	2.7

Table A - 3, continued

Science in my Future	Do you think science will be useful to you when you are older?				Would you like to be a scientist when you are older?			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Yes	50.8	53.2	53.3	48.6	30.0	29.4	9.6	12.2
Maybe	40.1	38.4	41.1	48.6	33.2	35.6	41.1	39.6
No	5.1	5.4	5.0	2.2	32.5	30.1	47.3	46.7
Multiple responses	0.5	0.7	0.0	0.0	0.4	0.6	0.0	0.0
Missing	3.5	2.2	0.6	0.7	3.9	4.3	2.0	1.5

Frequency of Science Discussion	How often do you talk to your family about what you do in science class?				How often do you talk to your friends about what you do in science class?			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
A lot	31.6	30.5	14.4	11.4	22.9	24.5	14.0	9.7
Some	44.0	44.9	62.6	65.4	38.5	40.4	48.9	51.3
Never or almost never	19.5	19.9	21.7	22.4	32.8	29.0	36.2	38.2
Multiple responses	0.4	0.6	0.0	0.0	0.1	0.7	0.0	0.0
Missing	4.5	4.1	1.4	0.8	5.6	5.2	0.9	0.8

How much effort did you put into this test?	Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
I tried really hard	81.2	78.1	87.0	82.8
I tried a little	9.6	12.5	6.9	6.2
I did not try at all	0.1	1.3	0.1	0.2
Multiple responses	0.1	0.0	0.0	0.0
Missing	8.9	8.1	6.0	10.9

Table A - 3, continued

How often do you do the following activities in science class?	Answer questions on worksheets				Read a science textbook			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	31.3	34.6	52.9	50.1	24.1	27.0	20.0	17.0
Every week	43.5	32.0	35.7	39.6	32.8	38.4	32.8	35.4
Every month	7.9	18.2	6.0	4.8	16.1	12.7	18.8	15.5
Every year	2.8	2.1	0.6	1.0	4.5	2.8	5.8	4.5
Never	7.1	7.1	2.8	2.7	15.6	12.7	20.5	25.4
Multiple responses	1.3	2.2	0.0	0.0	0.7	1.7	0.0	0.0
Missing	6.1	3.7	2.0	1.8	6.1	4.7	2.1	2.2

How often do you do the following activities in science class?	Work on experiments with a partner or group				Work on a project or written report			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	20.4	25.7	18.9	21.0	13.2	17.8	6.1	7.8
Every week	45.1	45.9	49.6	48.6	25.2	22.8	21.0	21.9
Every month	15.1	12.4	23.8	21.5	28.5	18.2	46.1	41.9
Every year	4.5	3.7	1.4	3.0	8.7	17.0	11.1	9.7
Never	6.1	6.0	4.1	4.0	16.1	15.9	13.1	16.5
Multiple responses	1.6	0.7	0.0	0.0	0.5	1.3	0.0	0.0
Missing	7.2	5.6	2.3	1.8	7.7	6.9	2.5	2.2

How often do you do the following activities in science class?	Use a science notebook			
	Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
Every day	57.3	48.7	73.0	69.1
Every week	26.1	34.6	18.9	24.9
Every month	4.3	3.0	3.9	3.7
Every year	2.9	3.6	1.1	0.7
Never	2.5	3.7	1.1	0.3
Multiple responses	0.0	0.4	0.0	0.0
Missing	6.8	6.0	2.0	1.3

Table A - 4. PASS, HISD, Spring 2012 & Spring 2014: Middle School Cohort Student Attitude Survey Responses

Grades	My grades in science are usually:				My grades in math are usually:				My grades in reading are usually:			
	Spring 2012		Spring 2014		Spring 2012		Spring 2014		Spring 2012		Spring 2014	
	Phase1	Phase 2	Phase1	Phase2	Phase1	Phase 2	Phase1	Phase2	Phase 1	Phase 2	Phase1	Phase 2
A's	15.7	15.1	16.8	19.8	28.5	27.7	27.9	24.0	24.4	17.6	27.9	24.0
B's	57.0	42.0	38.5	54.5	36.6	35.3	50.8	45.5	41.9	46.2	49.2	50.4
C's	15.7	25.2	31.3	19.8	20.9	21.0	16.2	19.8	15.7	18.5	17.9	17.4
D's	1.2	5.0	7.3	1.7	1.7	2.5	2.2	5.8	3.5	5.0	2.2	1.7
F's	0.0	0.0	5.0	0.0	1.2	1.7	1.7	0.0	2.3	1.7	1.1	1.7
E's	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S's	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.8	0.0	0.0
N's	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Multiple responses	9.3	11.8	0.0	0.0	8.7	10.1	0.0	0.0	8.7	9.2	0.0	0.0
Missing	1.2	0.8	1.1	4.1	2.3	0.8	1.1	5.0	3.5	0.8	1.7	5.0

I like science...	Spring 2012		Spring 2014	
	Phase1	Phase2	Phase 1	Phase 2
A lot	32.6	52.1	20.7	38.8
A little	56.4	41.2	63.1	52.9
Not at all	8.1	1.7	15.1	2.5
Multiple responses	0.0	0.0	0.0	0.0
Missing	2.9	5.0	1.1	5.8

Table A - 4, continued

Science in my Future	Do you think science will be useful to you when you are older?				Would you like to be a scientist when you are older?			
	Spring 2012		Spring 2014		Spring 2012		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Yes	54.7	62.2	34.6	41.3	4.7	8.4	2.8	9.9
Maybe	39.5	33.6	48.6	49.6	31.4	43.7	20.1	24.8
No	4.7	0.8	16.2	5.8	63.4	44.5	75.4	59.5
Multiple responses	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0
Missing	1.2	3.4	0.6	3.3	0.6	2.5	1.7	5.8

Frequency of Science Discussion	How often do you talk to your family about what you do in science class?				How often do you talk to your friends about what you do in science class?			
	Spring 2012		Spring 2014		Spring 2012		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
A lot	13.4	15.1	2.8	5.0	10.5	18.5	7.3	8.3
Some	45.9	60.5	36.9	52.9	43.6	54.6	40.2	52.1
Never or almost never	39.5	21.0	60.3	38.0	44.2	23.5	52.5	35.5
Multiple responses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Missing	1.2	3.4	0.0	4.1	1.7	3.4	0.0	4.1

How much effort did you put into this test?	Spring 2012		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
I tried really hard	73.3	66.4	69.8	77.7
I tried a little	14.5	10.1	19.6	16.5
I did not try at all	2.3	0.0	1.7	0.0
Multiple responses	0.0	0.0	0.0	0.0
Missing	9.9	23.5	8.9	5.8

Table A - 4, continued

How often do you do the following activities in science class?	Answer questions on worksheets				Read a science textbook			
	Spring 2012		Spring 2014		Spring 2012		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	44.8	57.1	62.6	69.4	30.2	26.9	22.9	8.3
Every week	32.6	25.2	30.7	24.0	50.6	44.5	48.6	30.6
Every month	15.1	4.2	2.8	0.8	2.9	11.8	15.1	22.3
Every year	1.2	2.5	0.6	0.8	1.2	1.7	2.2	5.8
Never	4.7	3.4	2.2	1.7	12.2	8.4	9.5	29.8
Multiple responses	0.0	0.8	0.0	0.0	0.0	0.8	0.0	0.0
Missing	1.7	6.7	1.1	3.3	2.9	5.9	1.7	3.3

How often do you do the following activities in science class?	Work on experiments with a partner or group				Work on a project or written report			
	Spring 2012		Spring 2014		Spring 2012		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	16.3	31.1	22.3	15.7	7.6	13.4	8.4	5.0
Every week	40.7	35.3	49.2	44.6	22.1	26.9	17.3	20.7
Every month	18.6	19.3	19.6	28.9	36.6	30.3	48.6	38.0
Every year	4.1	0.8	1.7	3.3	9.9	3.4	9.5	11.6
Never	16.3	7.6	6.1	5.0	20.3	19.3	14.5	21.5
Multiple responses	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0
Missing	4.1	5.9	1.1	2.5	2.9	6.7	1.7	3.3

How often do you do the following activities in science class?	Use a science notebook			
	Spring 2012		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
Every day	58.7	69.7	60.9	63.6
Every week	25.0	16.8	19.0	19.0
Every month	4.1	0.8	7.3	6.6
Every year	5.8	0.8	1.7	0.8
Never	1.7	5.0	10.1	6.6
Multiple responses	0.6	0.0	0.0	0.0
Missing	4.1	6.7	1.1	3.3

Responses for Fall 2011 & Spring 2014 Student Attitudes Toward Science Survey Items: New Mexico

Table A - 5. PASS, New Mexico, Fall 2011 & Spring 2014: Elementary Cohort Student Attitude Survey Responses

Grades	My grades in science are usually:				My grades in math are usually:				My grades in reading are usually:			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase2	Phase1	Phase 2	Phase1	Phase2	Phase 1	Phase 2	Phase1	Phase 2
A's	38.2	41.8	50.3	39.7	38.7	40.9	47.0	44.8	43.7	43.9	50.1	46.2
B's	32.9	30.6	37.6	43.9	27.9	26.6	33.1	32.2	22.6	20.9	32.1	32.6
C's	10.1	12.8	8.6	11.3	13.9	10.0	11.7	14.6	13.3	11.4	10.6	12.0
D's	0.7	1.0	2.3	3.1	1.8	1.9	5.1	4.7	2.8	3.6	4.1	4.9
F's	0.2	0.2	0.6	0.2	1.4	1.0	1.6	2.1	1.1	1.2	1.4	1.4
E's	1.2	0.0	0.0	0.0	0.5	0.2	0.0	0.0	0.5	0.5	0.0	0.0
S's	3.9	3.8	0.0	0.0	5.2	3.1	0.0	0.0	5.3	3.1	0.0	0.0
N's	9.9	5.0	0.0	0.0	7.1	5.0	0.0	0.0	6.6	4.5	0.0	0.0
Multiple responses	1.4	0.7	0.0	0.0	1.1	1.0	0.0	0.0	1.1	0.2	0.0	0.0
Missing	1.4	4.0	0.6	1.9	2.5	10.5	1.6	1.6	3.0	10.7	1.8	2.8

I like science...	Fall 2011		Spring 2014	
	Phase1	Phase2	Phase 1	Phase 2
A lot	75.7	60.6	57.1	50.0
A little	19.9	31.4	38.0	43.4
Not at all	2.7	3.3	3.7	4.0
Multiple responses	0.0	0.0	0.0	0.0
Missing	1.8	4.8	1.2	2.6

Table A - 5, continued

Science in my Future	Do you think science will be useful to you when you are older?				Would you like to be a scientist when you are older?			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Yes	60.6	52.0	57.5	50.2	24.2	21.9	14.3	9.9
Maybe	34.5	38.5	38.2	43.9	37.8	30.2	36.8	34.5
No	3.2	5.2	1.4	5.4	34.6	43.5	47.9	53.1
Multiple responses	0.5	0.2	0.0	0.0	0.4	0.0	0.0	0.0
Missing	1.2	4.0	0.2	0.5	3.0	4.5	1.0	2.6

Frequency of Science Discussion	How often do you talk to your family about what you do in science class?				How often do you talk to your friends about what you do in science class?			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
A lot	24.2	21.4	14.7	12.7	16.2	15.0	10.2	7.3
Some	52.9	43.0	59.9	61.0	34.6	32.5	47.4	41.1
Never or almost never	18.1	30.6	24.9	24.9	43.3	47.0	40.7	49.3
Multiple responses	0.4	0.2	0.0	0.0	0.2	0.2	0.0	0.0
Missing	4.4	4.8	0.6	1.4	5.7	5.2	1.8	2.3

How much effort did you put into this test?	Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
I tried really hard	83.5	77.4	79.5	76.5
I tried a little	9.4	11.2	4.9	5.4
I did not try at all	0.2	1.0	1.2	0.5
Multiple responses	0.0	0.0	0.0	0.0
Missing	6.9	10.5	14.5	17.6

Table A - 5, continued

How often do you do the following activities in science class?	Answer questions on worksheets				Read a science textbook			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	22.4	19.0	13.5	25.6	11.9	11.9	10.6	29.6
Every week	40.0	44.9	41.9	45.5	25.6	23.3	33.3	37.1
Every month	12.1	11.4	21.3	20.4	11.2	10.9	22.1	20.9
Every year	5.9	3.1	8.4	0.9	11.7	1.2	11.7	3.8
Never	13.5	16.6	13.7	5.4	30.9	47.0	21.1	5.6
Multiple responses	1.4	1.7	0.0	0.0	1.6	1.4	0.0	0.0
Missing	4.8	3.3	1.2	2.1	7.1	4.3	1.2	3.1

How often do you do the following activities in science class?	Work on experiments with a partner or group				Work on a project or written report			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	15.8	10.5	36.2	6.3	11.7	10.2	8.8	4.5
Every week	32.5	36.8	46.4	28.2	23.8	22.1	23.9	14.1
Every month	16.7	21.9	10.6	45.5	22.9	25.9	35.8	51.2
Every year	8.2	4.8	2.9	9.2	11.5	10.7	16.0	16.2
Never	17.4	20.9	2.2	8.7	22.2	25.2	13.7	11.7
Multiple responses	2.7	1.4	0.0	0.0	0.9	0.2	0.0	0.0
Missing	6.7	3.8	1.8	2.1	6.9	5.7	1.8	2.3

How often do you do the following activities in science class?	Use a science notebook			
	Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
Every day	30.9	15.0	44.0	21.1
Every week	36.1	29.5	43.1	23.9
Every month	9.1	14.0	5.9	21.4
Every year	3.0	4.0	2.0	4.7
Never	13.1	32.8	3.7	26.1
Multiple responses	0.9	0.0	0.0	0.0
Missing	6.9	4.8	1.4	2.8

Table A - 6. PASS, New Mexico, Fall 2011 & Spring 2014: Middle School Cohort Student Attitude Survey Responses

Grades	My grades in science are usually:				My grades in math are usually:				My grades in reading are usually:			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase2	Phase1	Phase 2	Phase1	Phase2	Phase 1	Phase 2	Phase1	Phase 2
A's	48.0	39.2	29.1	39.3	54.2	36.1	25.7	17.9	56.1	42.3	49.0	38.6
B's	34.6	35.1	32.5	22.8	27.9	38.1	29.9	35.2	28.2	32.0	32.9	36.6
C's	10.8	17.5	23.9	24.1	10.5	18.6	25.3	30.3	8.3	14.4	11.2	17.9
D's	2.7	7.2	8.4	10.3	2.5	3.1	10.6	14.5	2.7	5.2	3.8	4.8
F's	1.2	0.0	4.4	2.1	1.2	0.0	5.4	2.1	1.2	1.0	0.8	0.7
E's	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S's	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N's	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Multiple responses	2.2	1.0	0.0	0.0	1.7	0.0	0.0	0.0	1.5	0.0	0.0	0.0
Missing	0.5	0.0	1.8	1.4	2.0	4.1	3.2	0.0	2.0	5.2	2.4	1.4

I like science...	Fall 2011		Spring 2014	
	Phase1	Phase2	Phase 1	Phase 2
A lot	54.4	40.2	29.9	23.4
A little	41.4	52.6	54.0	62.1
Not at all	1.2	2.1	14.1	13.1
Multiple responses	0.2	0.0	0.0	0.0
Missing	2.7	5.2	2.0	1.4

Table A - 6, continued

Science in my Future	Do you think science will be useful to you when you are older?				Would you like to be a scientist when you are older?			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Yes	55.4	47.4	34.3	33.1	8.8	4.1	5.6	5.5
Maybe	38.7	38.1	48.6	53.8	39.5	36.1	23.7	21.4
No	3.2	5.2	16.3	11.7	49.0	48.5	68.7	71.0
Multiple responses	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Missing	2.5	9.3	0.8	1.4	2.7	11.3	2.0	2.1

Frequency of Science Discussion	How often do you talk to your family about what you do in science class?				How often do you talk to your friends about what you do in science class?			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
A lot	21.1	20.6	7.4	7.6	13.7	12.4	6.6	5.5
Some	57.1	47.4	42.6	45.5	45.8	41.2	43.8	44.1
Never or almost never	19.1	19.6	49.0	44.8	37.7	34.0	48.8	46.2
Multiple responses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Missing	2.7	12.4	1.0	2.1	2.7	12.4	0.8	4.1

How much effort did you put into this test?	Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
I tried really hard	82.8	73.2	64.1	51.7
I tried a little	12.7	17.5	22.7	18.6
I did not try at all	0.5	0.0	2.0	1.4
Multiple responses	0.0	0.0	0.0	0.0
Missing	3.9	9.3	11.2	28.3

Table A - 6, continued

How often do you do the following activities in science class?	Answer questions on worksheets				Read a science textbook			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	40.2	33.0	29.3	25.5	29.4	39.2	19.9	56.6
Every week	47.3	34.0	60.6	51.7	55.9	36.1	58.8	26.9
Every month	7.8	10.3	6.0	15.2	10.5	4.1	15.5	9.0
Every year	0.2	5.2	0.2	1.4	0.7	0.0	2.0	2.1
Never	1.7	6.2	0.2	6.2	1.5	7.2	0.8	4.1
Multiple responses	0.7	0.0	0.0	0.0	0.0	3.1	0.0	0.0
Missing	2.0	11.3	3.8	0.0	2.0	10.3	3.4	1.4

How often do you do the following activities in science class?	Work on experiments with a partner or group				Work on a project or written report			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	9.3	14.4	14.9	3.4	8.8	17.5	3.4	6.9
Every week	47.5	42.3	59.4	38.6	16.9	21.6	10.8	14.5
Every month	35.0	20.6	19.3	44.8	53.4	32.0	52.6	40.7
Every year	0.7	3.1	1.2	2.8	7.4	7.2	18.7	22.8
Never	3.9	7.2	0.8	9.0	10.5	9.3	10.8	11.7
Multiple responses	0.2	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Missing	3.2	11.3	4.4	1.4	2.9	12.4	3.8	3.4

How often do you do the following activities in science class?	Use a science notebook			
	Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
Every day	54.9	57.7	59.8	57.2
Every week	23.3	10.3	14.1	14.5
Every month	5.6	5.2	3.8	6.9
Every year	1.7	6.2	2.8	2.1
Never	13.0	8.2	15.7	18.6
Multiple responses	0.0	1.0	0.0	0.0
Missing	1.5	11.3	3.8	0.7

Responses for Fall 2011 & Spring 2014 Student Attitudes Toward Science Survey Items: North Carolina

Table A - 7. PASS, North Carolina, Fall 2011 & Spring 2014: Elementary Cohort Student Attitude Survey Responses

Grades	My grades in science are usually:				My grades in math are usually:				My grades in reading are usually:			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase2	Phase1	Phase 2	Phase1	Phase2	Phase 1	Phase 2	Phase1	Phase 2
A's	26.5	33.0	43.6	43.7	37.3	46.9	40.2	47.6	35.9	42.4	38.0	37.9
B's	20.4	23.4	38.4	36.9	21.6	18.4	37.1	34.8	19.9	19.4	42.4	42.4
C's	4.9	4.8	12.9	13.8	5.0	5.2	14.3	11.5	7.2	6.1	12.8	13.1
D's	0.7	1.9	2.0	3.6	1.8	1.7	4.2	3.2	2.0	2.9	3.9	4.2
F's	1.1	0.7	1.1	1.3	1.2	1.9	2.1	2.3	1.6	2.3	0.9	1.5
E's	1.7	1.6	0.0	0.0	1.9	1.0	0.0	0.0	3.1	2.3	0.0	0.0
S's	35.4	25.2	0.0	0.0	23.9	17.2	0.0	0.0	21.6	15.5	0.0	0.0
N's	3.4	5.9	0.0	0.0	1.4	4.2	0.0	0.0	1.8	4.8	0.0	0.0
Multiple responses	4.4	2.8	0.0	0.0	2.9	1.1	0.0	0.0	2.9	0.8	0.0	0.0
Missing	1.3	0.8	2.0	0.6	2.9	2.3	2.0	0.7	4.1	3.5	2.0	0.8

I like science...	Fall 2011		Spring 2014	
	Phase1	Phase2	Phase 1	Phase 2
A lot	57.4	62.0	54.7	51.3
A little	33.0	28.0	39.1	42.7
Not at all	6.3	7.9	4.6	4.9
Multiple responses	0.0	0.2	0.0	0.0
Missing	3.3	2.0	1.7	1.1

Table A - 7, continued

Science in my Future	Do you think science will be useful to you when you are older?				Would you like to be a scientist when you are older?			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Yes	45.4	43.1	46.8	50.3	19.7	16.4	7.7	6.5
Maybe	43.3	44.8	45.5	43.5	25.7	30.2	28.9	27.4
No	8.8	10.2	6.9	6.1	51.5	50.7	61.9	65.0
Multiple responses	2.1	0.9	0.0	0.0	0.0	0.1	0.0	0.0
Missing	0.4	1.0	0.7	0.2	2.7	2.7	1.5	1.1

Frequency of Science Discussion	How often do you talk to your family about what you do in science class?				How often do you talk to your friends about what you do in science class?			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
A lot	24.2	24.2	15.0	12.6	16.8	13.2	10.5	8.3
Some	47.1	46.8	60.8	64.5	34.3	36.5	48.7	46.9
Never or almost never	25.9	25.9	23.4	22.3	44.9	47.2	39.4	44.2
Multiple responses	0.3	0.7	0.0	0.0	0.7	0.3	0.0	0.0
Missing	2.6	2.3	0.8	0.6	3.4	2.9	1.4	0.6

How much effort did you put into this test?	Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
I tried really hard	86.7	91.7	86.8	85.5
I tried a little	7.1	5.2	4.6	2.7
I did not try at all	0.8	0.9	0.1	0.3
Multiple responses	0.1	0.0	0.0	0.0
Missing	5.3	2.2	8.5	11.5

Table A - 7, continued

How often do you do the following activities in science class?	Answer questions on worksheets				Read a science textbook			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	36.4	36.2	30.5	30.1	19.2	21.7	19.9	12.9
Every week	31.7	36.0	48.9	50.3	22.3	20.7	36.9	28.1
Every month	8.1	8.3	12.8	10.7	7.8	9.9	20.0	21.5
Every year	4.2	6.2	1.8	2.1	3.5	3.4	3.7	4.0
Never	14.7	9.4	3.1	4.3	43.6	40.4	16.4	30.8
Multiple responses	3.1	1.9	0.0	0.0	1.6	1.7	0.0	0.0
Missing	1.8	2.1	2.8	2.7	2.0	2.2	3.1	2.7

How often do you do the following activities in science class?	Work on experiments with a partner or group				Work on a project or written report			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	18.8	19.1	30.6	10.9	13.9	12.6	5.4	3.6
Every week	33.0	29.7	43.1	34.8	21.5	20.7	19.0	12.1
Every month	14.5	18.2	18.3	37.9	19.3	20.5	49.4	43.2
Every year	6.4	6.6	2.1	5.7	11.1	10.5	12.0	14.9
Never	22.4	21.3	1.8	8.3	28.4	30.5	10.5	23.1
Multiple responses	1.9	1.8	0.0	0.0	0.4	0.7	0.0	0.0
Missing	2.9	3.2	4.2	2.4	5.5	4.5	3.8	3.2

How often do you do the following activities in science class?	Use a science notebook			
	Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
Every day	39.6	35.8	75.6	61.1
Every week	28.1	28.0	16.3	18.6
Every month	7.4	7.3	3.4	7.2
Every year	5.8	4.2	1.4	3.1
Never	15.1	20.3	0.8	7.6
Multiple responses	0.5	0.5	0.0	0.0
Missing	3.4	3.9	2.5	2.5

Table A - 8. PASS, North Carolina, Fall 2011 & Spring 2014: Middle School Cohort Student Attitude Survey Responses

Grades	My grades in science are usually:				My grades in math are usually:				My grades in reading are usually:			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase2	Phase1	Phase 2	Phase1	Phase2	Phase 1	Phase 2	Phase1	Phase 2
A's	35.9	36.9	33.9	28.7	39.5	39.6	30.4	33.5	34.3	40.0	38.6	38.0
B's	40.0	42.0	31.7	36.7	33.4	38.7	40.8	42.5	38.0	37.4	37.0	40.4
C's	15.1	12.2	24.5	22.3	15.1	11.5	18.5	16.1	16.8	11.8	16.8	15.2
D's	2.6	3.2	6.3	7.5	3.6	2.3	6.9	4.9	3.1	2.9	4.0	4.1
F's	0.7	0.2	2.0	3.8	2.3	0.8	2.0	1.8	1.2	0.5	1.6	0.9
E's	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S's	0.2	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0
N's	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Multiple responses	5.0	4.5	0.0	0.0	4.5	4.5	0.0	0.0	4.5	4.0	0.0	0.0
Missing	0.5	0.8	1.6	1.1	1.4	2.6	1.4	1.2	1.7	3.3	2.0	1.4

I like science...	Fall 2011		Spring 2014	
	Phase1	Phase2	Phase 1	Phase 2
A lot	48.7	49.7	26.6	30.5
A little	44.4	43.0	62.0	59.5
Not at all	5.4	3.9	10.1	8.6
Multiple responses	0.0	0.0	0.0	0.0
Missing	1.6	3.4	1.3	1.5

Table A - 8, continued

Science in my Future	Do you think science will be useful to you when you are older?				Would you like to be a scientist when you are older?			
	Fall 2011		Spring 2013		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Yes	52.7	54.3	36.8	45.7	9.0	7.5	3.8	3.7
Maybe	44.0	41.0	50.9	46.4	30.5	30.8	21.6	24.8
No	2.3	3.3	11.4	7.6	59.3	60.4	71.7	70.4
Multiple responses	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Missing	0.9	1.4	0.9	0.4	1.2	1.4	2.9	1.1

Frequency of Science Discussion	How often do you talk to your family about what you do in science class?				How often do you talk to your friends about what you do in science class?			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
A lot	17.3	16.8	3.6	4.6	9.4	13.8	8.9	9.1
Some	58.2	61.6	46.9	56.1	53.2	47.9	46.6	49.7
Never or almost never	23.4	20.1	47.6	38.8	35.5	36.8	42.8	40.2
Multiple responses	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Missing	1.0	1.5	1.8	0.6	1.9	1.6	1.8	1.1

How much effort did you put into this test?	Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
I tried really hard	79.4	81.2	66.3	71.3
I tried a little	17.0	12.0	18.8	18.1
I did not try at all	0.2	0.4	1.4	1.0
Multiple responses	0.2	0.0	0.0	0.0
Missing	3.3	6.4	13.4	9.6

Table A - 8, continued

How often do you do the following activities in science class?	Answer questions on worksheets				Read a science textbook			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	46.3	30.9	36.1	24.6	39.0	28.8	29.0	11.7
Every week	43.3	55.7	43.5	59.1	38.8	38.4	41.5	30.2
Every month	5.2	6.8	13.2	11.6	8.1	17.3	17.8	34.9
Every year	1.4	1.7	0.7	0.5	0.9	1.7	4.2	5.2
Never	1.9	2.1	1.1	2.7	11.4	10.1	2.7	16.4
Multiple responses	0.3	0.3	0.0	0.0	0.3	0.4	0.0	0.0
Missing	1.6	2.7	5.4	1.5	1.4	3.2	4.9	1.6

How often do you do the following activities in science class?	Work on experiments with a partner or group				Work on a project or written report			
	Fall 2011		Spring 2014		Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2	Phase1	Phase 2
Every day	17.0	12.9	4.7	6.3	8.1	6.8	1.3	4.5
Every week	57.9	48.7	31.7	35.4	29.8	19.8	16.3	22.3
Every month	18.5	25.2	44.4	50.2	35.7	46.5	52.9	64.6
Every year	1.0	1.3	7.1	3.0	4.3	6.5	19.2	5.2
Never	3.1	8.3	6.2	3.1	19.6	16.3	5.1	1.6
Multiple responses	0.5	0.9	0.0	0.0	0.5	0.4	0.0	0.0
Missing	1.9	2.9	6.0	1.9	1.9	3.7	5.3	1.7

How often do you do the following activities in science class?	Use a science notebook			
	Fall 2011		Spring 2014	
	Phase1	Phase 2	Phase1	Phase 2
Every day	68.6	70.7	63.0	68.8
Every week	21.5	11.5	16.5	16.7
Every month	3.5	3.1	7.4	5.5
Every year	0.9	1.5	0.9	1.6
Never	4.2	10.3	8.0	6.1
Multiple responses	0.0	0.2	0.0	0.0
Missing	1.4	2.7	4.2	1.4