Office of Accountability
Department of Research, Evaluation, and Assessment

A Longitudinal Analysis of a Volunteer Prekindergarten Cohort in Light of a Vanderbilt Study

Technical Report

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Overview

The Vanderbilt Peabody Research Institute's 2015 study, *A Randomized Control Trial of a Statewide Voluntary Prekindergarten Program on Children's Skills and Behaviors through Third Grade*, has generated a great deal of interest in examining the short and long-term benefits of PreK programs. Knox County Schools had students that were used as subjects in this study and have a vested interest in the study's results. Academic results from this study found that Volunteer PreK (VPK) students initially outperformed their control group peers in Kindergarten, but that the peers essentially caught up by the end of the year. Attendance results showed no difference between the two groups while behavioral results showed a decline for the VPK students as they entered the second and third grades when compared to their peers.

While all of the VPK programs were deemed to be "high-quality," there was some latitude as to what was involved in the PreK programming. Knox County Schools PreK personnel believe that their approach to PreK was better than most programs and that it did not necessarily contribute to some of the negative results that were found in the Vanderbilt study. While we do not have the ability to perform randomized control trials to evaluate our PreK program, we do have longitudinal data that can be used to examine student academic and behavioral trends and see to what extent they match or differ from the Vanderbilt study.

Methodology

The Vanderbilt study used PreK students from the 2009-2010 school year (SY0910) and then added those from SY1011 to bolster the study's numbers to approximately 1076 students - of which 773 were in the treatment group to go along with 303 in the control group. This study will use the VPK cohort from SY0506 as the treatment group. There were 117 students in that initial group and about 80% were still around through SY1415. Most of the students were in 8th grade in SY1415, but four were a year behind through the six years of this study.

This study will use a Matched-Pair design where students are paired with other students who have the same demographic features of: year, school, grade, gender, ethnicity, economic status, special education status, and English language learner status. As the matching was performed for each school year, a given student could be paired with six different students over the six years. It did not matter if any of the demographic features changed for a student using this methodology as each student was matched with a control student who had the same demographic features for that year. As demographic features do not ensure a perfect match, we have added an extra layer of analysis by creating five sets of pairs for each student with different control subjects in each trial. We used this method of non-replacement in order to have independent trials. We will view this data in a boot-strapping manner to

remove some of the possibility of the creation of a bad sample from our control group. If a control student could not be found for a given treatment student, then that treatment student was removed from the trial. The first trial averaged 88 students in each grade while the fifth trial was down to about 64 students in each grade.

We will look at trends across the years but focus on the aggregate of the years for our longitudinal approach. All of the data for Trial 1 will be presented as well as a summary of all of the trials. The individual results of the other trials will appear in appendices. We will consider the non-academic data of attendance and discipline referrals as well as the academic data that is from the Tennessee Comprehensive Assessment Program (TCAP). We will consider the TCAP subjects of Reading/Language Arts (RLA), Math, and Science.

Attendance Results

The percent attended data was computed for all of the students in the study. Table 1 provides measures of central tendency and dispersion for Trial 1. The data for each group is very similar. They each show the mean attendance increasing for the first three years (typically third through fifth grades) and then diminishing during the next three years. This pattern was typical for each of the five trials.

Table 1: Trial 1 attendance data

				Attendance					
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	94.5	94.8	84.8	100.0	.4	3.6	88
			SY1011	94.6	96.2	79.3	100.0	.5	5.0	84
			SY1112	95.3	96.0	79.7	100.0	.4	3.8	85
			SY1213	94.3	95.4	78.6	100.0	.5	4.7	90
			SY1314	94.1	96.4	61.5	100.0	.7	7.0	91
			SY1415	92.7	95.2	55.7	100.0	.8	7.4	89
			Total	94.3	95.8	55.7	100.0	.2	5.5	527
	Yes	School Year	SY0910	94.5	95.4	79.8	100.0	.4	3.8	88
			SY1011	94.9	95.9	80.5	100.0	.4	3.9	84
			SY1112	95.2	96.0	84.0	100.0	.4	4.1	85
			SY1213	94.1	95.4	74.6	100.0	.5	5.0	90
			SY1314	94.0	95.2	76.6	100.0	.5	5.2	91
			SY1415	92.8	94.0	72.5	100.0	.6	5.3	89
			Total	94.2	95.4	72.5	100.0	.2	4.6	527

Figure 1 provides a graphical perspective of the attendance means for Trial 1. Within this trial we see that the treatment group had the higher mean for three of the six years while the control group had the higher mean for three other years. This did not turn out to be the typical result for the other trials. In Trial 2 the treatment group had a higher attendance percentage in all six years while in the other trials they were ahead in four, five, and four of the years. When we consider the totals for each trial, in only Trial 1 was the control group's

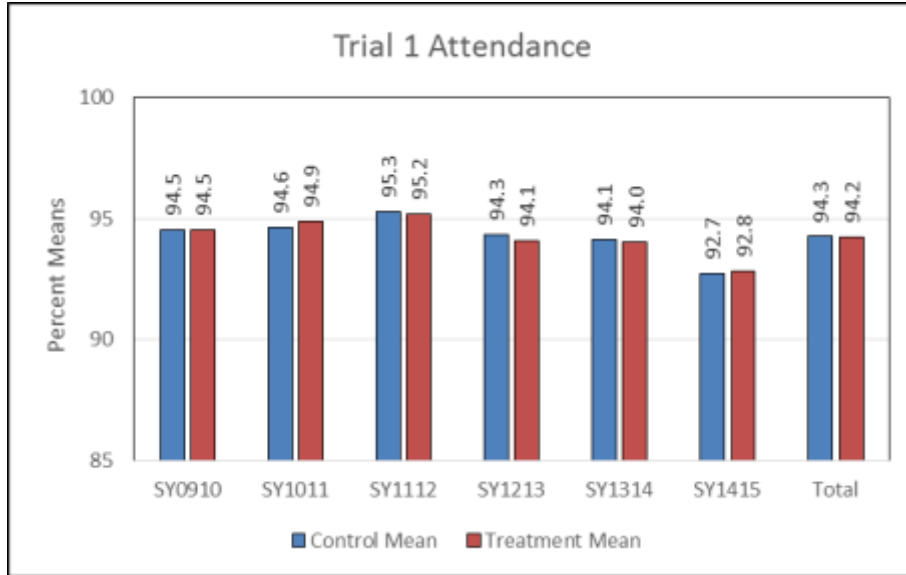percentage ahead of the treatment group's percentage. This attendance summary data is presented in Figure 2.

Trial 1 Attendance

	SY0910	SY1011	SY1112	SY1213	SY1314	SY1415	Total
Control Mean	94.5	94.6	95.3	94.3	94.1	92.7	94.3
Treatment Mean	94.5	94.9	95.2	94.1	94.0	92.8	94.2

Percent Means

Figure 1: Trial 1 attendance means

Attendance Summary

	Trial 1 Total (3)	Trial 2 Total (6)	Trial 3 Total (4)	Trial 4 Total (5)	Trial 5 Total (4)
Control Mean	94.3	93.8	93.9	93.5	93.6
Treatment Mean	94.2	94.2	94.1	94.0	93.9

Percent Means

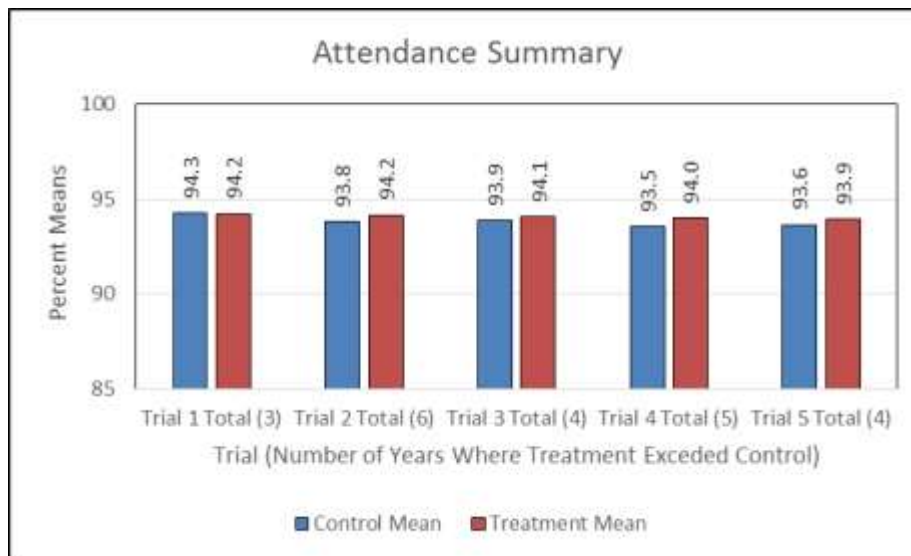Trial (Number of Years Where Treatment Exceded Control)

Figure 2: Attendance summary for all trials

Our data consists of five trials spanning six years, or 30 trial-years. In over 73% of the possible trial-years, the treatment group had a higher mean percent (22 out of 30). Exploratory t-tests were conducted on the total means. None of them turned out to be

statistically significant (using p < .05 for significance). The closest to significance was Trial 4 where the mean percentage difference between the two groups was almost a half of a percent, but even in this case, the odds of a result this extreme happening by chance was still about one in five. This was not close enough to our one in twenty threshold for determining significance. The results are represented in Table 2.

Table 2: t-test results on the difference in means

	Attendance Control Mean Minus Treatment Mean	t-test p value
Trial 1 Total	.0147	.962
Trial 2 Total	-.3353	.327
Trial 3 Total	-.1721	.626
Trial 4 Total	-.4828	.208
Trial 5 Total	-.2844	.481

The t-tests were considered to be exploratory because percentage distributions have a ceiling which can affect the assumption of the normality of the distribution. A histogram of the two distributions for Trial 1 can be found in Figure 3 where the lack of normality is evident.
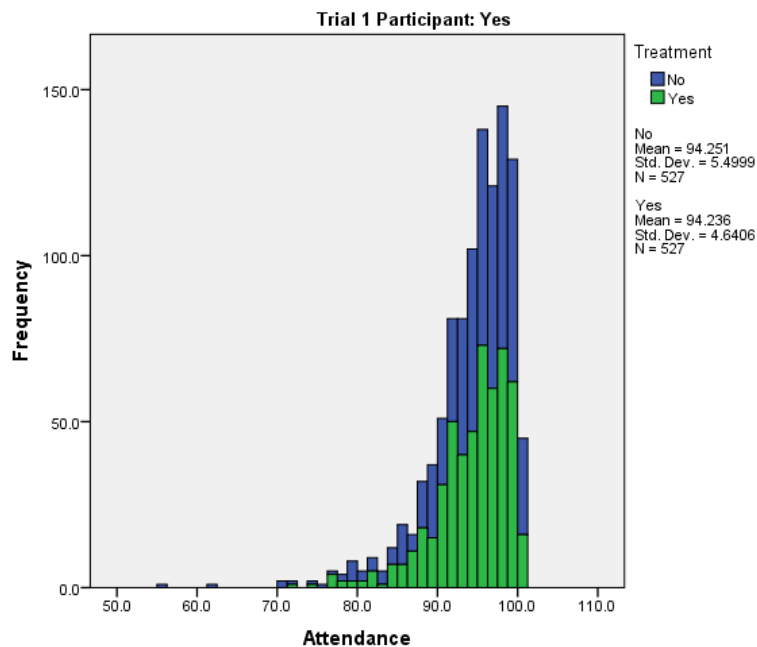

Figure 3: The distribution of attendance percentages for Trial 1

Because the underlying distributions are not quite normal, non-parametric tests were also conducted on the distributions. The Mann-Whitney U Test considered the distributions and found no significance in any of the trials with the smallest p-value being .220. The Median Test also failed to show any significance in the difference of medians. These results can be found in Appendix B.

While testing failed to show any significant differences in the means, medians, and distributions; the histogram reveals that there is some evidence of a difference in the dispersions of the two groups. In every one of the trials the VPK distribution had a smaller standard deviation. The treatment group in Figure 3 was typical in that the smallest attendance percentage was in the low-seventies (72.5). Each of the control groups had at least two students and as many as five students who had attendance percentages under 70. Figure 3 shows one in the mid-fifties and one in the low-sixties. While the differences in attendance were not statistically significant, this provides some evidence that the VPK cohort of students had more consistent attendance while the attendance summary provides some evidence that the VPK students had slightly better attendance.

Discipline Results

The Vanderbilt study used teacher ratings to evaluate student behavior. We will use actual discipline referrals for our evaluation. Unlike attendance, where everyone has positive data, not all students received a discipline referral. Our first inspection of the data investigates the percentage of students that receive at least one referral during the school year. Table 3 contains the data for Trial 1 in both counts and percentages while Figure 4 is a visual representation of the percentage data. Appendix C contains the data for all of the trials.

Table 3: Trial 1 students with at least one discipline referral

				Any Discipline Incidents		Any Discipline Incidents	
				No	Yes	No	Yes
Treatment	No	School Year	SY0910	77	11	87.5%	12.5%
			SY1011	64	20	76.2%	23.8%
			SY1112	68	17	80.0%	20.0%
			SY1213	59	31	65.6%	34.4%
			SY1314	60	31	65.9%	34.1%
			SY1415	58	31	65.2%	34.8%
			Total	386	141	73.2%	26.8%
	Yes	School Year	SY0910	80	8	90.9%	9.1%
			SY1011	67	17	79.8%	20.2%
			SY1112	68	17	80.0%	20.0%
			SY1213	62	28	68.9%	31.1%
			SY1314	56	35	61.5%	38.5%
			SY1415	60	29	67.4%	32.6%
			Total	393	134	74.6%	25.4%

The percentage of students receiving at least one discipline referral tended to increase as the students progressed through the grades. It was not unusual for one year to buck the trend as the control group did in SY1112 and both groups did in SY1314. Every trial in the study had an aberration, yet the overall trend was an increase over time.
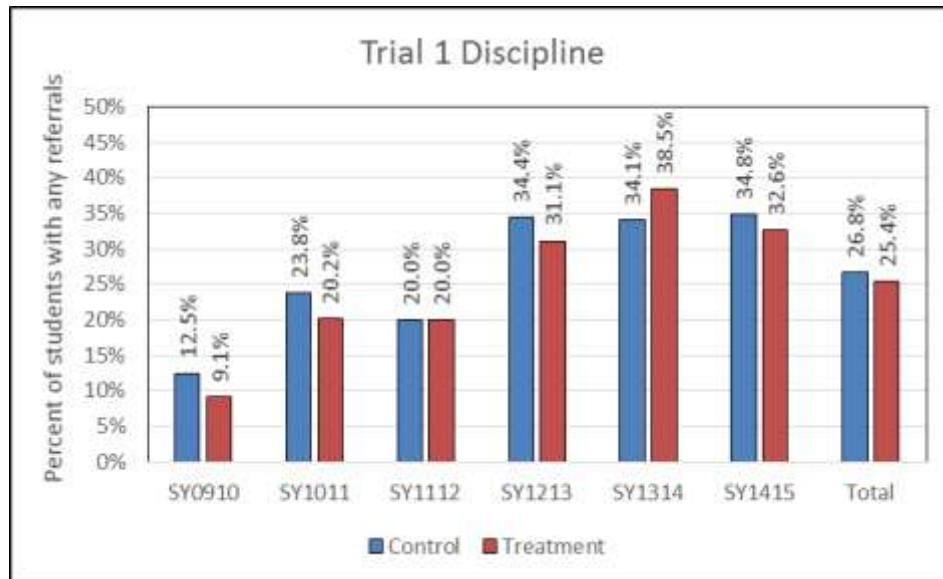

Figure 4: Trial 1 percentages of students with at least one discipline referral

There was no clear trend when the percentages for the control and treatment groups were compared. While the control group had a greater percentage of students with a discipline referral in four of the six years for Trial 1, the situation was reversed in the other trials. When the trial-years are considered it turned out that the groups were evenly split at fifteen times having the greater percentage. A summary of the trials can be found in Figure 5. With the evidence so evenly split, it was doubtful that any differences would be found using hypothesis testing. A Chi-Squared test was conducted on each of the groups on each of the trials using the overall averages to get the expected number of students with any discipline referrals. As anticipated, none of the trial groups approached a significant difference. These results are captured in Table 4. Similar tests were conducted using the within trial means to compute the expectations. The results for these tests produced similar results. These can be observed in Table 5.
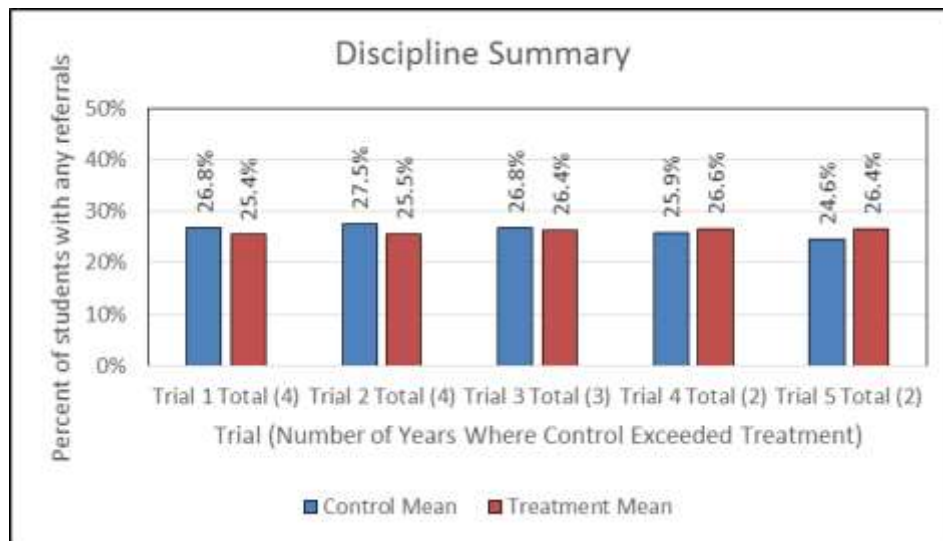

Figure 5: Discipline summary for all trials

Table 4: Chi-Squared test on the number of discipline referrals using the global mean for the expected values

| | | Any Discipline Incidents | | | | | | Chi-Squared p-value |
| | | Actual | | Expected | | Difference | | |
		No	Yes	No	Yes	No	Yes	
Trial 1	Control	386	141	389	138	-3	3	0.777
	Treatment	393	134	389	138	4	-4	0.682
Trial 2	Control	358	136	365	129	-7	7	0.505
	Treatment	368	126	365	129	3	-3	0.721
Trial 3	Control	330	121	333	118	-3	3	0.765
	Treatment	332	119	333	118	-1	1	0.933
Trial 4	Control	309	108	308	109	1	-1	0.885
	Treatment	306	111	308	109	-2	2	0.850
Trial 5	Control	288	94	282	100	6	-6	0.476
	Treatment	281	101	282	100	-1	1	0.919

Table 5: Chi-Squared test on the number of discipline referrals using the trial mean for the expected values

| | | Any Discipline Incidents | | | | | | Chi-Squared p-value |
| | | Actual | | Expected | | Difference | | |
		No	Yes	No	Yes	No	Yes	
Trial 1	Control	386	141	389.5	137.5	-4	4	0.777
	Treatment	393	134	389.5	137.5	4	-4	0.682
Trial 2	Control	358	136	363	131	-5	5	0.505
	Treatment	368	126	363	131	5	-5	0.721
Trial 3	Control	330	121	331	120	-1	1	0.765
	Treatment	332	119	331	120	1	-1	0.933
Trial 4	Control	309	108	307.5	109.5	2	-2	0.885
	Treatment	306	111	307.5	109.5	-2	2	0.850
Trial 5	Control	288	94	284.5	97.5	4	-4	0.476
	Treatment	281	101	284.5	97.5	-4	4	0.919

As was the case with attendance percents, the mean number of discipline referrals was also skewed, but with a floor instead of a ceiling. Figure 6 demonstrates just how far the distributions are from being normal.
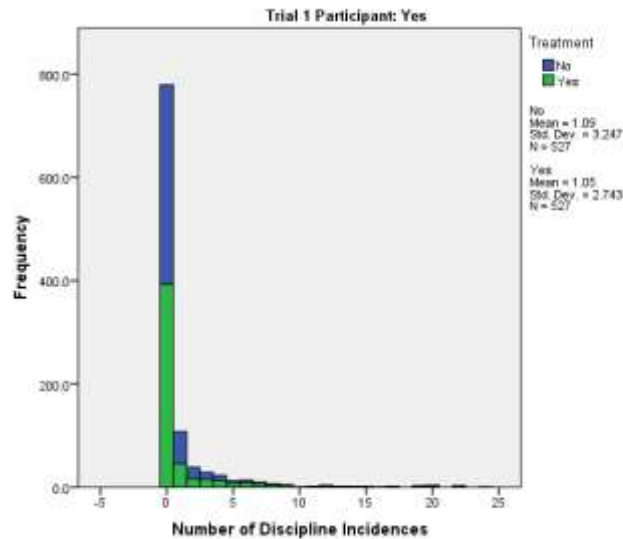
Figure 6: The distribution of the number of discipline referrals for Trial 1

Non-parametric tests were conducted on the distributions and all of them were far from being significant. The results of these tests can be found in Appendix D. There was no trend difference between the treatment and control groups for the means or for the standard deviations. We must therefore conclude that there is no evidence for a difference in the number of discipline referrals and subsequently the behavior of the treatment and control groups.

Academic Results

The Vanderbilt study used Woodcock Johnson assessments to investigate academic differences. They noted some regression of the VPK students in second and third grades on these assessments. We have the ability to investigate student performance on the assessments that the State on Tennessee actually uses to monitor its schools. We will consider the TCAP Achievement tests for the subjects of Reading/Language Arts (RLA), Math, and Science. It should be noted that a small percentage of our students took a modified version of this test – around three percent. Additionally, about twenty percent of our students took the Algebra I End of Course test during SY1415.

The academic data will be considered in two ways. We will look at the categorical data of Achievement Levels. The categories are: Below Basic, Basic, Proficient, or Advanced. We will be concentrating on those who were Proficient or Advanced (PA) which is used by the state for accountability purposes. The second way we will consider the data is through the scaled variable data of Normal Curve Equivalents (NCEs). While we will include all of the tests in the achievement level data analysis, we do not have NCEs for the Modified tests or for Algebra I.

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Reading/Language Arts Results

The distribution of achievement levels for Reading/Language Arts across the years for Trial 1 can be found in Table 6 with all of the trials available in Appendix E. If we focus on the right hand column we can note the percentage of the students who achieved either the level of Proficient or of Advanced. If we compare the treatment and control groups by year we can see that the treatment group had a higher percentage of students Proficient or Advanced for four of the six school years, yet when the data is collected over the span of six years, the treatment group is ahead by .2% (241 out of 527 students PA in the treatment group and 240 out of 527 students PA in the control group). A graph of this data can be found in Figure 7.

Table 6: Trial 1 Achievement Level percentages for Reading/Language Arts

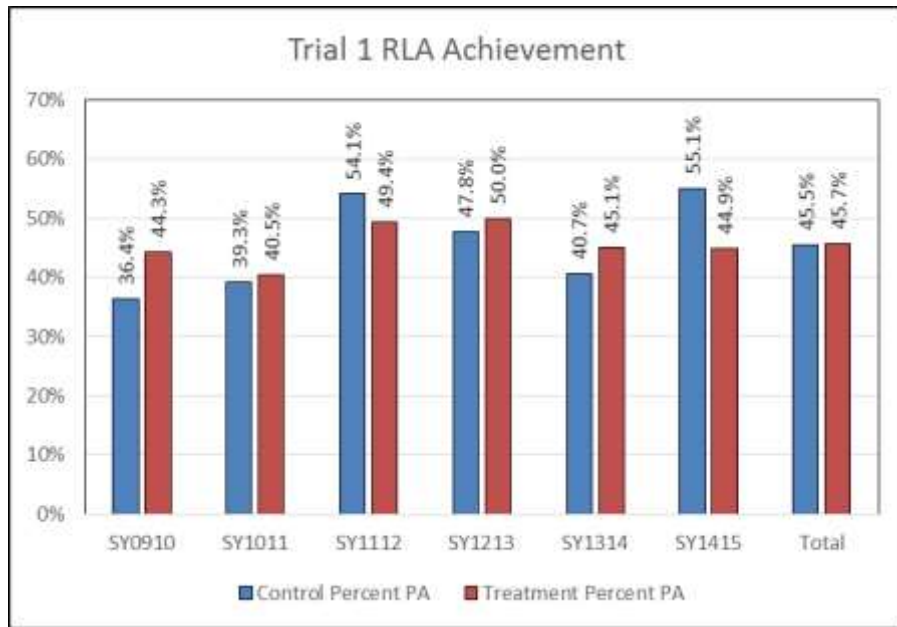|				Count	RLA Level				PA RLA	
					Below Basic	Basic	Proficient	Advanced	No	Yes
					Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	88	21.6%	42.0%	26.1%	10.2%	63.6%	36.4%
			SY1011	84	21.4%	39.3%	29.8%	9.5%	60.7%	39.3%
			SY1112	85	8.2%	37.6%	50.6%	3.5%	45.9%	54.1%
			SY1213	90	14.4%	37.8%	42.2%	5.6%	52.2%	47.8%
			SY1314	91	16.5%	42.9%	33.0%	7.7%	59.3%	40.7%
			SY1415	89	10.1%	34.8%	43.8%	11.2%	44.9%	55.1%
			Total	527	15.4%	39.1%	37.6%	8.0%	54.5%	45.5%
	Yes	School Year	SY0910	88	15.9%	39.8%	36.4%	8.0%	55.7%	44.3%
			SY1011	84	17.9%	41.7%	32.1%	8.3%	59.5%	40.5%
			SY1112	85	7.1%	43.5%	43.5%	5.9%	50.6%	49.4%
			SY1213	90	12.2%	37.8%	46.7%	3.3%	50.0%	50.0%
			SY1314	91	14.3%	40.7%	41.8%	3.3%	54.9%	45.1%
			SY1415	89	15.7%	39.3%	34.8%	10.1%	55.1%	44.9%
			Total	527	13.9%	40.4%	39.3%	6.5%	54.3%	45.7%

Figure 7: Trial 1 Percent Proficient or Advanced for Reading/Language Arts

When we consider all of the trials, Trial 1 and Trial 5 had the aggregated treatment group with a higher percentage. The other three trials favored the control group. When we consider all of the trials over all of the years, the advantage goes to control group. They had the higher percentage in 18 of the 30 possible trial-year combinations, or 60% of the possibilities. This matches with the 60% of the trials (3 out of 5).
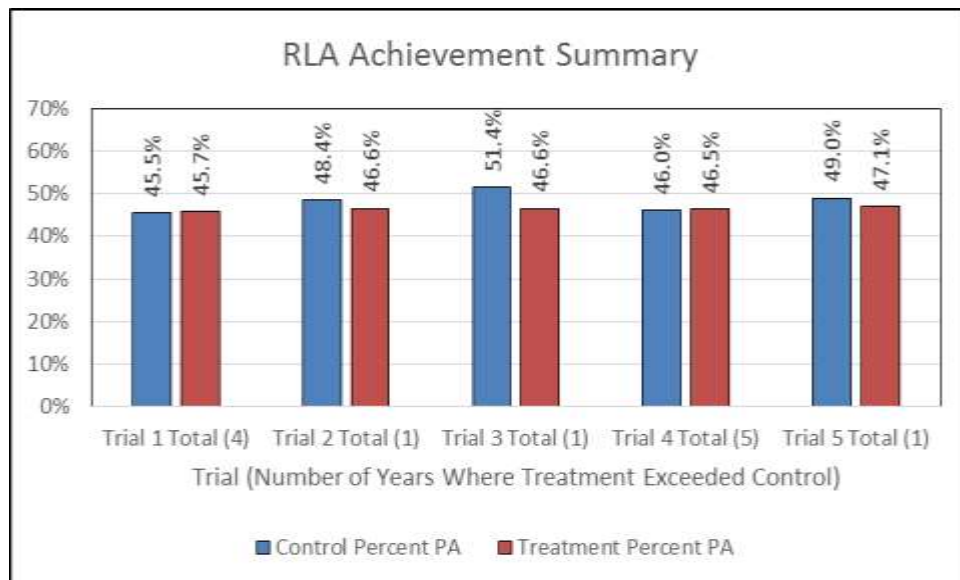

Figure 8: Reading/Language Arts percent Proficient or Advanced for all trials

Were any of these results statistically significant? We ran Chi-Squared Goodness of Fit tests using the overall mean percent PA to produce the expected outcomes. These results can be found in Table 7. We also ran the tests using the individual trial mean percent PA to compute the expected outcomes. These results can be found in Table 8. It turns out that each group in Trial 1 underperformed based upon the global means. Compared to one another they are essentially equal. A look back at Figure 8 shows the greatest difference between the percents happened in Trial 3. The Table 7 data suggests that the treatment group performed fairly close to the global expectations. They fell three students shy of hitting the expected PA number. The control group for this trial was 19 students ahead of what was predicted. Yet, a result this extreme happens about 7% of the time and is not considered statistically significant. When we consider the intra-year mean for this trial we see from Table 8 that the chances of getting a result as extreme as the 11 students happens about 30% of the time. We therefore must conclude that there is no difference between the groups in the level of achievement in each trial.

Table 7: Chi-Squared test on RLA Proficient or Advanced numbers using the global means for the expected values

| | | Proficient or Advanced | | | | | | Chi-Squared p-value |
| | | Actual | | Expected | | Difference | | |
		No	Yes	No	Yes	No	Yes	
Trial 1	Control	287	240	278	249	9	-9	0.438
	Treatment	286	241	278	249	8	-8	0.492
Trial 2	Control	255	239	261	233	-6	6	0.607
	Treatment	264	230	261	233	3	-3	0.766
Trial 3	Control	219	232	238	213	-19	19	0.073
	Treatment	241	210	238	213	3	-3	0.778
Trial 4	Control	225	192	220	197	5	-5	0.629
	Treatment	223	194	220	197	3	-3	0.774
Trial 5	Control	195	187	202	180	-7	7	0.499
	Treatment	202	180	202	180	0	0	0.967

Table 8: Chi-Squared test on RLA Proficient or Advanced numbers using the trial means for the expected values

| | | Proficient or Advanced | | | | | | Chi-Squared p-value |
| | | Actual | | Expected | | Difference | | |
		No	Yes	No	Yes	No	Yes	
Trial 1	Control	287	240	287	241	1	-1	0.965
	Treatment	286	241	287	241	-1	1	0.965
Trial 2	Control	255	239	260	235	-5	5	0.685
	Treatment	264	230	260	235	5	-5	0.685
Trial 3	Control	219	232	230	221	-11	11	0.300
	Treatment	241	210	230	221	11	-11	0.300
Trial 4	Control	225	192	224	193	1	-1	0.922
	Treatment	223	194	224	193	-1	1	0.922
Trial 5	Control	195	187	199	184	-4	4	0.720
	Treatment	202	180	199	184	4	-4	0.720

We considered the categorical labels of Proficient or Advanced. We will now turn our attention to the Normal Curve Equivalents. Histograms of the Trial 1 data were created and the results show that the distributions are fairly normal. These histograms can be found in Figure 9 while the central tendency and dispersion data for Trial 1 are available in Table 9 with all of the trials being available in Appendix F.
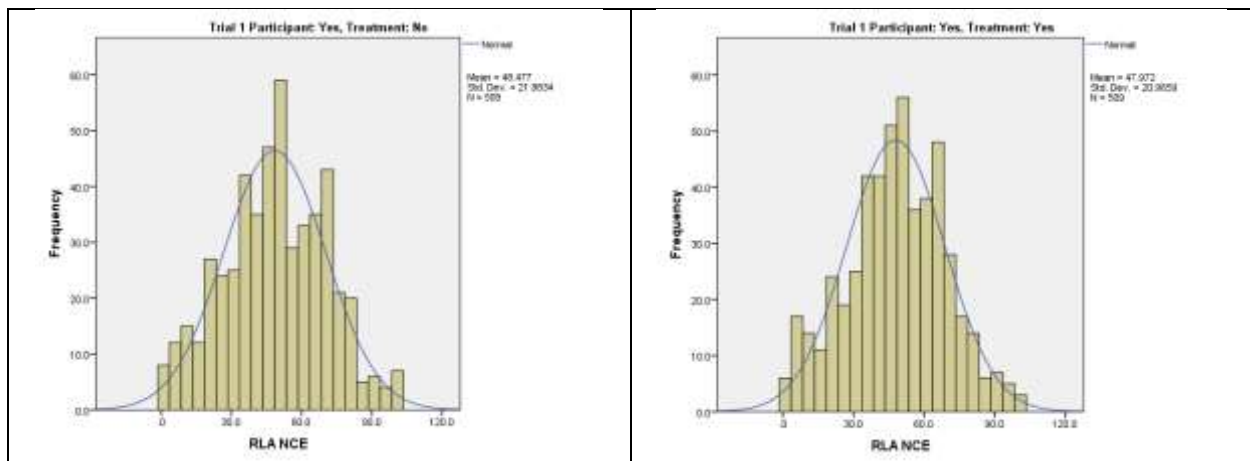

Figure 9: Histograms of the Reading/Language Arts NCE distributions with normal curves

Table 9: Trial 1 Reading/Language Arts NCEs measures of central tendency and dispersion

				RLA NCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	45.2	43	3	99	2.5	23.8	88
			SY1011	47.3	47	4	99	2.7	24.3	84
			SY1112	53.0	55	2	99	2.1	18.8	85
			SY1213	47.2	46	1	98	2.3	21.2	90
			SY1314	47.9	47	1	94	2.2	20.8	91
			SY1415	50.5	52	1	99	2.3	21.6	89
			Total	48.5	49	1	99	1.0	21.9	527
	Yes	School Year	SY0910	47.2	49	3	99	2.4	22.7	88
			SY1011	48.4	48	1	99	2.6	23.5	84
			SY1112	52.3	51	1	94	2.2	19.3	85
			SY1213	47.3	47	1	93	2.1	19.5	90
			SY1314	45.7	45	1	89	2.1	19.8	91
			SY1415	47.5	48	4	88	2.2	20.6	89
			Total	48.0	49	1	99	.9	21.0	527

A graph of the mean NCEs for Trial 1 of RLA is available in Figure 10. There is a general pattern of increase over the first three years and then some vacillating after that. Each group had a higher mean NCE for three of the six years for this particular trial with the control group having a slightly higher mean when the data was aggregated.
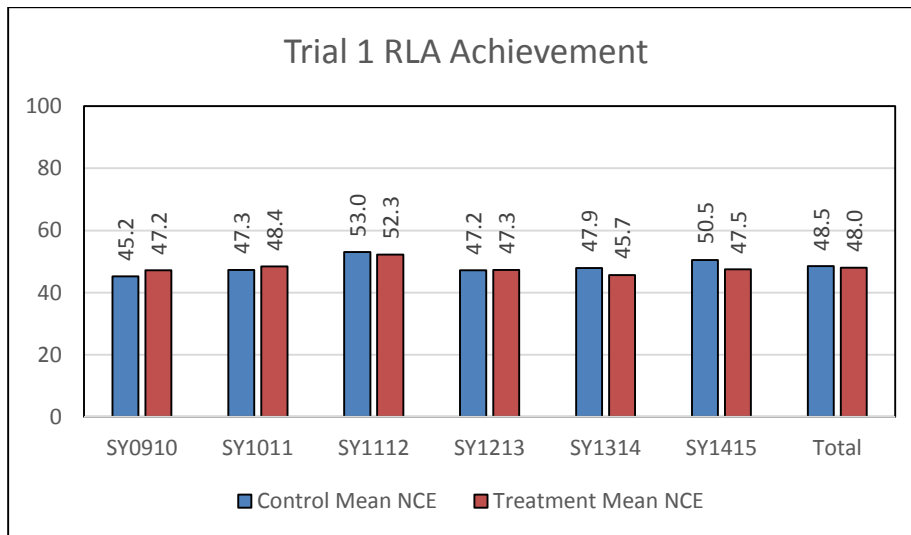

Figure 10: Trial 1 mean NCEs for RLA

When we consider the totals from each of the trials a trend is visible. While the number of times that the treatment mean exceeds the control mean is similar to the PA data (11 instead of 12 times out of 30), for the aggregate of every trial the control mean NCE was greater than the treatment mean NCE. This is presented graphically in Figure 11.
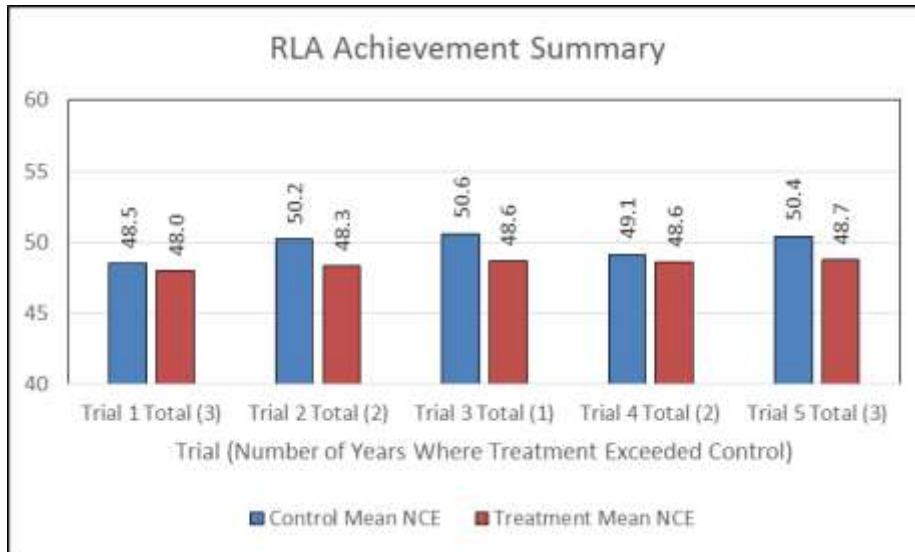

Figure 11: Reading/Language Arts mean NCEs for all trials

A statistical t-test was in order to determine if any of the results were significant. The results of these tests are available in Table 10. Three of the trials had p values below .2, but none were close to our threshold of .05. We must therefore conclude that there is no statistical significance between the two groups on Reading/Language Arts achievement, but there is some evidence that the treatment group did not perform as well as the control groups in this subject area.

Table 10: t-tests on Reading/Language Arts mean NCEs for all trials

RLA NCE	Count per Group	Control Mean NCE	Treatment Mean NCE	Treatment minus Control mean NCE	t-test p value
Trial 1	509	48.5	48.0	-0.5	.707
Trial 2	480	50.2	48.3	-1.9	.188
Trial 3	442	50.6	48.6	-1.9	.193
Trial 4	409	49.1	48.6	-0.6	.193
Trial 5	376	50.4	48.7	-1.7	.287

Math Results

The analysis for math and science will follow the same approach as was used for RLA. The categorical data of achievement levels for Math for Trial 1 are available in Table 11 with each of the trials available in Appendix G. A graph of the percents Proficient and Advanced can be seen in Figure 12 for Trial 1.

Table 11: Trial 1 Achievement Level percentages for Math

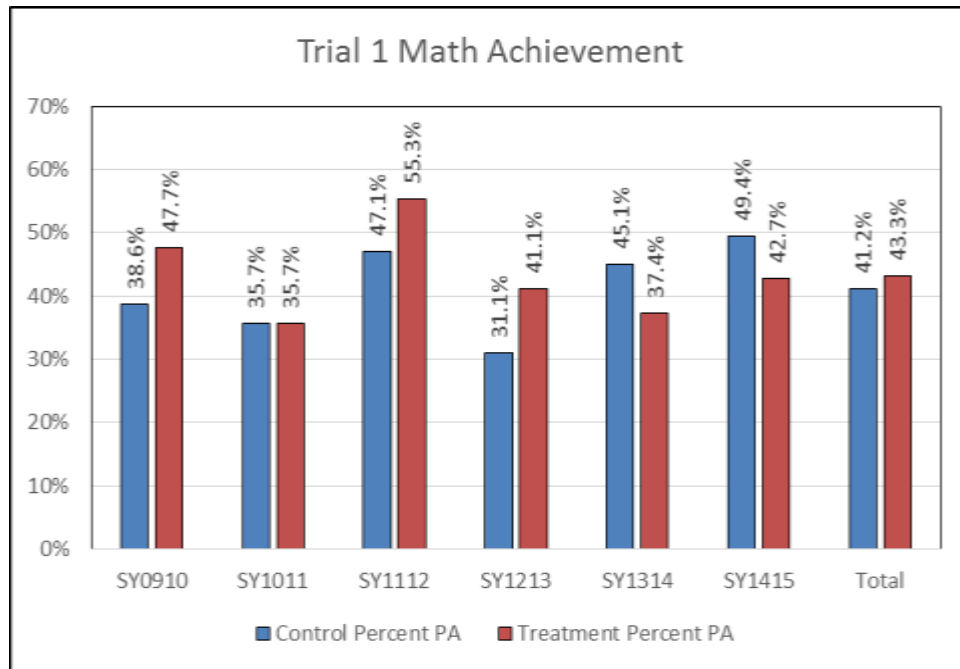|				Count	Math Level				PA Math	
					Below Basic	Basic	Proficient	Advanced	No	Yes
					Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	88	12.5%	48.9%	29.5%	9.1%	61.4%	38.6%
			SY1011	84	21.4%	42.9%	27.4%	8.3%	64.3%	35.7%
			SY1112	85	16.5%	36.5%	35.3%	11.8%	52.9%	47.1%
			SY1213	90	21.1%	47.8%	17.8%	13.3%	68.9%	31.1%
			SY1314	91	30.8%	24.2%	33.0%	12.1%	54.9%	45.1%
			SY1415	89	24.7%	25.8%	29.2%	20.2%	50.6%	49.4%
			Total	527	21.3%	37.6%	28.7%	12.5%	58.8%	41.2%
	Yes	School Year	SY0910	88	14.8%	37.5%	37.5%	10.2%	52.3%	47.7%
			SY1011	84	21.4%	42.9%	27.4%	8.3%	64.3%	35.7%
			SY1112	85	8.2%	36.5%	37.6%	17.6%	44.7%	55.3%
			SY1213	90	15.6%	43.3%	28.9%	12.2%	58.9%	41.1%
			SY1314	91	19.8%	42.9%	22.0%	15.4%	62.6%	37.4%
			SY1415	89	28.1%	29.2%	21.3%	21.3%	57.3%	42.7%
			Total	527	18.0%	38.7%	29.0%	14.2%	56.7%	43.3%

Figure 12: Trial 1 Percent Proficient or Advanced for Math

For Trial 1 each group had a higher percentage of students Proficient or Advanced than the other group in three of the six years of the study. Over the course of all of the trials the treatment group maintained a slight edge in the number of possible trial-year (16 to 14), but had a larger edge in the number of aggregate trials with a greater number of students Proficient or Advanced as they were ahead in 4 of the five trials. This data can be visualized in Figure 13.
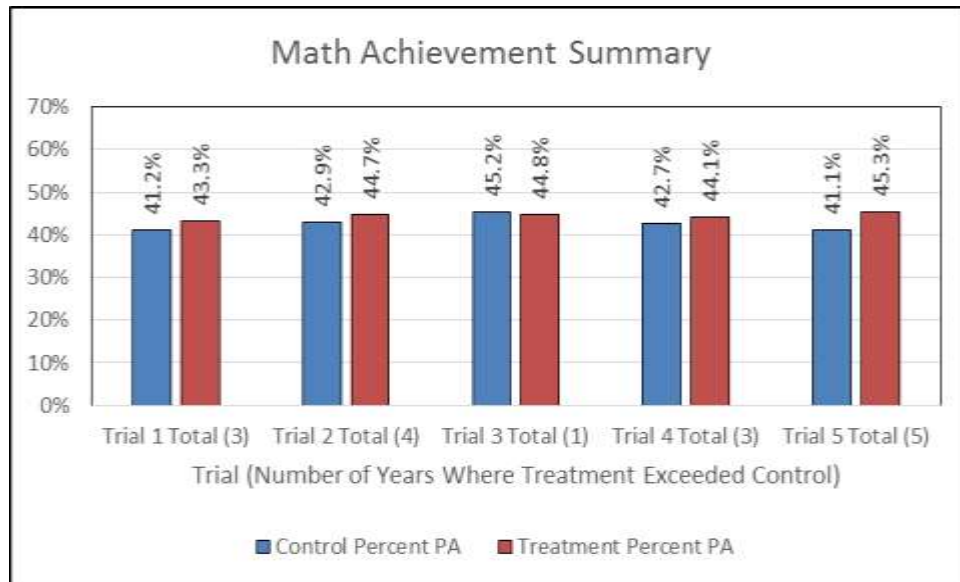
Figure 13: Math percent Proficient or Advanced for all trials

Chi-Squared tests were conducted using the two types of trial means used for RLA with none of the tests being statistically significant. The results for these tests can be found in Tables 12 and 13.

Table 12: Chi-Squared test on Math Proficient or Advanced numbers using the global means for the expected values

| | | Proficient or Advanced | | | | | | Chi-Squared p-value |
| | | Actual | | Expected | | Difference | | |
		No	Yes	No	Yes	No	Yes	
Trial 1	Control	310	217	298	229	12	-12	0.281
	Treatment	299	228	298	229	1	-1	0.911
Trial 2	Control	282	212	279	215	3	-3	0.791
	Treatment	273	221	279	215	-6	6	0.581
Trial 3	Control	247	204	255	196	-8	8	0.459
	Treatment	249	202	255	196	-6	6	0.582
Trial 4	Control	239	178	236	181	3	-3	0.736
	Treatment	233	184	236	181	-3	3	0.799
Trial 5	Control	225	157	216	166	9	-9	0.343
	Treatment	209	173	216	166	-7	7	0.482

Table 13: Chi-Squared test on Math Proficient or Advanced numbers using the trial means for the expected values

		Proficient or Advanced						Chi-Squared p-value
		Actual		Expected		Difference		
		No	Yes	No	Yes	No	Yes	
Trial 1	Control	310	217	305	223	6	-6	0.628
	Treatment	299	228	305	223	-6	6	0.628
Trial 2	Control	282	212	278	217	5	-5	0.683
	Treatment	273	221	278	217	-5	5	0.683
Trial 3	Control	247	204	248	203	-1	1	0.925
	Treatment	249	202	248	203	1	-1	0.925
Trial 4	Control	239	178	236	181	3	-3	0.767
	Treatment	233	184	236	181	-3	3	0.767
Trial 5	Control	225	157	217	165	8	-8	0.409
	Treatment	209	173	217	165	-8	8	0.409

With no statistically significant difference in the aggregate achievement levels between the two groups, we turn our attention to the scaled Math NCE variable. The measures of central tendency and dispersion for Trial 1 can be found in Table 14 with all of the trials appearing in Appendix H. A graph of the means for Trial 1 can be found in Figure 14.

Table 14: Trial 1 Math NCEs measures of central tendency and dispersion

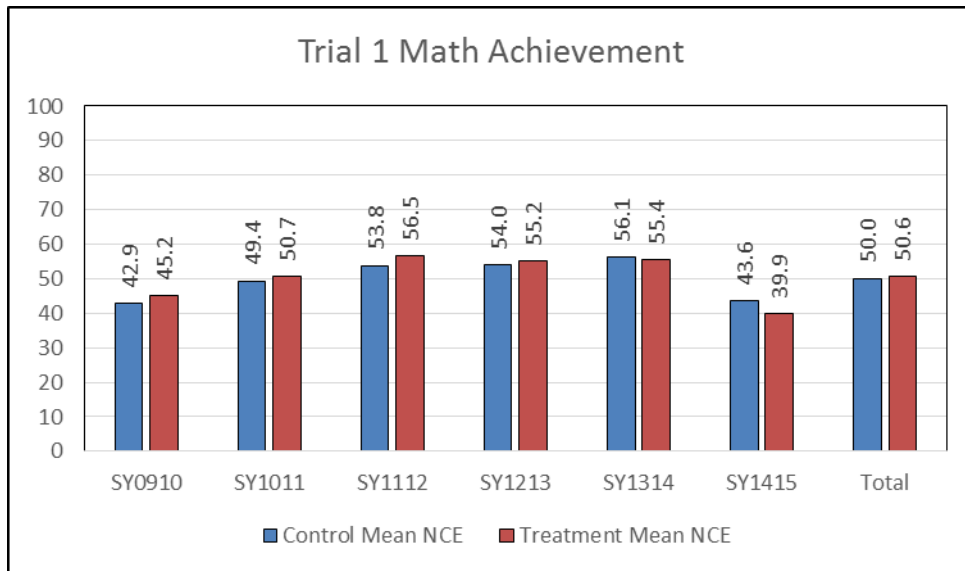|				Math NCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	42.9	41	1	98	2.3	21.0	87
			SY1011	49.4	48	1	99	2.6	23.9	83
			SY1112	53.8	54	1	95	2.1	18.9	78
			SY1213	54.0	54	22	99	1.9	18.0	85
			SY1314	56.1	58	17	98	2.2	20.1	87
			SY1415	43.6	46	1	82	2.2	19.3	75
			Total	50.0	50	1	99	.9	20.8	495
	Yes	School Year	SY0910	45.2	46	1	99	2.4	22.6	87
			SY1011	50.7	53	1	96	2.4	21.5	83
			SY1112	56.5	59	1	95	2.0	17.6	78
			SY1213	55.2	56	1	92	2.0	18.0	85
			SY1314	55.4	54	1	90	2.0	19.1	87
			SY1415	39.9	43	1	82	2.1	18.6	75
			Total	50.6	51	1	99	.9	20.5	495

Figure 14: Trial 1 mean NCEs for Math

The mean NCEs show a general increase for the first five years and then a marked decrease for SY1415. This decrease can mostly be attributed to the students who were taking Algebra I instead of the 8th grade TCAP and for whom we do not have NCEs. The treatment group had the better mean Math NCE in four of the six years for Trial 1. This turned out to be their best trial. When we look at all of the trial-year combinations the control group was ahead of the treatment group a small majority of the time, 17 to 13. Yet, when we consider the trial aggregates, the treatment group had the better mean NCE in 4 of the 5 trials. A summary graph of this information can be found in Figure 15.
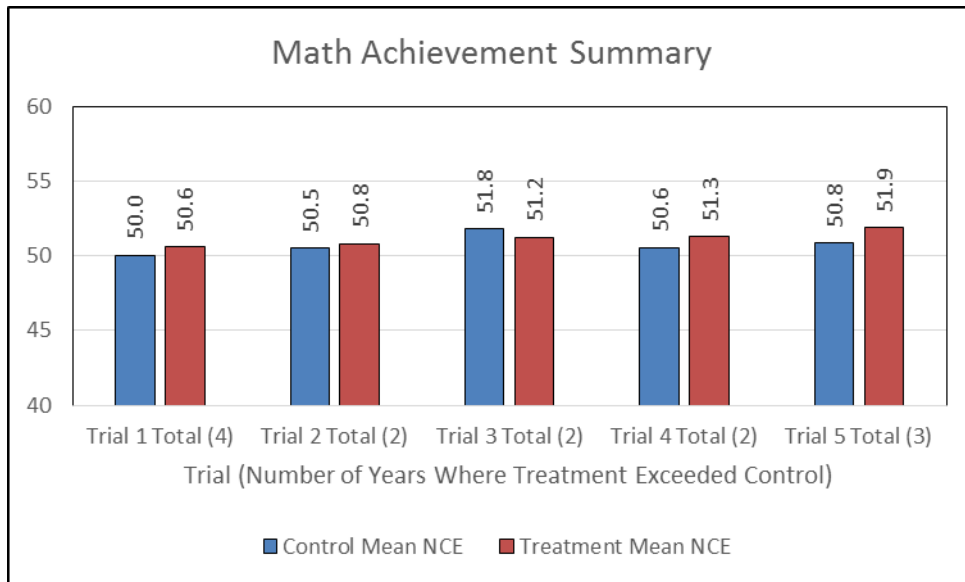
Figure 15: Math mean NCEs for all trials

Our next step was to apply t-tests to the means. The results of these tests can be found in Table 15. While there is some evidence that the treatment group performed better on the trials, none of the differences turned out to be statistically significant.

Table 15: t-tests on Math mean NCEs for all trials

Math NCE	Count per Group	Control Mean NCE	Treatment Mean NCE	Treatment minus Control mean NCE	t-test p value
Trial 1	495	50.0	50.6	0.6	.670
Trial 2	466	50.5	50.8	0.3	.824
Trial 3	429	51.8	51.2	-0.6	.697
Trial 4	399	50.6	51.3	0.8	.697
Trial 5	367	50.8	51.9	1.1	.475

Science Results

The categorical data of achievement levels for Science for Trial 1 are available in Table 16 and in Figure 16. The achievement levels for all of the trials are available in Appendix I.

Table 16: Trial 1 Achievement Level percentages for Science

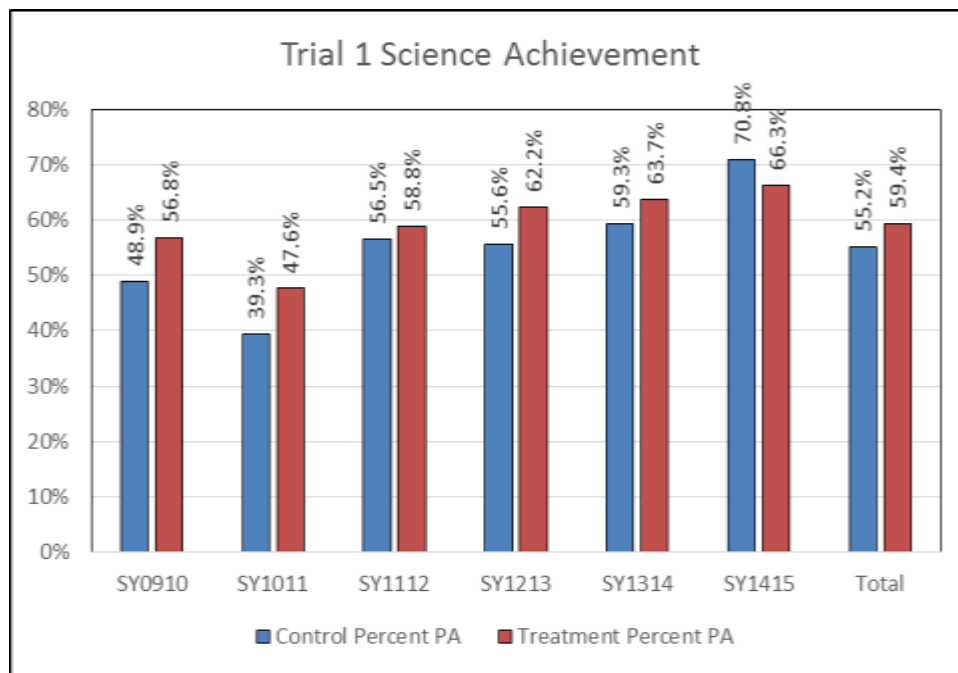|					Science Level				PA Science	
				Count	Below Basic	Basic	Proficient	Advanced	No	Yes
					Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	88	29.5%	21.6%	42.0%	6.8%	51.1%	48.9%
			SY1011	84	27.4%	33.3%	26.2%	13.1%	60.7%	39.3%
			SY1112	85	17.6%	25.9%	43.5%	12.9%	43.5%	56.5%
			SY1213	90	17.8%	26.7%	41.1%	14.4%	44.4%	55.6%
			SY1314	91	14.3%	26.4%	36.3%	23.1%	40.7%	59.3%
			SY1415	89	9.0%	20.2%	48.3%	22.5%	29.2%	70.8%
			Total	527	19.2%	25.6%	39.7%	15.6%	44.8%	55.2%
	Yes	School Year	SY0910	88	19.3%	23.9%	43.2%	13.6%	43.2%	56.8%
			SY1011	84	23.8%	28.6%	39.3%	8.3%	52.4%	47.6%
			SY1112	85	12.9%	28.2%	50.6%	8.2%	41.2%	58.8%
			SY1213	90	14.4%	23.3%	48.9%	13.3%	37.8%	62.2%
			SY1314	91	13.2%	23.1%	41.8%	22.0%	36.3%	63.7%
			SY1415	89	14.6%	19.1%	39.3%	27.0%	33.7%	66.3%
			Total	527	16.3%	24.3%	43.8%	15.6%	40.6%	59.4%

Figure 16: Trial 1 Percent Proficient or Advanced for Science

The treatment group performed better in five out the six years for Trial 1 as well as overall. This was not an aberration as shown in the Science achievement summary in Figure 17. The treatment group's percent Proficient or Advanced was better in 60% of the trial years (18 out of 30) while they were more successful in four of the five trials (80%).
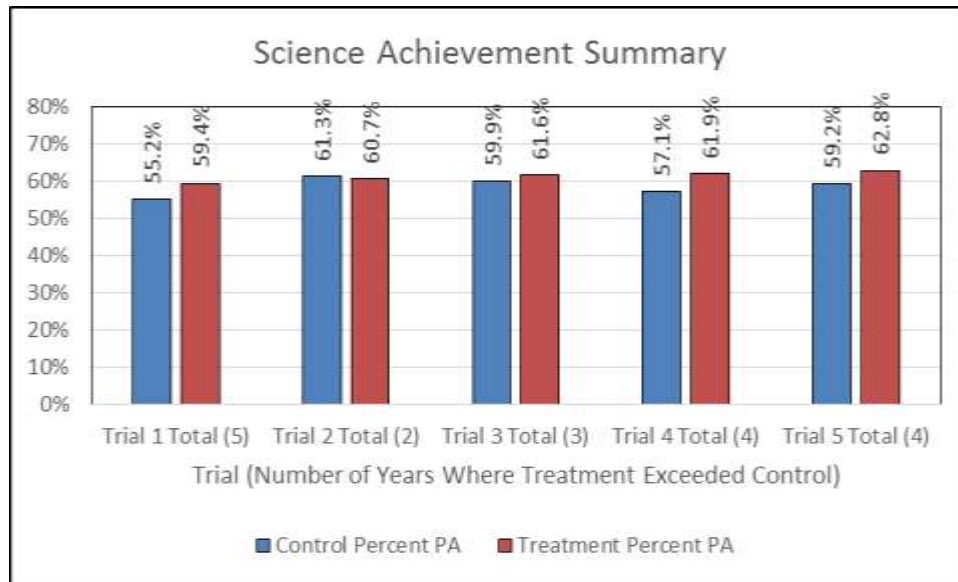
Figure 17: Science percent Proficient or Advanced for all trials

Chi-Squared testing was performed using the global mean (Table 17) as well as the individual trial mean (Table 18) to create the expected number of Proficient and Advanced students.

Table 17: Chi-Squared test on Science Proficient or Advanced numbers using the global means for the expected values

		Proficient or Advanced						Chi-Squared p-value
		Actual		Expected		Difference		
		No	Yes	No	Yes	No	Yes	
Trial 1	Control	236	291	212	315	24	-24	0.031
	Treatment	214	313	212	315	2	-2	0.842
Trial 2	Control	191	303	198	296	-7	7	0.492
	Treatment	194	300	198	296	-4	4	0.680
Trial 3	Control	181	270	181	270	0	0	0.984
	Treatment	173	278	181	270	-8	8	0.430
Trial 4	Control	179	238	168	249	11	-11	0.253
	Treatment	159	258	168	249	-9	9	0.393
Trial 5	Control	156	226	153	229	3	-3	0.793
	Treatment	142	240	153	229	-11	11	0.230

When using the global means for the expectations, the control group in Trial 1 had significantly fewer students (24) Proficient or Advanced than would be expected. The treatment group had 2 fewer students for this same trial. When using the trial mean to

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generate the expectations, the difference between the treatment groups was not statistically significant as a result this extreme (11 students either way for the two groups) would be expected to occur about a third of the time. Trial 4 was actually the closest to statistical significance with a p value of .319.

Table 18: Chi-Squared test on Science Proficient or Advanced numbers using the trial means for the expected values

| | | Proficient or Advanced | | | | | | Chi-Squared p-value |
| | | Actual | | Expected | | Difference | | |
		No	Yes	No	Yes	No	Yes	
Trial 1	Control	236	291	225	302	11	-11	0.333
	Treatment	214	313	225	302	-11	11	0.333
Trial 2	Control	191	303	193	302	-2	2	0.890
	Treatment	194	300	193	302	2	-2	0.890
Trial 3	Control	181	270	177	274	4	-4	0.700
	Treatment	173	278	177	274	-4	4	0.700
Trial 4	Control	179	238	169	248	10	-10	0.319
	Treatment	159	258	169	248	-10	10	0.319
Trial 5	Control	156	226	149	233	7	-7	0.463
	Treatment	142	240	149	233	-7	7	0.463

Moving to the scaled Science NCE variable, the measures of central tendency and dispersion for Trial 1 can be found in Table 19 and a graph of the means can be found in Figure 18. Appendix J contains tables for all of the trials. In Trial 1 the treatment group had a better mean NCE for the first four years and overall while the control group had a higher mean NCE for the last two years. The aggregates for all of the trials were put together and represented in Figure 19. From this graph we see that the treatment group had a greater mean NCE in 17 of the possible trial-years and overall in four of the five trials.

Table 19: Trial 1 Science NCEs measures of central tendency and dispersion

				Science NCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	42.9	43.0	1.0	81.0	2.2	20.7	87
			SY1011	46.6	45.0	3.0	93.0	2.3	21.4	83
			SY1112	51.3	51.0	1.0	99.0	2.2	19.2	78
			SY1213	53.7	49.0	1.0	97.0	2.1	19.5	85
			SY1314	54.9	55.0	6.0	99.0	2.5	23.6	87
			SY1415	51.7	52.0	5.0	97.0	2.2	20.3	89
			Total	50.2	49.0	1.0	99.0	.9	21.2	509
	Yes	School Year	SY0910	48.6	49.0	1.0	99.0	2.4	22.6	87
			SY1011	48.5	50.0	5.0	99.0	2.4	21.8	83
			SY1112	53.6	55.0	3.0	99.0	2.1	18.1	78
			SY1213	55.2	55.0	2.0	91.0	2.0	18.7	85
			SY1314	53.9	53.0	11.0	99.0	2.1	19.8	87
			SY1415	48.6	49.0	1.0	99.0	2.2	21.0	89
			Total	51.4	52.0	1.0	99.0	.9	20.5	509
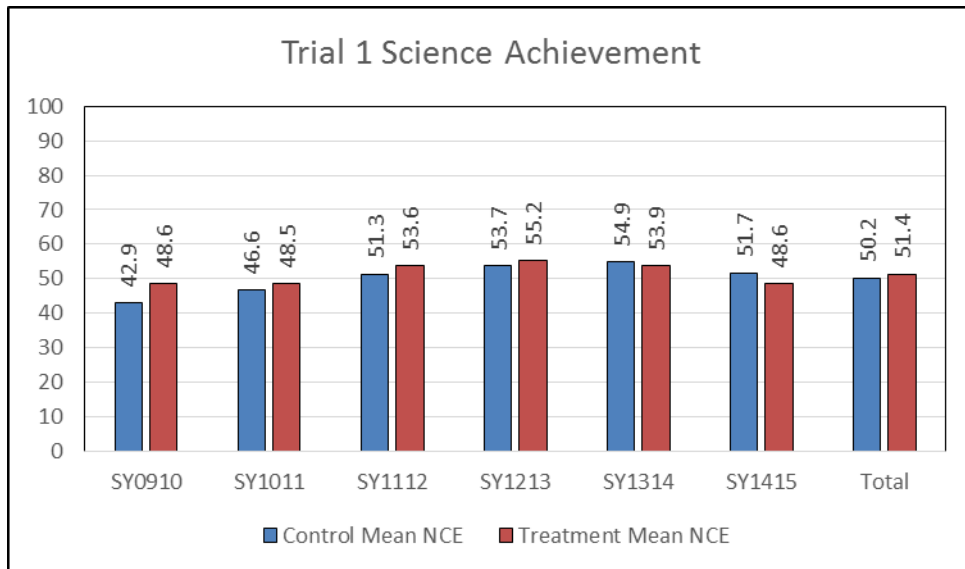
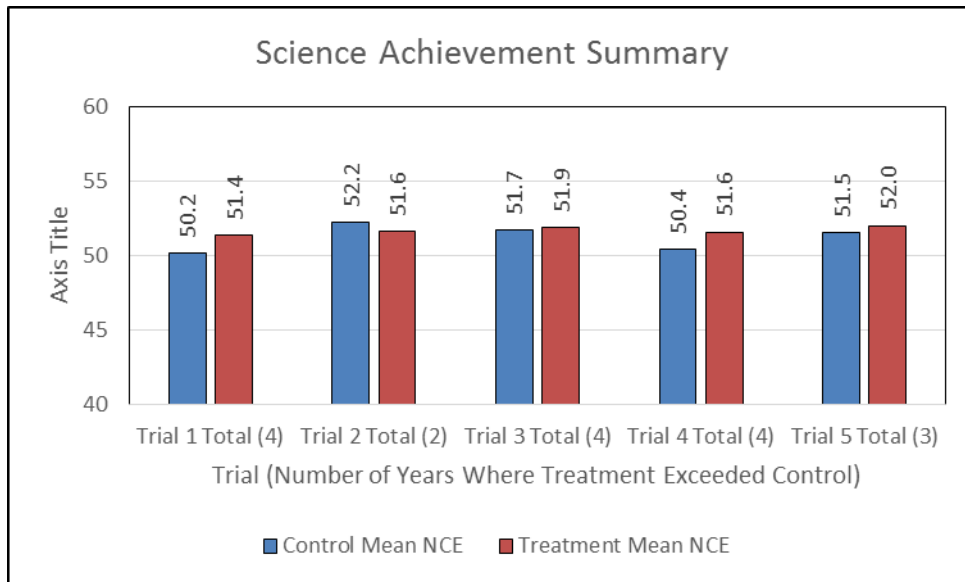**Figure 18: Trial 1 mean NCEs for Science**

Figure 19: Science mean NCEs for all trials

Hypothesis testing using t-tests were performed on each trial and while there is some evidence that the treatment group performed better overall, none of the mean differences in the NCEs turned out to be statistically significant.

Table 20: t-tests on Science mean NCEs for all trials

Science NCE	Count per Group	Control Mean NCE	Treatment Mean NCE	Treatment minus Control mean NCE	t-test p value
Trial 1	509	50.2	51.4	1.2	.365
Trial 2	480	52.2	51.6	-0.6	.635
Trial 3	442	51.7	51.9	0.2	.893
Trial 4	409	50.4	51.6	1.2	.893
Trial 5	376	51.5	52.0	0.5	.742

Conclusions and Considerations

The Vanderbilt study, *A Randomized Control Trial of a Statewide Voluntary Prekindergarten Program on Children's Skills and Behaviors through Third Grade*, followed students from PreK into third grade. They noted attendance, behavior, and academic comparisons to a control group of students. Our study took a cohort of students who attended our Volunteer PreK program and followed them for the six year period of what typically was the third through eighth grades. We also were able to compare our students to a control group in the same areas that the Vanderbilt study used, but with different instruments in most cases. Table 21 provides a side-by-side comparison of methodology and findings.

Table 21: A side-by-side comparison between this study and the Vanderbilt study

Item	Vanderbilt Study	Knox County Schools Study
Design	A Randomized Control Trial, which is the gold standard for a study. The study began with 773 students in the treatment group and 303 students in the control group. 92% of each group were still a part of the study after five years. The years of the study were from PreK into the third grade.	A Matched-Pair design was used based on demographic features. To guard against faulty matches, multiple trials were performed without replacement. The VPK program had 117 students of which 88 had available data during the first year of our study (third grade) and 89 had available data after six years of our study (typically eighth grade).
Attendance	The study addressed subgroups of children and found that the TN-VPK attendance was not affected by subgroups.	We found that there was not a statistically significant difference in attendance but we noted some evidence that students who attended our VPK program had slightly better attendance through the intermediate and middle school years with no extreme outliers when compared to the control groups.
Behavior	The study used survey instruments that were given to teachers. The first grade teachers noted that the TN-VPK students had poorer work skills in the classroom and felt more negative about school. This general negativity continued into the third grade where the peer relations favored the TN-VPK students	We used discipline referrals as our measure. This measure that was less subjective than the one used in the Vanderbilt study because VPK participation probably did not played a part in any decision to submit a referral. We found no statistical differences between the two groups and no evidential trends in the data.

Item	Vanderbilt Study	Knox County Schools Study
Academics	The study used Woodcock Johnson assessments and noted a significant difference between the TN-VPK students at the start of kindergarten, but a catching up by the control group by the end of the kindergarten year. In the first grade the groups performed in a similar manner. It was perplexing that during the second and third grades the control group performed significantly better on the achievement composite and on the math subtests.	We used TCAP achievement levels and Normal Curve Equivalents for our measures. These are the measures that are used on the state report card and for accountability purposes. We considered the subjects of Reading/Language Arts, Math, and Science. We found no statistically significant difference between the two groups, but we did note that over the course of the intermediate and middle school years that there was some evidence that the control group performed better in Reading/Language Arts. There was the same amount of evidence that the VPK students performed better in Science. There was slightly less evidence that the VPK students performed better in Math. This last results is the reverse of what the Vanderbilt study found for this subject.

We found enough evidence to show that the Knox County School trends were different in grades three to eight for the VPK students than what the TN-VPK students exhibited in grades PreK to three. It is possible that some of the TN-VPK trends will reverse in the coming years. It is also possible that while the Knox County Volunteer Prekindergarten program was one of the "high quality" programs in the Vanderbilt study, the nature of the program allowed for some better long-term results.

Possible future studies for us would include: 1) Replicating this study with another cohort, 2) Replicating this study with more trials using replacement, 3) Analyzing the content of our VPK in order to note why our VPK students were somewhat stronger in Science and Math while being somewhat weaker in Reading/Language Arts. If the Vanderbilt group continues following this cohort, it would be interesting to note if the Woodcock Johnson assessments are a reasonable proxy for the TCAP assessments.

Appendix A: Attendance Data by Trial

Trial 1			Attendance						
			Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year							
		SY0910	94.5	94.8	84.8	100.0	.4	3.6	88
		SY1011	94.6	96.2	79.3	100.0	.5	5.0	84
		SY1112	95.3	96.0	79.7	100.0	.4	3.8	85
		SY1213	94.3	95.4	78.6	100.0	.5	4.7	90
		SY1314	94.1	96.4	61.5	100.0	.7	7.0	91
		SY1415	92.7	95.2	55.7	100.0	.8	7.4	89
		Total	94.3	95.8	55.7	100.0	.2	5.5	527
	Yes	School Year							
		SY0910	94.5	95.4	79.8	100.0	.4	3.8	88
		SY1011	94.9	95.9	80.5	100.0	.4	3.9	84
		SY1112	95.2	96.0	84.0	100.0	.4	4.1	85
		SY1213	94.1	95.4	74.6	100.0	.5	5.0	90
		SY1314	94.0	95.2	76.6	100.0	.5	5.2	91
		SY1415	92.8	94.0	72.5	100.0	.6	5.3	89
		Total	94.2	95.4	72.5	100.0	.2	4.6	527

Trial 2			Attendance						
			Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year							
		SY0910	94.0	95.4	76.3	100.0	.5	4.7	84
		SY1011	94.8	95.3	63.9	100.0	.6	5.3	79
		SY1112	95.0	96.0	61.7	100.0	.6	5.4	74
		SY1213	93.3	94.8	70.9	100.0	.7	6.5	86
		SY1314	93.4	95.2	71.0	100.0	.7	6.0	85
		SY1415	92.6	94.3	61.1	100.0	.8	7.2	86
		Total	93.8	95.3	61.1	100.0	.3	6.0	494
	Yes	School Year							
		SY0910	94.4	95.4	79.8	100.0	.4	3.8	84
		SY1011	94.9	95.9	80.5	100.0	.5	4.0	79
		SY1112	95.2	96.3	84.0	100.0	.5	4.2	74
		SY1213	94.0	95.4	74.6	100.0	.5	5.0	86
		SY1314	93.9	95.2	76.6	100.0	.6	5.3	85
		SY1415	92.7	93.7	72.5	100.0	.6	5.3	86
		Total	94.2	95.4	72.5	100.0	.2	4.7	494

Trial 3			Attendance						
			Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year							
		SY0910	94.0	94.8	76.3	100.0	.6	5.3	71
		SY1011	94.2	95.8	79.3	100.0	.6	4.7	67
		SY1112	95.8	96.6	85.1	100.0	.4	3.1	70
		SY1213	93.4	95.4	63.2	100.0	.8	7.0	79
		SY1314	92.9	95.2	46.7	100.0	.8	7.5	82
		SY1415	93.3	94.6	79.0	100.0	.6	5.2	82
		Total	93.9	95.4	46.7	100.0	.3	5.8	451
	Yes	School Year							
		SY0910	94.3	95.4	79.8	100.0	.5	4.0	71
		SY1011	94.9	95.9	80.5	100.0	.5	3.9	67
		SY1112	95.1	96.0	84.0	100.0	.5	4.2	70
		SY1213	93.9	95.4	74.6	100.0	.6	5.2	79
		SY1314	93.9	95.2	76.6	100.0	.6	5.4	82
		SY1415	92.6	93.4	72.5	100.0	.6	5.3	82
		Total	94.1	95.2	72.5	100.0	.2	4.8	451

Trial 4				Attendance						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	95.1	96.0	85.0	100.0	.4	3.4	63
			SY1011	94.2	95.9	75.7	100.0	.6	4.6	59
			SY1112	94.2	95.4	70.1	100.0	.7	5.8	62
			SY1213	93.1	94.8	64.4	100.0	.7	6.3	76
			SY1314	93.4	95.5	69.3	100.0	.7	6.3	80
			SY1415	91.8	94.6	51.5	100.0	.9	8.2	77
			Total	93.5	95.4	51.5	100.0	.3	6.1	417
	Yes	School Year	SY0910	94.2	95.4	79.8	100.0	.5	4.2	63
			SY1011	94.6	95.9	80.5	100.0	.5	4.0	59
			SY1112	95.1	96.3	84.0	100.0	.5	4.3	62
			SY1213	93.9	95.4	74.6	100.0	.6	5.2	76
			SY1314	93.9	95.2	76.6	100.0	.6	5.4	80
			SY1415	92.8	94.0	72.5	100.0	.6	5.4	77
			Total	94.0	95.2	72.5	100.0	.2	4.9	417

Trial 5				Attendance						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	93.0	94.5	68.8	100.0	.9	6.8	56
			SY1011	93.1	95.0	78.7	100.0	.8	5.7	54
			SY1112	94.8	96.6	70.9	100.0	.8	5.9	53
			SY1213	93.2	94.8	74.7	100.0	.7	6.0	71
			SY1314	94.1	95.5	74.9	100.0	.6	5.5	78
			SY1415	93.5	96.1	67.7	100.0	.8	7.1	70
			Total	93.6	95.4	67.7	100.0	.3	6.2	382
	Yes	School Year	SY0910	93.7	94.8	79.8	98.8	.6	4.2	56
			SY1011	94.4	95.9	80.5	99.4	.5	4.0	54
			SY1112	95.5	96.6	84.0	100.0	.5	3.8	53
			SY1213	93.8	95.4	74.6	100.0	.6	5.2	71
			SY1314	93.9	95.2	76.6	100.0	.6	5.4	78
			SY1415	92.6	93.7	72.5	100.0	.7	5.6	70
			Total	93.9	95.2	72.5	100.0	.3	4.9	382

Appendix B: Non-Parametric Test Results for Attendance

Trial 1	**Hypothesis Test Summary** Null Hypothesis / Test / Sig. / Decision 1 The distribution of Attendance is the same across categories of Treatment. — Independent-Samples Mann-Whitney U Test — .220 — Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05.	**Hypothesis Test Summary** Null Hypothesis / Test / Sig. / Decision 1 The medians of Attendance are the same across categories of Treatment. — Independent-Samples Median Test — .267 — Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05.
Trial 2	**Hypothesis Test Summary** Null Hypothesis / Test / Sig. / Decision 1 The distribution of Attendance is the same across categories of Treatment. — Independent-Samples Mann-Whitney U Test — .775 — Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05.	**Hypothesis Test Summary** Null Hypothesis / Test / Sig. / Decision 1 The medians of Attendance are the same across categories of Treatment. — Independent-Samples Median Test — .656 — Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05.
Trial 3	**Hypothesis Test Summary** Null Hypothesis / Test / Sig. / Decision 1 The distribution of Attendance is the same across categories of Treatment. — Independent-Samples Mann-Whitney U Test — .619 — Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05.	**Hypothesis Test Summary** Null Hypothesis / Test / Sig. / Decision 1 The medians of Attendance are the same across categories of Treatment. — Independent-Samples Median Test — .387 — Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05.
Trial 4	**Hypothesis Test Summary** Null Hypothesis / Test / Sig. / Decision 1 The distribution of Attendance is the same across categories of Treatment. — Independent-Samples Mann-Whitney U Test — .912 — Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05.	**Hypothesis Test Summary** Null Hypothesis / Test / Sig. / Decision 1 The medians of Attendance are the same across categories of Treatment. — Independent-Samples Median Test — .678 — Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05.
Trial 5	**Hypothesis Test Summary** Null Hypothesis / Test / Sig. / Decision 1 The distribution of Attendance is the same across categories of Treatment. — Independent-Samples Mann-Whitney U Test — .386 — Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05.	**Hypothesis Test Summary** Null Hypothesis / Test / Sig. / Decision 1 The medians of Attendance are the same across categories of Treatment. — Independent-Samples Median Test — .468 — Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05.

Appendix C: Discipline Data - Students with any Discipline Incidents

Trial 1				Any Discipline Incidents		Any Discipline Incidents	
				No	Yes	No	Yes
Treatment	No	School Year	SY0910	77	11	87.5%	12.5%
			SY1011	64	20	76.2%	23.8%
			SY1112	68	17	80.0%	20.0%
			SY1213	59	31	65.6%	34.4%
			SY1314	60	31	65.9%	34.1%
			SY1415	58	31	65.2%	34.8%
			Total	386	141	73.2%	26.8%
	Yes	School Year	SY0910	80	8	90.9%	9.1%
			SY1011	67	17	79.8%	20.2%
			SY1112	68	17	80.0%	20.0%
			SY1213	62	28	68.9%	31.1%
			SY1314	56	35	61.5%	38.5%
			SY1415	60	29	67.4%	32.6%
			Total	393	134	74.6%	25.4%

Trial 2				Any Discipline Incidents		Any Discipline Incidents	
				No	Yes	No	Yes
Treatment	No	School Year	SY0910	78	6	92.9%	7.1%
			SY1011	64	15	81.0%	19.0%
			SY1112	57	17	77.0%	23.0%
			SY1213	57	29	66.3%	33.7%
			SY1314	49	36	57.6%	42.4%
			SY1415	53	33	61.6%	38.4%
			Total	358	136	72.5%	27.5%
	Yes	School Year	SY0910	76	8	90.5%	9.5%
			SY1011	63	16	79.7%	20.3%
			SY1112	58	16	78.4%	21.6%
			SY1213	61	25	70.9%	29.1%
			SY1314	53	32	62.4%	37.6%
			SY1415	57	29	66.3%	33.7%
			Total	368	126	74.5%	25.5%

Trial 3				Any Discipline Incidents		Any Discipline Incidents	
				No	Yes	No	Yes
Treatment	No	School Year	SY0910	66	5	93.0%	7.0%
			SY1011	50	17	74.6%	25.4%
			SY1112	57	13	81.4%	18.6%
			SY1213	54	25	68.4%	31.6%
			SY1314	54	28	65.9%	34.1%
			SY1415	49	33	59.8%	40.2%
			Total	330	121	73.2%	26.8%
	Yes	School Year	SY0910	63	8	88.7%	11.3%
			SY1011	53	14	79.1%	20.9%
			SY1112	54	16	77.1%	22.9%
			SY1213	57	22	72.2%	27.8%
			SY1314	52	30	63.4%	36.6%
			SY1415	53	29	64.6%	35.4%
			Total	332	119	73.6%	26.4%

Trial 4				Any Discipline Incidents		Any Discipline Incidents	
				No	Yes	No	Yes
Treatment	No	School Year	SY0910	61	2	96.8%	3.2%
			SY1011	49	10	83.1%	16.9%
			SY1112	54	8	87.1%	12.9%
			SY1213	46	30	60.5%	39.5%
			SY1314	54	26	67.5%	32.5%
			SY1415	45	32	58.4%	41.6%
			Total	309	108	74.1%	25.9%
	Yes	School Year	SY0910	57	6	90.5%	9.5%
			SY1011	47	12	79.7%	20.3%
			SY1112	47	15	75.8%	24.2%
			SY1213	55	21	72.4%	27.6%
			SY1314	51	29	63.8%	36.3%
			SY1415	49	28	63.6%	36.4%
			Total	306	111	73.4%	26.6%

Trial 5				Any Discipline Incidents		Any Discipline Incidents	
				No	Yes	No	Yes
Treatment	No	School Year	SY0910	50	6	89.3%	10.7%
			SY1011	48	6	88.9%	11.1%
			SY1112	43	10	81.1%	18.9%
			SY1213	48	23	67.6%	32.4%
			SY1314	57	21	73.1%	26.9%
			SY1415	42	28	60.0%	40.0%
			Total	288	94	75.4%	24.6%
	Yes	School Year	SY0910	50	6	89.3%	10.7%
			SY1011	44	10	81.5%	18.5%
			SY1112	41	12	77.4%	22.6%
			SY1213	50	21	70.4%	29.6%
			SY1314	50	28	64.1%	35.9%
			SY1415	46	24	65.7%	34.3%
			Total	281	101	73.6%	26.4%

Appendix D: Non-Parametric Test Results for Discipline Incidents

Trial 1	**Hypothesis Test Summary** — 1. The distribution of Number of Discipline Incidences is the same across categories of Treatment. / Independent-Samples Mann-Whitney U Test / Sig. .845 / Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05. **Hypothesis Test Summary** — 1. The medians of Number of Discipline Incidences are the same across categories of Treatment. / Independent-Samples Median Test / Sig. .674 / Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05.
Trial 2	**Hypothesis Test Summary** — 1. The distribution of Number of Discipline Incidences is the same across categories of Treatment. / Independent-Samples Mann-Whitney U Test / Sig. .505 / Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05. **Hypothesis Test Summary** — 1. The medians of Number of Discipline Incidences are the same across categories of Treatment. / Independent-Samples Median Test / Sig. .517 / Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05.
Trial 3	**Hypothesis Test Summary** — 1. The distribution of Number of Discipline Incidences is the same across categories of Treatment. / Independent-Samples Mann-Whitney U Test / Sig. .943 / Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05. **Hypothesis Test Summary** — 1. The medians of Number of Discipline Incidences are the same across categories of Treatment. / Independent-Samples Median Test / Sig. .940 / Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05.
Trial 4	**Hypothesis Test Summary** — 1. The distribution of Number of Discipline Incidences is the same across categories of Treatment. / Independent-Samples Mann-Whitney U Test / Sig. .768 / Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05. **Hypothesis Test Summary** — 1. The medians of Number of Discipline Incidences are the same across categories of Treatment. / Independent-Samples Median Test / Sig. .875 / Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05.
Trial 5	**Hypothesis Test Summary** — 1. The distribution of Number of Discipline Incidences is the same across categories of Treatment. / Independent-Samples Mann-Whitney U Test / Sig. .438 / Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05. **Hypothesis Test Summary** — 1. The medians of Number of Discipline Incidences are the same across categories of Treatment. / Independent-Samples Median Test / Sig. .619 / Retain the null hypothesis. Asymptotic significances are displayed. The significance level is .05.

Appendix E: Reading/Language Arts Achievement Level Percents

Trial 1			Count	RLA Level				PA RLA	
				Below Basic	Basic	Proficient	Advanced	No	Yes
				Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	88	21.6%	42.0%	26.1%	10.2%	63.6%	36.4%
			SY1011	84	21.4%	39.3%	29.8%	9.5%	60.7%	39.3%
			SY1112	85	8.2%	37.6%	50.6%	3.5%	45.9%	54.1%
			SY1213	90	14.4%	37.8%	42.2%	5.6%	52.2%	47.8%
			SY1314	91	16.5%	42.9%	33.0%	7.7%	59.3%	40.7%
			SY1415	89	10.1%	34.8%	43.8%	11.2%	44.9%	55.1%
			Total	527	15.4%	39.1%	37.6%	8.0%	54.5%	45.5%
	Yes	School Year	SY0910	88	15.9%	39.8%	36.4%	8.0%	55.7%	44.3%
			SY1011	84	17.9%	41.7%	32.1%	8.3%	59.5%	40.5%
			SY1112	85	7.1%	43.5%	43.5%	5.9%	50.6%	49.4%
			SY1213	90	12.2%	37.8%	46.7%	3.3%	50.0%	50.0%
			SY1314	91	14.3%	40.7%	41.8%	3.3%	54.9%	45.1%
			SY1415	89	15.7%	39.3%	34.8%	10.1%	55.1%	44.9%
			Total	527	13.9%	40.4%	39.3%	6.5%	54.3%	45.7%

Trial 2			Count	RLA Level				PA RLA	
				Below Basic	Basic	Proficient	Advanced	No	Yes
				Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	84	13.1%	40.5%	34.5%	11.9%	53.6%	46.4%
			SY1011	79	15.2%	36.7%	31.6%	16.5%	51.9%	48.1%
			SY1112	74	13.5%	36.5%	35.1%	14.9%	50.0%	50.0%
			SY1213	86	11.6%	32.6%	52.3%	3.5%	44.2%	55.8%
			SY1314	85	17.6%	41.2%	27.1%	14.1%	58.8%	41.2%
			SY1415	86	5.8%	45.3%	38.4%	10.5%	51.2%	48.8%
			Total	494	12.8%	38.9%	36.6%	11.7%	51.6%	48.4%
	Yes	School Year	SY0910	84	15.5%	38.1%	38.1%	8.3%	53.6%	46.4%
			SY1011	79	17.7%	39.2%	34.2%	8.9%	57.0%	43.0%
			SY1112	74	5.4%	45.9%	41.9%	6.8%	51.4%	48.6%
			SY1213	86	10.5%	38.4%	47.7%	3.5%	48.8%	51.2%
			SY1314	85	12.9%	41.2%	42.4%	3.5%	54.1%	45.9%
			SY1415	86	16.3%	39.5%	33.7%	10.5%	55.8%	44.2%
			Total	494	13.2%	40.3%	39.7%	6.9%	53.4%	46.6%

Trial 3			Count	RLA Level				PA RLA	
				Below Basic	Basic	Proficient	Advanced	No	Yes
				Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	71	19.7%	38.0%	28.2%	14.1%	57.7%	42.3%
			SY1011	67	13.4%	35.8%	37.3%	13.4%	49.3%	50.7%
			SY1112	70	8.6%	28.6%	45.7%	17.1%	37.1%	62.9%
			SY1213	79	11.4%	29.1%	51.9%	7.6%	40.5%	59.5%
			SY1314	82	12.2%	36.6%	40.2%	11.0%	48.8%	51.2%
			SY1415	82	9.8%	47.6%	31.7%	11.0%	57.3%	42.7%
			Total	451	12.4%	36.1%	39.2%	12.2%	48.6%	51.4%
	Yes	School Year	SY0910	71	12.7%	42.3%	38.0%	7.0%	54.9%	45.1%
			SY1011	67	19.4%	35.8%	35.8%	9.0%	55.2%	44.8%
			SY1112	70	5.7%	44.3%	42.9%	7.1%	50.0%	50.0%
			SY1213	79	7.6%	40.5%	48.1%	3.8%	48.1%	51.9%
			SY1314	82	12.2%	41.5%	42.7%	3.7%	53.7%	46.3%
			SY1415	82	17.1%	41.5%	30.5%	11.0%	58.5%	41.5%
			Total	451	12.4%	41.0%	39.7%	6.9%	53.4%	46.6%

Trial 4			Count	RLA Level				PA RLA	
				Below Basic	Basic	Proficient	Advanced	No	Yes
				Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	63	17.5%	39.7%	25.4%	17.5%	57.1%	42.9%
			SY1011	59	18.6%	45.8%	28.8%	6.8%	64.4%	35.6%
			SY1112	62	4.8%	35.5%	37.1%	22.6%	40.3%	59.7%
			SY1213	76	19.7%	27.6%	48.7%	3.9%	47.4%	52.6%
			SY1314	80	15.0%	40.0%	36.3%	8.8%	55.0%	45.0%
			SY1415	77	11.7%	48.1%	33.8%	6.5%	59.7%	40.3%
			Total	417	14.6%	39.3%	35.5%	10.6%	54.0%	46.0%
	Yes	School Year	SY0910	63	12.7%	42.9%	36.5%	7.9%	55.6%	44.4%
			SY1011	59	16.9%	37.3%	35.6%	10.2%	54.2%	45.8%
			SY1112	62	6.5%	46.8%	41.9%	4.8%	53.2%	46.8%
			SY1213	76	7.9%	38.2%	50.0%	3.9%	46.1%	53.9%
			SY1314	80	11.3%	42.5%	42.5%	3.8%	53.8%	46.3%
			SY1415	77	16.9%	41.6%	32.5%	9.1%	58.4%	41.6%
			Total	417	12.0%	41.5%	40.0%	6.5%	53.5%	46.5%

Trial 5			Count	RLA Level				PA RLA	
				Below Basic	Basic	Proficient	Advanced	No	Yes
				Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	56	14.3%	37.5%	37.5%	10.7%	51.8%	48.2%
			SY1011	54	14.8%	37.0%	35.2%	13.0%	51.9%	48.1%
			SY1112	53	9.4%	41.5%	34.0%	15.1%	50.9%	49.1%
			SY1213	71	12.7%	29.6%	53.5%	4.2%	42.3%	57.7%
			SY1314	78	11.5%	37.2%	37.2%	14.1%	48.7%	51.3%
			SY1415	70	14.3%	47.1%	31.4%	7.1%	61.4%	38.6%
			Total	382	12.8%	38.2%	38.5%	10.5%	51.0%	49.0%
	Yes	School Year	SY0910	56	14.3%	44.6%	35.7%	5.4%	58.9%	41.1%
			SY1011	54	14.8%	38.9%	37.0%	9.3%	53.7%	46.3%
			SY1112	53	5.7%	45.3%	43.4%	5.7%	50.9%	49.1%
			SY1213	71	8.5%	38.0%	49.3%	4.2%	46.5%	53.5%
			SY1314	78	11.5%	41.0%	43.6%	3.8%	52.6%	47.4%
			SY1415	70	12.9%	42.9%	34.3%	10.0%	55.7%	44.3%
			Total	382	11.3%	41.6%	40.8%	6.3%	52.9%	47.1%

Appendix F: Reading/Language Arts NCE Results

Trial 1				RLANCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	45.2	43	3	99	2.5	23.8	88
			SY1011	47.3	47	4	99	2.7	24.3	84
			SY1112	53.0	55	2	99	2.1	18.8	85
			SY1213	47.2	46	1	98	2.3	21.2	90
			SY1314	47.9	47	1	94	2.2	20.8	91
			SY1415	50.5	52	1	99	2.3	21.6	89
			Total	48.5	49	1	99	1.0	21.9	527
	Yes	School Year	SY0910	47.2	49	3	99	2.4	22.7	88
			SY1011	48.4	48	1	99	2.6	23.5	84
			SY1112	52.3	51	1	94	2.2	19.3	85
			SY1213	47.3	47	1	93	2.1	19.5	90
			SY1314	45.7	45	1	89	2.1	19.8	91
			SY1415	47.5	48	4	88	2.2	20.6	89
			Total	48.0	49	1	99	.9	21.0	527

Trial 2				RLANCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	50.6	52	3	99	2.6	23.6	84
			SY1011	52.9	53	4	99	2.8	25.0	79
			SY1112	50.6	50	1	99	3.1	26.1	74
			SY1213	50.5	50	6	98	2.3	20.6	86
			SY1314	46.3	44	1	94	2.7	24.6	85
			SY1415	50.7	50	6	99	2.1	19.9	86
			Total	50.2	51	1	99	1.1	23.2	494
	Yes	School Year	SY0910	48.0	49	3	99	2.5	22.9	84
			SY1011	49.4	51	1	99	2.7	23.5	79
			SY1112	52.1	49	1	94	2.4	20.2	74
			SY1213	47.6	48	1	93	2.1	19.1	86
			SY1314	46.4	45	1	89	2.2	19.9	85
			SY1415	47.2	48	4	88	2.2	20.9	86
			Total	48.3	49	1	99	1.0	21.1	494

Trial 3				RLANCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	48.2	47	1	99	3.2	26.5	71
			SY1011	52.0	55	2	99	3.0	24.4	67
			SY1112	54.6	58	7	99	2.9	23.9	70
			SY1213	50.0	52	3	99	2.5	21.8	79
			SY1314	50.6	50	1	99	2.5	22.6	82
			SY1415	48.8	48	9	99	2.3	20.6	82
			Total	50.6	51	1	99	1.1	23.2	451
	Yes	School Year	SY0910	48.5	49	3	99	2.6	22.2	71
			SY1011	50.1	52	1	99	3.0	24.3	67
			SY1112	52.0	51	1	94	2.5	20.5	70
			SY1213	49.1	49	1	93	2.1	18.4	79
			SY1314	46.3	45	1	89	2.2	20.0	82
			SY1415	46.8	46	4	88	2.3	21.3	82
			Total	48.6	49	1	99	1.0	21.1	451

Trial 4				RLANCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	49.0	49	1	99	3.2	25.8	63
			SY1011	46.3	46	1	90	3.0	23.2	59
			SY1112	59.1	56	14	99	3.0	23.1	62
			SY1213	47.3	51	1	89	2.7	23.1	76
			SY1314	47.4	47	1	99	2.7	23.6	80
			SY1415	47.1	47	1	99	2.3	20.6	77
			Total	49.1	49	1	99	1.2	23.4	417
	Yes	School Year	SY0910	48.9	49	3	99	2.8	22.2	63
			SY1011	51.1	52	1	99	3.2	24.4	59
			SY1112	50.1	49	1	90	2.6	19.8	62
			SY1213	49.4	51	1	93	2.2	18.7	76
			SY1314	46.6	45	1	89	2.3	20.0	80
			SY1415	46.4	46	4	88	2.4	20.8	77
			Total	48.6	49	1	99	1.0	20.9	417

Trial 5				RLANCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	51.2	53	1	95	3.1	23.0	56
			SY1011	51.2	53	7	99	3.3	24.3	54
			SY1112	55.9	51	10	99	3.3	24.0	53
			SY1213	47.9	52	1	98	2.5	20.8	71
			SY1314	51.3	51	5	99	2.7	23.3	78
			SY1415	46.6	48	1	89	2.4	20.2	70
			Total	50.4	51	1	99	1.2	22.5	382
	Yes	School Year	SY0910	47.2	48	3	99	2.9	21.6	56
			SY1011	52.1	52	1	99	3.2	23.6	54
			SY1112	50.2	49	1	90	2.8	20.4	53
			SY1213	49.4	50	1	93	2.3	19.2	71
			SY1314	46.6	46	1	89	2.3	20.3	78
			SY1415	48.0	49	4	88	2.4	20.2	70
			Total	48.7	50	1	99	1.1	20.8	382

Appendix G: Math Achievement Level Percents

Trial 1			Count	Math Level				PA Math	
				Below Basic	Basic	Proficient	Advanced	No	Yes
				Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	88	12.5%	48.9%	29.5%	9.1%	61.4%	38.6%
			SY1011	84	21.4%	42.9%	27.4%	8.3%	64.3%	35.7%
			SY1112	85	16.5%	36.5%	35.3%	11.8%	52.9%	47.1%
			SY1213	90	21.1%	47.8%	17.8%	13.3%	68.9%	31.1%
			SY1314	91	30.8%	24.2%	33.0%	12.1%	54.9%	45.1%
			SY1415	89	24.7%	25.8%	29.2%	20.2%	50.6%	49.4%
			Total	527	21.3%	37.6%	28.7%	12.5%	58.8%	41.2%
	Yes	School Year	SY0910	88	14.8%	37.5%	37.5%	10.2%	52.3%	47.7%
			SY1011	84	21.4%	42.9%	27.4%	8.3%	64.3%	35.7%
			SY1112	85	8.2%	36.5%	37.6%	17.6%	44.7%	55.3%
			SY1213	90	15.6%	43.3%	28.9%	12.2%	58.9%	41.1%
			SY1314	91	19.8%	42.9%	22.0%	15.4%	62.6%	37.4%
			SY1415	89	28.1%	29.2%	21.3%	21.3%	57.3%	42.7%
			Total	527	18.0%	38.7%	29.0%	14.2%	56.7%	43.3%

Trial 2			Count	Math Level				PA Math	
				Below Basic	Basic	Proficient	Advanced	No	Yes
				Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	84	10.7%	41.7%	32.1%	15.5%	52.4%	47.6%
			SY1011	79	25.3%	39.2%	25.3%	10.1%	64.6%	35.4%
			SY1112	74	16.2%	36.5%	25.7%	21.6%	52.7%	47.3%
			SY1213	86	24.4%	38.4%	25.6%	11.6%	62.8%	37.2%
			SY1314	85	27.1%	32.9%	27.1%	12.9%	60.0%	40.0%
			SY1415	86	22.1%	27.9%	29.1%	20.9%	50.0%	50.0%
			Total	494	21.1%	36.0%	27.5%	15.4%	57.1%	42.9%
	Yes	School Year	SY0910	84	15.5%	34.5%	39.3%	10.7%	50.0%	50.0%
			SY1011	79	20.3%	41.8%	29.1%	8.9%	62.0%	38.0%
			SY1112	74	6.8%	35.1%	39.2%	18.9%	41.9%	58.1%
			SY1213	86	14.0%	43.0%	30.2%	12.8%	57.0%	43.0%
			SY1314	85	20.0%	42.4%	22.4%	15.3%	62.4%	37.6%
			SY1415	86	29.1%	27.9%	22.1%	20.9%	57.0%	43.0%
			Total	494	17.8%	37.4%	30.2%	14.6%	55.3%	44.7%

Trial 3			Count	Math Level				PA Math	
				Below Basic	Basic	Proficient	Advanced	No	Yes
				Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	71	11.3%	36.6%	38.0%	14.1%	47.9%	52.1%
			SY1011	67	20.9%	40.3%	25.4%	13.4%	61.2%	38.8%
			SY1112	70	11.4%	31.4%	32.9%	24.3%	42.9%	57.1%
			SY1213	79	19.0%	41.8%	22.8%	16.5%	60.8%	39.2%
			SY1314	82	19.5%	37.8%	24.4%	18.3%	57.3%	42.7%
			SY1415	82	29.3%	28.0%	20.7%	22.0%	57.3%	42.7%
			Total	451	18.8%	35.9%	27.1%	18.2%	54.8%	45.2%
	Yes	School Year	SY0910	71	14.1%	36.6%	38.0%	11.3%	50.7%	49.3%
			SY1011	67	17.9%	43.3%	29.9%	9.0%	61.2%	38.8%
			SY1112	70	7.1%	35.7%	37.1%	20.0%	42.9%	57.1%
			SY1213	79	15.2%	40.5%	31.6%	12.7%	55.7%	44.3%
			SY1314	82	20.7%	40.2%	23.2%	15.9%	61.0%	39.0%
			SY1415	82	29.3%	29.3%	20.7%	20.7%	58.5%	41.5%
			Total	451	17.7%	37.5%	29.7%	15.1%	55.2%	44.8%

Trial 4			Count	Math Level				PA Math	
				Below Basic	Basic	Proficient	Advanced	No	Yes
				Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	63	11.1%	50.8%	27.0%	11.1%	61.9%	38.1%
			SY1011	59	27.1%	42.4%	23.7%	6.8%	69.5%	30.5%
			SY1112	62	12.9%	29.0%	29.0%	29.0%	41.9%	58.1%
			SY1213	76	31.6%	32.9%	26.3%	9.2%	64.5%	35.5%
			SY1314	80	26.3%	27.5%	32.5%	13.8%	53.8%	46.3%
			SY1415	77	31.2%	22.1%	20.8%	26.0%	53.2%	46.8%
			Total	417	24.0%	33.3%	26.6%	16.1%	57.3%	42.7%
	Yes	School Year	SY0910	63	12.7%	38.1%	38.1%	11.1%	50.8%	49.2%
			SY1011	59	16.9%	45.8%	28.8%	8.5%	62.7%	37.3%
			SY1112	62	8.1%	37.1%	38.7%	16.1%	45.2%	54.8%
			SY1213	76	15.8%	39.5%	31.6%	13.2%	55.3%	44.7%
			SY1314	80	21.3%	38.8%	23.8%	16.3%	60.0%	40.0%
			SY1415	77	28.6%	31.2%	20.8%	19.5%	59.7%	40.3%
			Total	417	17.7%	38.1%	29.7%	14.4%	55.9%	44.1%

Trial 5			Count	Math Level				PA Math	
				Below Basic	Basic	Proficient	Advanced	No	Yes
				Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	56	5.4%	48.2%	42.9%	3.6%	53.6%	46.4%
			SY1011	54	14.8%	51.9%	24.1%	9.3%	66.7%	33.3%
			SY1112	53	15.1%	35.8%	22.6%	26.4%	50.9%	49.1%
			SY1213	71	25.4%	38.0%	26.8%	9.9%	63.4%	36.6%
			SY1314	78	24.4%	39.7%	25.6%	10.3%	64.1%	35.9%
			SY1415	70	28.6%	24.3%	28.6%	18.6%	52.9%	47.1%
			Total	382	19.9%	39.0%	28.3%	12.8%	58.9%	41.1%
	Yes	School Year	SY0910	56	12.5%	39.3%	39.3%	8.9%	51.8%	48.2%
			SY1011	54	14.8%	46.3%	29.6%	9.3%	61.1%	38.9%
			SY1112	53	5.7%	37.7%	39.6%	17.0%	43.4%	56.6%
			SY1213	71	16.9%	35.2%	33.8%	14.1%	52.1%	47.9%
			SY1314	78	20.5%	38.5%	24.4%	16.7%	59.0%	41.0%
			SY1415	70	24.3%	34.3%	22.9%	18.6%	58.6%	41.4%
			Total	382	16.5%	38.2%	30.9%	14.4%	54.7%	45.3%

Appendix H: Math NCE Results

Trial 1				Math NCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	42.9	41	1	98	2.3	21.0	87
			SY1011	49.4	48	1	99	2.6	23.9	83
			SY1112	53.8	54	1	95	2.1	18.9	78
			SY1213	54.0	54	22	99	1.9	18.0	85
			SY1314	56.1	58	17	98	2.2	20.1	87
			SY1415	43.6	46	1	82	2.2	19.3	75
			Total	50.0	50	1	99	.9	20.8	495
	Yes	School Year	SY0910	45.2	46	1	99	2.4	22.6	87
			SY1011	50.7	53	1	96	2.4	21.5	83
			SY1112	56.5	59	1	95	2.0	17.6	78
			SY1213	55.2	56	1	92	2.0	18.0	85
			SY1314	55.4	54	1	90	2.0	19.1	87
			SY1415	39.9	43	1	82	2.1	18.6	75
			Total	50.6	51	1	99	.9	20.5	495

Trial 2				Math NCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	46.7	47	1	98	2.3	21.0	84
			SY1011	51.4	51	1	99	2.6	22.8	79
			SY1112	53.1	53	1	89	2.4	20.4	74
			SY1213	53.0	56	6	99	2.2	19.5	86
			SY1314	55.6	56	8	99	2.2	20.0	85
			SY1415	42.8	41	1	88	2.2	18.3	86
			Total	50.5	51	1	99	1.0	20.7	494
	Yes	School Year	SY0910	45.5	47	1	99	2.5	23.1	84
			SY1011	51.4	55	1	96	2.5	21.8	79
			SY1112	57.2	59	1	95	2.1	17.8	74
			SY1213	55.7	56	1	92	2.0	17.9	86
			SY1314	55.5	58	1	90	2.1	19.1	85
			SY1415	39.4	42	1	82	2.2	18.6	86
			Total	50.8	52	1	99	1.0	20.7	494

Trial 3			Math NCE						
			Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	47.9	49	1	98	2.6	21.8	71
			SY1011	51.1	50	1	96	2.9	23.7	67
			SY1112	57.7	58	5	99	2.5	20.5	70
			SY1213	53.8	56	1	99	2.3	19.8	79
			SY1314	58.3	56	1	99	2.3	20.9	82
			SY1415	41.2	38	5	89	2.3	18.8	82
			Total	51.8	53	1	99	1.0	21.6	451
	Yes	School Year	SY0910	45.8	47	1	99	2.7	23.1	71
			SY1011	52.9	56	4	96	2.5	20.4	67
			SY1112	57.3	59	1	95	2.2	18.2	70
			SY1213	56.1	57	1	92	2.1	18.3	79
			SY1314	55.4	56	1	90	2.1	19.2	82
			SY1415	39.2	41	1	82	2.3	18.8	82
			Total	51.2	52	1	99	1.0	20.6	451

Note: The "SY...", "Mean", "Median", "Minimum", "Maximum", "Standard Error of Mean", "Standard Deviation", and "Count" values above belong to the Math NCE column group.

Trial 4			Math NCE						
			Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	46.2	46	6	99	2.9	22.8	63
			SY1011	47.2	50	1	96	2.9	22.5	59
			SY1112	58.0	60	1	99	2.6	20.3	62
			SY1213	51.1	54	1	99	2.5	20.9	76
			SY1314	57.9	59	15	99	2.4	21.6	80
			SY1415	41.9	41	1	77	2.4	19.7	77
			Total	50.6	51	1	99	1.1	22.0	417
	Yes	School Year	SY0910	46.0	47	1	99	2.9	23.0	63
			SY1011	53.5	56	4	96	2.6	20.1	59
			SY1112	55.7	57	1	95	2.2	17.2	62
			SY1213	56.3	58	1	92	2.2	18.4	76
			SY1314	55.7	58	1	90	2.2	19.3	80
			SY1415	39.9	43	1	82	2.3	18.7	77
			Total	51.3	52	1	99	1.0	20.3	417

Trial 5				Math NCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	45.9	47	9	98	2.3	17.1	56
			SY1011	51.4	53	1	99	3.1	22.4	54
			SY1112	58.3	56	8	99	3.0	21.8	53
			SY1213	52.7	53	1	99	2.4	20.0	71
			SY1314	54.5	56	1	99	2.3	20.1	78
			SY1415	41.9	43	1	73	2.4	18.5	70
			Total	50.8	53	1	99	1.1	20.6	382
	Yes	School Year	SY0910	44.8	45	1	99	3.1	22.8	56
			SY1011	54.5	56	4	96	2.7	20.0	54
			SY1112	56.7	58	18	95	2.2	15.8	53
			SY1213	56.9	59	1	92	2.3	18.8	71
			SY1314	56.0	59	1	90	2.2	19.4	78
			SY1415	41.4	44	1	82	2.2	17.0	70
			Total	51.9	52	1	99	1.0	20.0	382

Appendix I: Science Achievement Level Percents

Trial 1			Count	Science Level				PA Science	
				Below Basic	Basic	Proficient	Advanced	No	Yes
				Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	88	29.5%	21.6%	42.0%	6.8%	51.1%	48.9%
			SY1011	84	27.4%	33.3%	26.2%	13.1%	60.7%	39.3%
			SY1112	85	17.6%	25.9%	43.5%	12.9%	43.5%	56.5%
			SY1213	90	17.8%	26.7%	41.1%	14.4%	44.4%	55.6%
			SY1314	91	14.3%	26.4%	36.3%	23.1%	40.7%	59.3%
			SY1415	89	9.0%	20.2%	48.3%	22.5%	29.2%	70.8%
			Total	527	19.2%	25.6%	39.7%	15.6%	44.8%	55.2%
	Yes	School Year	SY0910	88	19.3%	23.9%	43.2%	13.6%	43.2%	56.8%
			SY1011	84	23.8%	28.6%	39.3%	8.3%	52.4%	47.6%
			SY1112	85	12.9%	28.2%	50.6%	8.2%	41.2%	58.8%
			SY1213	90	14.4%	23.3%	48.9%	13.3%	37.8%	62.2%
			SY1314	91	13.2%	23.1%	41.8%	22.0%	36.3%	63.7%
			SY1415	89	14.6%	19.1%	39.3%	27.0%	33.7%	66.3%
			Total	527	16.3%	24.3%	43.8%	15.6%	40.6%	59.4%

Trial 2			Count	Science Level				PA Science	
				Below Basic	Basic	Proficient	Advanced	No	Yes
				Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	84	15.5%	19.0%	59.5%	6.0%	34.5%	65.5%
			SY1011	79	19.0%	30.4%	40.5%	10.1%	49.4%	50.6%
			SY1112	74	16.2%	29.7%	39.2%	14.9%	45.9%	54.1%
			SY1213	86	14.0%	19.8%	50.0%	16.3%	33.7%	66.3%
			SY1314	85	14.1%	24.7%	42.4%	18.8%	38.8%	61.2%
			SY1415	86	8.1%	23.3%	47.7%	20.9%	31.4%	68.6%
			Total	494	14.4%	24.3%	46.8%	14.6%	38.7%	61.3%
	Yes	School Year	SY0910	84	19.0%	21.4%	45.2%	14.3%	40.5%	59.5%
			SY1011	79	20.3%	30.4%	40.5%	8.9%	50.6%	49.4%
			SY1112	74	13.5%	25.7%	51.4%	9.5%	39.2%	60.8%
			SY1213	86	14.0%	23.3%	48.8%	14.0%	37.2%	62.8%
			SY1314	85	11.8%	23.5%	42.4%	22.4%	35.3%	64.7%
			SY1415	86	15.1%	18.6%	39.5%	26.7%	33.7%	66.3%
			Total	494	15.6%	23.7%	44.5%	16.2%	39.3%	60.7%

Trial 3				Count	Science Level				PA Science	
					Below Basic	Basic	Proficient	Advanced	No	Yes
					Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	71	23.9%	21.1%	40.8%	14.1%	45.1%	54.9%
			SY1011	67	17.9%	37.3%	28.4%	16.4%	55.2%	44.8%
			SY1112	70	18.6%	20.0%	45.7%	15.7%	38.6%	61.4%
			SY1213	79	13.9%	24.1%	50.6%	11.4%	38.0%	62.0%
			SY1314	82	7.3%	28.0%	39.0%	25.6%	35.4%	64.6%
			SY1415	82	9.8%	22.0%	51.2%	17.1%	31.7%	68.3%
			Total	451	14.9%	25.3%	43.0%	16.9%	40.1%	59.9%
	Yes	School Year	SY0910	71	18.3%	22.5%	43.7%	15.5%	40.8%	59.2%
			SY1011	67	20.9%	28.4%	40.3%	10.4%	49.3%	50.7%
			SY1112	70	14.3%	24.3%	51.4%	10.0%	38.6%	61.4%
			SY1213	79	11.4%	22.8%	51.9%	13.9%	34.2%	65.8%
			SY1314	82	11.0%	24.4%	42.7%	22.0%	35.4%	64.6%
			SY1415	82	15.9%	18.3%	39.0%	26.8%	34.1%	65.9%
			Total	451	15.1%	23.3%	44.8%	16.9%	38.4%	61.6%

Trial 4				Count	Science Level				PA Science	
					Below Basic	Basic	Proficient	Advanced	No	Yes
					Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	63	22.2%	23.8%	44.4%	9.5%	46.0%	54.0%
			SY1011	59	23.7%	42.4%	30.5%	3.4%	66.1%	33.9%
			SY1112	62	6.5%	30.6%	50.0%	12.9%	37.1%	62.9%
			SY1213	76	22.4%	22.4%	46.1%	9.2%	44.7%	55.3%
			SY1314	80	16.3%	17.5%	40.0%	26.3%	33.8%	66.3%
			SY1415	77	10.4%	24.7%	49.4%	15.6%	35.1%	64.9%
			Total	417	16.8%	26.1%	43.6%	13.4%	42.9%	57.1%
	Yes	School Year	SY0910	63	15.9%	23.8%	44.4%	15.9%	39.7%	60.3%
			SY1011	59	20.3%	28.8%	42.4%	8.5%	49.2%	50.8%
			SY1112	62	16.1%	27.4%	48.4%	8.1%	43.5%	56.5%
			SY1213	76	11.8%	21.1%	52.6%	14.5%	32.9%	67.1%
			SY1314	80	11.3%	22.5%	43.8%	22.5%	33.8%	66.3%
			SY1415	77	15.6%	18.2%	40.3%	26.0%	33.8%	66.2%
			Total	417	14.9%	23.3%	45.3%	16.5%	38.1%	61.9%

Trial 5			Count	Science Level				PA Science	
				Below Basic	Basic	Proficient	Advanced	No	Yes
				Percent	Percent	Percent	Percent	Percent	Percent
Treatment	No	School Year	SY0910	56	17.9%	17.9%	50.0%	14.3%	35.7%	64.3%
			SY1011	54	18.5%	40.7%	29.6%	11.1%	59.3%	40.7%
			SY1112	53	18.9%	26.4%	41.5%	13.2%	45.3%	54.7%
			SY1213	71	19.7%	22.5%	45.1%	12.7%	42.3%	57.7%
			SY1314	78	11.5%	19.2%	41.0%	28.2%	30.8%	69.2%
			SY1415	70	12.9%	24.3%	47.1%	15.7%	37.1%	62.9%
			Total	382	16.2%	24.6%	42.7%	16.5%	40.8%	59.2%
	Yes	School Year	SY0910	56	17.9%	23.2%	46.4%	12.5%	41.1%	58.9%
			SY1011	54	18.5%	29.6%	42.6%	9.3%	48.1%	51.9%
			SY1112	53	15.1%	28.3%	49.1%	7.5%	43.4%	56.6%
			SY1213	71	12.7%	19.7%	52.1%	15.5%	32.4%	67.6%
			SY1314	78	10.3%	21.8%	44.9%	23.1%	32.1%	67.9%
			SY1415	70	11.4%	20.0%	41.4%	27.1%	31.4%	68.6%
			Total	382	13.9%	23.3%	46.1%	16.8%	37.2%	62.8%

Appendix J: Science NCE Results

Trial 1				Science NCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	42.9	43	1	81	2.2	20.7	88
			SY1011	46.6	45	3	93	2.3	21.4	84
			SY1112	51.3	51	1	99	2.2	19.2	85
			SY1213	53.7	49	1	97	2.1	19.5	90
			SY1314	54.9	55	6	99	2.5	23.6	91
			SY1415	51.7	52	5	97	2.2	20.3	89
			Total	50.2	49	1	99	.9	21.2	527
	Yes	School Year	SY0910	48.6	49	1	99	2.4	22.6	88
			SY1011	48.5	50	5	99	2.4	21.8	84
			SY1112	53.6	55	3	99	2.1	18.1	85
			SY1213	55.2	55	2	91	2.0	18.7	90
			SY1314	53.9	53	11	99	2.1	19.8	91
			SY1415	48.6	49	1	99	2.2	21.0	89
			Total	51.4	52	1	99	.9	20.5	527

Trial 2				Science NCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	51.2	56	6	99	2.3	20.8	84
			SY1011	49.8	52	3	99	2.2	19.3	79
			SY1112	51.9	51	1	99	2.7	22.4	74
			SY1213	57.0	56	1	99	2.1	18.7	86
			SY1314	53.2	55	1	91	2.2	20.2	85
			SY1415	50.3	50	5	99	2.1	19.7	86
			Total	52.2	53	1	99	.9	20.2	494
	Yes	School Year	SY0910	49.1	51	1	99	2.5	22.9	84
			SY1011	49.5	52	5	99	2.5	21.7	79
			SY1112	53.7	55	3	99	2.2	18.6	74
			SY1213	55.2	55	2	91	2.1	18.9	86
			SY1314	54.3	54	11	99	2.1	19.2	85
			SY1415	48.4	49	1	99	2.2	20.8	86
			Total	51.6	53	1	99	.9	20.5	494

Trial 3				Science NCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	46.4	47	4	91	2.6	22.2	71
			SY1011	51.3	48	13	99	2.6	20.9	67
			SY1112	51.9	55	1	97	2.5	20.6	70
			SY1213	54.6	56	1	99	2.3	20.0	79
			SY1314	57.5	58	18	99	2.4	21.9	82
			SY1415	47.9	46	8	89	2.0	18.4	82
			Total	51.7	51	1	99	1.0	20.9	451
	Yes	School Year	SY0910	49.3	51	1	99	2.7	22.5	71
			SY1011	50.3	53	5	99	2.7	22.2	67
			SY1112	53.3	55	3	99	2.3	18.7	70
			SY1213	56.1	55	2	91	2.1	18.4	79
			SY1314	54.1	54	11	99	2.1	19.2	82
			SY1415	48.1	49	1	99	2.3	21.1	82
			Total	51.9	53	1	99	1.0	20.5	451

Trial 4				Science NCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	47.5	47	8	97	2.8	22.3	63
			SY1011	44.3	45	1	93	2.6	20.2	59
			SY1112	56.5	58	25	91	2.2	16.8	62
			SY1213	52.5	56	8	97	2.4	20.5	76
			SY1314	53.7	53	3	99	2.7	23.4	80
			SY1415	47.5	49	1	89	2.2	19.0	77
			Total	50.4	50	1	99	1.0	20.9	417
	Yes	School Year	SY0910	49.7	51	1	99	2.8	22.6	63
			SY1011	49.8	53	5	99	2.9	22.1	59
			SY1112	51.1	54	3	99	2.4	18.3	62
			SY1213	56.2	55	2	91	2.2	18.6	76
			SY1314	54.5	55	11	99	2.2	19.3	80
			SY1415	47.5	49	1	97	2.3	20.4	77
			Total	51.6	53	1	99	1.0	20.3	417

Trial 5				Science NCE						
				Mean	Median	Minimum	Maximum	Standard Error of Mean	Standard Deviation	Count
Treatment	No	School Year	SY0910	50.8	51	8	97	2.9	21.9	56
			SY1011	49.1	46	16	98	2.6	19.0	54
			SY1112	51.7	51	9	91	2.9	21.1	53
			SY1213	53.9	55	1	97	2.3	19.0	71
			SY1314	56.1	57	8	99	2.4	20.9	78
			SY1415	46.5	50	1	89	2.3	19.1	70
			Total	51.5	51	1	99	1.0	20.3	382
	Yes	School Year	SY0910	48.4	48	1	99	3.0	22.7	56
			SY1011	50.6	54	5	99	2.9	21.5	54
			SY1112	50.6	51	3	99	2.5	18.4	53
			SY1213	56.9	56	2	91	2.3	19.0	71
			SY1314	55.0	55	11	99	2.2	19.2	78
			SY1415	49.0	49	1	97	2.3	19.3	70
			Total	52.0	53	1	99	1.0	20.1	382