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An Efficacy Study of the Algebra II Version 10 Course

Florida Virtual School

[Report 455, December 2012]



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Executive Summary

Florida Virtual School[®] contracted with the Educational Research Institute of America to analyze the test score data for students enrolled in the Algebra II version 10 course.

Florida Virtual School (FLVS[®]) is an established leader in developing and providing virtual Kindergarten through grade 12 education solutions to students worldwide. A nationally recognized e-Learning model, FLVS, founded in 1997, was the country's first state-wide Internet-based public high school. In 2000, the Florida Legislature established FLVS as an independent educational entity with a gubernatorial appointed board. FLVS is the only public school with funding tied directly to student performance.

Each course has a real-time teacher who guides each student through the coursework, which is broken down into modules. As a student works through the modules of a course, he or she will connect with the teacher to take exams online and receive discussion-based assessments over the phone. Students do the work at their own pace and on their own time, but they interact with their teachers in multiple ways--including Live Lessons, phone calls, chat, texting, and email--throughout the course.

The Algebra II course is designed to meet the Florida Next Generation Sunshine State Standards and is mapped to national standards.

Pretest/posttest comparisons of students' performance were based on nine module tests which covered the total content for the course (an extra module designated only for honors students was not included in the analysis). The results showed statistically significant gains from pretesting to posttesting for each of the nine modules. The effect size, a measure of how much gain was made, was very large in each module.

Inferential statistics were not possible for the subgroups since each group of students took a small number of randomly selected items which were not always equal in difficulty. The following differences for average scores across all 9 modules showed the following:

Basic and Honors Students

The average pretest score for the basic students was 43% correct, and their average posttest score was 78%, resulting in a gain of 35%.

- The average pretest score for the honors students was 50% correct, and their average posttest score was 87% correct, resulting in a gain of 37%.

Male and Female Students

- The average pretest score for the male students was 46% correct, and their average posttest scores was 83% correct, resulting in a gain 37%.
- The average pretest score for the female students was 46% correct, and their average posttest score was 81% correct, resulting in a gain of 35%.

Lower Socio-Economic Status and Higher Socio-Economic Status Students

- The average pretest score for the lower socio-economic students was 46% correct, and their average posttest scores was 80% correct, resulting in a gain of 34%.
- The average pretest score for the higher socio-economic students was 46% correct, and their average posttest score was 83%, resulting in a gain of 37%.

White, Minority, and Multi-Ethnic Students

- The average pretest score for the white students was 45% correct, and their average posttest scores was 82% correct, resulting in a gain of 37%.
- The average pretest score for the minority students was 49% correct, and their average posttest score was 81%, resulting in a gain of 32%.
- The average pretest score for the multi-ethnic students was 47% correct, and their average posttest score was 83% correct, resulting in a gain 36%.

Research Design

Carefully constructed studies are needed to determine the efficacy of online courses as these courses continue to expand to all students and provide an important education opportunity to students who cannot or choose not to otherwise attend regular school programs. In addition, the enrichment of students' educational opportunities through online courses can help to prepare students for the demands of post-secondary education and the workplace. FLVS has developed a unique approach to online course instruction in which excellent online resources are accompanied by significant direct instruction, support, and guidance from teachers. Real-world application provides unique student preparation for college and/or courses.

The use of a modular approach to course development includes pretest and posttest assessments that help to guide instruction and provide excellent data to analyze program success. This study used the pretest and posttest module scores of large numbers of students over a several year period.

Research Questions

The following questions guided the design of the study and the data analyses:

1. *Do students enrolled in the **Florida Virtual School Algebra II** program increase their knowledge and skills in Algebra II?*
2. *Do students enrolled in basic or honors courses achieve similar gains in the **Florida Virtual School Algebra II** program?*
3. *Do students with differing demographic characteristics (gender, socio-economic status, and ethnicity) achieve similar gains when enrolled in the **Florida Virtual School Algebra II** program?*

Course Description

The Algebra II version 10 course is designed with a total of 10 instructional modules. These modules include instructional activities to meet a specific set of standards for each module.

Starting with a review of basic algebra, students learn about polynomials, quadratic equations, radical and rational expressions, exponential and logarithmic relations, and sequences and series. This course allows students to learn while having fun. Interactive examples help guide students' journey through customized feedback and praise. Mathematical concepts are applied to everyday occurrences such as earthquakes, stadium seating, and purchasing movie tickets.

Students investigate the effects of an equation on its graph through the use of technology. Students have opportunities to collaborate and work with their peers on specific lessons. Algebra II is an advanced mathematics course using hands-on activities, applications, group interactions, and the latest technology.

Segment I:

Module 1: Review of Algebra

Module 2: Systems of Equations and Inequalities

Module 3: Factoring

Module 4: Radical Expressions

Module 5: Solving Quadratic Equations

Segment II:

Module 6: Polynomial Functions

Module 7: Rational Expressions

Module 8: Exponents and Logarithms

Module 9: Sequences and Series

Module 10: Conic Sections (Honors only and not included in this analysis)

Besides engaging students in challenging curriculum, FLVS guides students to reflect on their learning and to evaluate their progress through a variety of assessments. Assessments can be in the form of self-checks, collaboration activities, practice lessons, multiple-choice questions, writing assignments, projects, research papers, essays, discussion-based assessments, and student discussions. State and nationally-recognized educational standards and frameworks guide assessment design. Instructors evaluate progress and provide interventions through the variety of assessments built into the course, as well as through contact with the student in other venues.

Description of the Research Sample

The study included students enrolled in the Algebra II course between July 1, 2011 and October 30, 2012.

Tables 1 to 3 provide a description of the demographic characteristics of the students included in the analysis.

Table 1: Grade Levels of Students Comprising the Research Sample

<i>Grade Levels</i>				
<i>8</i>	<i>9</i>	<i>10</i>	<i>11</i>	<i>12</i>
<i>4%</i>	<i>15%</i>	<i>32%</i>	<i>36%</i>	<i>13%</i>

Table 2: Gender, Course, and Free Lunch Eligibility for Free/Reduced Lunch Program of Students Comprising the Research Sample

<i>Gender</i>		<i>Course</i>		<i>Eligible for Free Reduced Lunch Program</i>	
<i>Males</i>	<i>Females</i>	<i>Basic</i>	<i>Honors</i>	<i>Yes</i>	<i>No</i>
<i>44%</i>	<i>56%</i>	<i>56%</i>	<i>44%</i>	<i>26%</i>	<i>74%</i>

Table 3: Ethnicity of Students Comprising the Research Sample

<i>Ethnicity</i>		
<i>White</i>	<i>Minority</i>	<i>Multi-Ethnic</i>
<i>54%</i>	<i>20%</i>	<i>26%</i>

Description of the Assessments

For this Algebra II study, there are 9 module pretests and 9 module posttests (called a module test within the course). Each pretest includes 19 groups of banked test items for a total of 171 groups. To limit item exposure and promote academic integrity, each student randomly receives only one test item from the bank of items in each group. For Algebra II, each pretest group consists of 4 banked test items for a total of 684 pretest items, but each student only receives a total of 171 pretest items from those banked items spread across the 9 module pretests. Each group of items covers 1 or 2 standards, and each standard is assessed multiple times. Each group of items was also designed to measure the same set of standards at the same cognitive complexity level. This random sampling provides a broad assessment since all 684 items are included in the assessment bank, but each student takes only 19 items per module pretest, and a total of 171 pretest items across the 9 module pretests throughout the course.

Each posttest includes 20 groups of banked test items for a total of 180 groups. To limit item exposure and promote academic integrity, each student randomly receives only one test item from the bank of items for each group. For Algebra II, each posttest group consists of 5 banked test items for a total of 900 posttest items, but each student only receives a total of 180 posttest items from those banked items spread across the 9 posttests. Each group of items covers 1 or 2 standards, and each standard is assessed multiple times. Each group of items was also designed to measure the same set of standards at the same cognitive complexity level. This random sampling provides a broad assessment. All 180 items are included in the assessment bank, but each student takes only 20 items per posttest and a total of 180 posttest items across the 9 module tests throughout the course.

The pretests and posttests were developed to assess the skills and strategies included in each Algebra II module. The assessments focused on the skills, strategies, and knowledge necessary for effective understanding of Algebra II knowledge and skills.

Table 4
Algebra II Module Pretests

	<i>Basic and Honors</i>	
<i>Pretest Modules</i>	<i>Total # of Banked Items</i>	<i># of Items per Student</i>
<i>Module 1</i>	<i>76</i>	<i>19</i>
<i>Module 2</i>	<i>76</i>	<i>19</i>
<i>Module 3</i>	<i>76</i>	<i>19</i>
<i>Module 4</i>	<i>76</i>	<i>19</i>
<i>Module 5</i>	<i>76</i>	<i>19</i>
<i>Module 6</i>	<i>76</i>	<i>19</i>
<i>Module 7</i>	<i>76</i>	<i>19</i>
<i>Module 8</i>	<i>76</i>	<i>19</i>
<i>Module 9</i>	<i>76</i>	<i>19</i>

Table 5
Algebra II Module Posttests

	<i>Basic and Honors</i>	
<i>Posttest Modules</i>	<i>Total # of Banked Items</i>	<i># of Items per Student</i>
<i>Module 1</i>	<i>100</i>	<i>20</i>
<i>Module 2</i>	<i>100</i>	<i>20</i>
<i>Module 3</i>	<i>100</i>	<i>20</i>
<i>Module 4</i>	<i>100</i>	<i>20</i>
<i>Module 5</i>	<i>100</i>	<i>20</i>
<i>Module 6</i>	<i>80</i>	<i>20</i>
<i>Module 7</i>	<i>80</i>	<i>20</i>
<i>Module 8</i>	<i>80</i>	<i>20</i>
<i>Module 9</i>	<i>80</i>	<i>20</i>

Data Analyses and Results

Data analyses were based on the percent correct score for each student. Since different number of test items were included on the pretests and posttests, it was necessary to use percent correct scores. Only those students who were administered both a pretest and posttest for the module being analyzed are included in the data analysis.

Separate analyses were conducted for each of the modules 1 to 9. Module 10 is for honors level students only and therefore not included in the analysis.

The following analyses were conducted to determine answers to the research questions that were the guiding focus of this study:

1. Pretest/posttest comparisons, using *Paired Comparison t-tests*, were used to analyze growth for each module.
2. Students were divided into two sub-groups based on their enrollment in either the basic or honors section of the Algebra II course. Pretest/posttest comparisons were then analyzed using *Paired Comparison t-tests* to determine if both groups increased statistically significantly.
3. Students were then divided into demographic groups based on gender, socio-economic status (determined by eligibility for free/reduced lunch program) and ethnicity (white, minority, or multi-ethnic). Pretest/posttest comparisons were then analyzed using *Paired Comparison t-tests* to determine if there were any increase differences between the various demographic groups.
4. An effect-size analysis was computed for each of the paired *t-tests*. Cohen's *d* statistic was used to determine the effect size. This statistic provides an indication of the strength of the treatment effect regardless of the statistical significance. Cohen's *d* statistic is interpreted as follows:
 - .2 = small effect
 - .5 = medium effect
 - .8 = large effect

Results for Each Module

Each of the three research questions are analyzed for each module:

1. Do students enrolled in the ***Florida Virtual School Algebra II*** program increase their knowledge and skills in Algebra II?
2. Do students enrolled in basic or honors courses achieve similar gains in the ***Florida Virtual School Algebra II*** program?
3. Do students with differing demographic characteristics (gender, socio-economic status, and ethnicity) achieve similar gains when enrolled in the ***Florida Virtual School Algebra II*** program?

Module 1

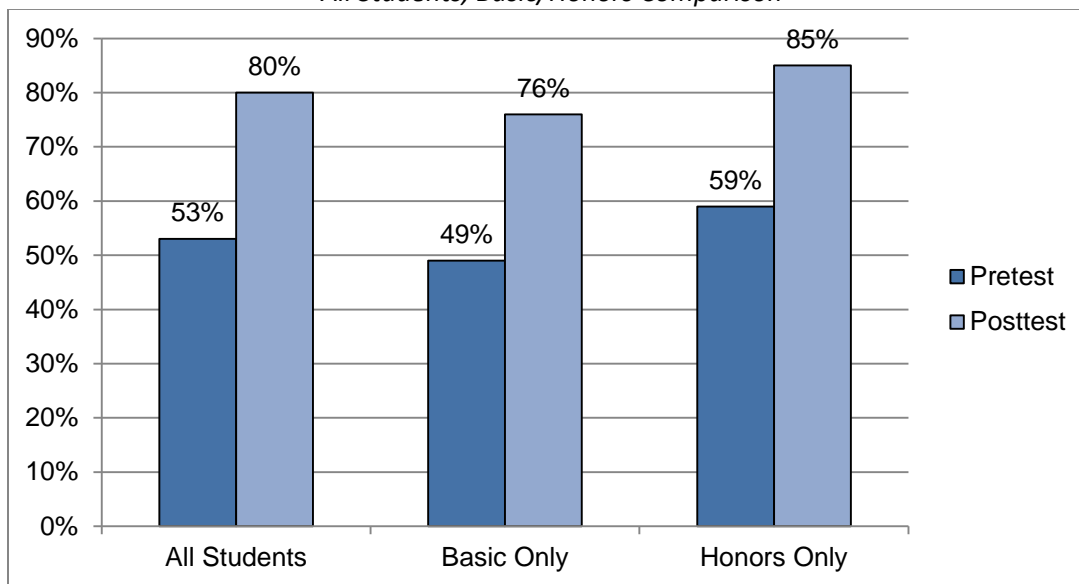
This module reviews solving equations, identifying and writing linear equations and inequalities, and graphing linear equations and inequalities. Table 6 shows that the increases from pretesting to posttesting were all statistically significant ($\leq .0001$) and the effect sizes were all large. As expected, the honors students scored higher than the basic students. Other than that difference, it appears there was little difference between the various demographic groups.

*Table 6: Comparison of Pretest to Posttest Percent Correct Scores
Algebra II Instructional Module 1*

Group	Number of Students	Mean	Standard Deviation	t-Test	Significance	Effect Size
<i>All Students</i>						
<i>Pretest</i>	4839	53%	.22	79.902	$\leq .0001$	1.37
<i>Posttest</i>	4839	80%	.17			
<i>Basic Only</i>						
<i>Pretest</i>	2768	49%	.21	59.583	$\leq .0001$	1.41
<i>Posttest</i>	2768	76%	.17			
<i>Honors Only</i>						
<i>Pretest</i>	2071	59%	.21	53.349	$\leq .0001$	1.39
<i>Posttest</i>	2071	85%	.16			
<i>Males Only</i>						
<i>Pretest</i>	2163	55%	.22	53.679	$\leq .0001$	1.30
<i>Posttest</i>	2163	80%	.16			
<i>Females Only</i>						
<i>Pretest</i>	2676	52%	.21	59.205	$\leq .0001$	1.38
<i>Posttest</i>	2676	79%	.18			
<i>Free/Reduced Lunch Only</i>						
<i>Pretest</i>	1351	52%	.21	41.953	$\leq .0001$	1.34
<i>Posttest</i>	1351	77%	.16			
<i>No Free/Reduced Lunch Only</i>						
<i>Pretest</i>	3488	54%	.22	68.025	$\leq .0001$	1.32
<i>Posttest</i>	3488	80%	.17			
<i>Non-Minority Only</i>						
<i>Pretest</i>	2475	53%	.21	61.283	$\leq .0001$	1.41
<i>Posttest</i>	2475	80%	.16			
<i>Minority Only</i>						
<i>Pretest</i>	1058	55%	.23	32.429	$\leq .0001$	1.23
<i>Posttest</i>	1058	78%	.16			
<i>Multi-Ethnic</i>						
<i>Pretest</i>	1306	53%	.21	41.046	$\leq .0001$	1.35
<i>Posttest</i>	1306	80%	.19			

Figures 1, 2, and 3 provide a visual look at the increases. In general, the percentage increases were about 30% for each comparison group.

*Figure 1: Algebra II Module 1
Pretest and Posttest Percent Correct Scores
All Students, Basic/Honors Comparison*



*Figure 2: Algebra II Module 1
Pretest and Posttest Percent Correct Scores
Males/Females & Free/Reduced Lunch/No Free Reduced Lunch*

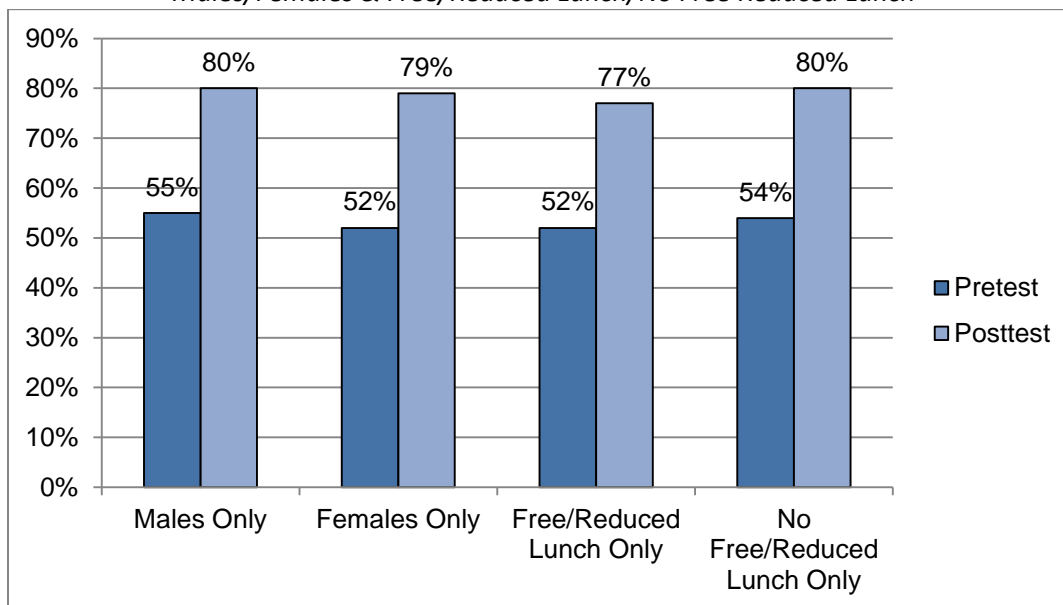
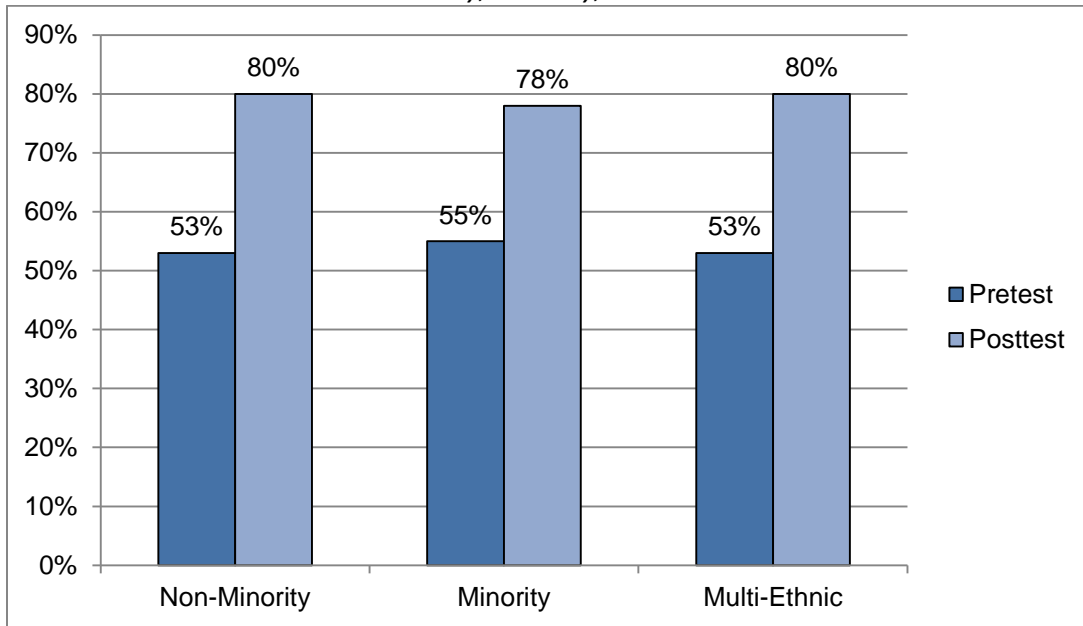


Figure 3: Algebra II Module 1
Pretest and Posttest Percent Correct Scores
Non-Minority, Minority, & Multi-Ethnic



Module 2

This module reviews solving systems of linear equations by graphing, elimination, and substitution, real-world problems, and linear programming. Table 7 shows that the increases from pretesting to posttesting were all statistically significant ($\leq .0001$) and the effect sizes were all large. As expected, the honors students scored higher than the basic students. Other than that difference, it appears there was little difference between the various demographic groups.

*Table 7: Comparison of Pretest to Posttest Percent Correct Scores
Algebra II Instructional Module 2*

Group	Number of Students	Mean	Standard Deviation	t-Test	Significance	Effect Size
All Students						
Pretest	3573	45%	.27	70.585	$\leq .0001$	1.41
Posttest	3573	78%	.18			
Basic Only						
Pretest	1987	40%	.26	50.734	$\leq .0001$	1.45
Posttest	1987	73%	.19			
Honors Only						
Pretest	1586	51%	.27	49.411	$\leq .0001$	1.51
Posttest	1586	84%	.15			
Males Only						
Pretest	1599	45%	.28	48.525	$\leq .0001$	1.49
Posttest	1599	80%	.18			
Females Only						
Pretest	1974	45%	.26	51.353	$\leq .0001$	1.41
Posttest	1974	77%	.19			
Free/Reduced Lunch Only						
Pretest	971	44%	.26	36.635	$\leq .0001$	1.43
Posttest	971	76%	.18			
No Free/Reduced Lunch Only						
Pretest	2602	46%	.27	60.337	$\leq .0001$	1.44
Posttest	2602	79%	.18			
Non-Minority Only						
Pretest	1864	45%	.26	54.130	$\leq .0001$	1.52
Posttest	1864	79%	.18			
Minority Only						
Pretest	759	47%	.28	28.036	$\leq .0001$	1.21
Posttest	759	76%	.19			
Multi-Ethnic						
Pretest	950	45%	.27	36.570	$\leq .0001$	1.48
Posttest	950	79%	.18			

Figures 4, 5, and 6 provide a visual look at the increases. In general, the percentage increases were about 25% to 30% for each comparison group.

Figure 4: Algebra II Module 2
Pretest and Posttest Percent Correct Scores
All Students, Basic/Honors Comparison

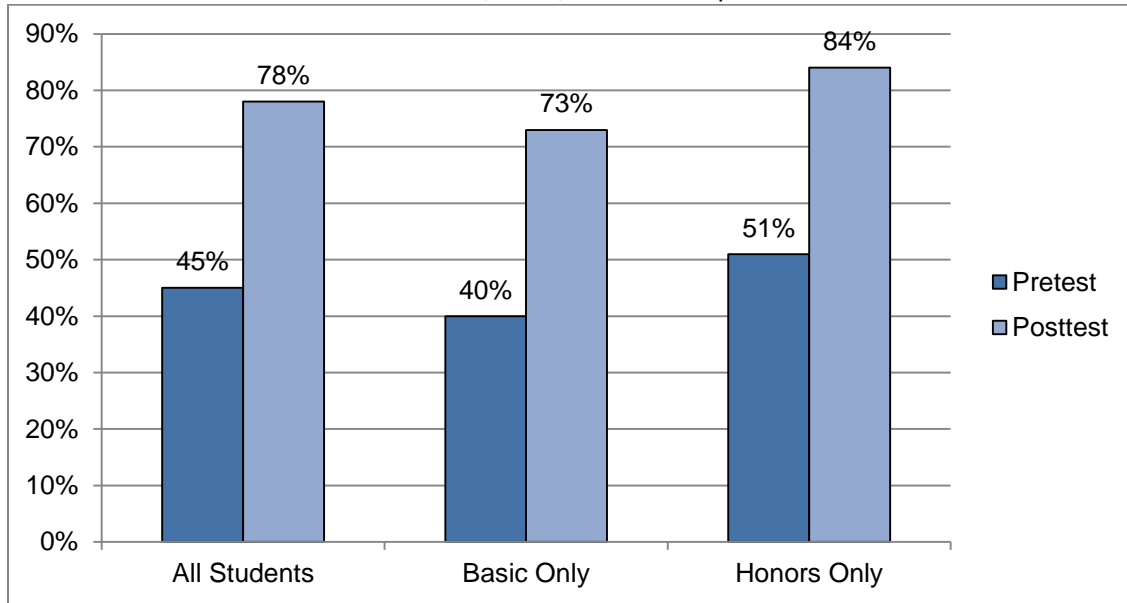


Figure 5: Algebra II Module 2
Pretest and Posttest Percent Correct Scores
Males/Females & Free/Reduced Lunch/No Free Reduced Lunch

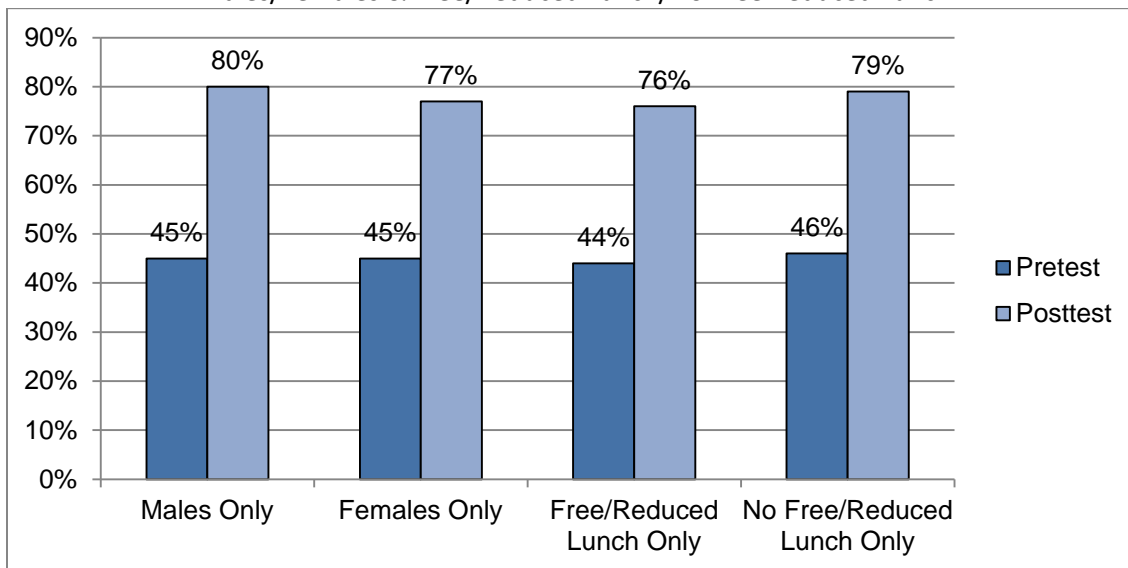
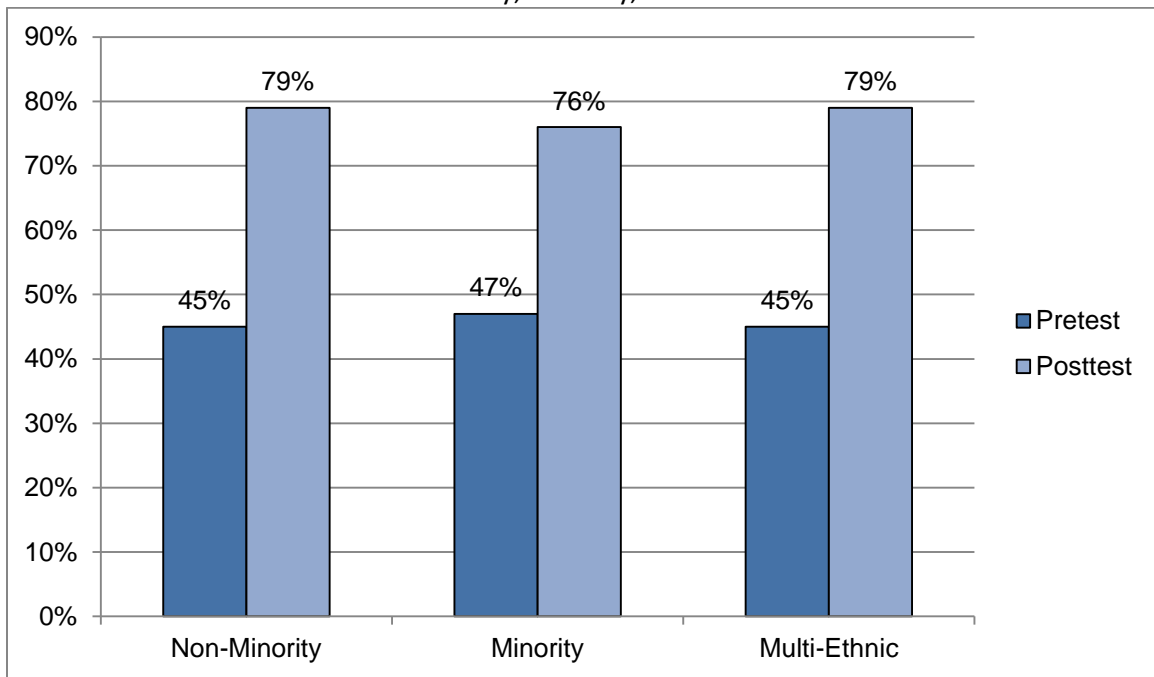


Figure 6: Algebra II Module 2
Pretest and Posttest Percent Correct Scores
Non-Minority, Minority, & Multi-Ethnic



Module 3

This module covers factoring trinomials, factoring special cases, and contains an honors lesson on Pascal's triangle. Table 8 shows that the increases from pretesting to posttesting were all statistically significant ($\leq .0001$) and the effect sizes were all large. As expected, the honors students scored higher than the basic students. Other than that difference, it appears there was little difference between the various demographic groups.

*Table 8: Comparison of Pretest to Posttest Percent Correct Scores
Algebra II Instructional Module 3*

Group	Number of Students	Mean	Standard Deviation	t-Test	Significance	Effect Size
<i>All Students</i>						
<i>Pretest</i>	3233	55%	.25	67.995	$\leq .0001$	1.56
<i>Posttest</i>	3233	86%	.13			
<i>Basic Only</i>						
<i>Pretest</i>	1813	52%	.26	48.602	$\leq .0001$	1.48
<i>Posttest</i>	1813	83%	.14			
<i>Honors Only</i>						
<i>Pretest</i>	1420	59%	.24	48.407	$\leq .0001$	1.61
<i>Posttest</i>	1420	89%	.11			
<i>Males Only</i>						
<i>Pretest</i>	1443	55%	.26	45.649	$\leq .0001$	1.56
<i>Posttest</i>	1443	87%	.13			
<i>Females Only</i>						
<i>Pretest</i>	1790	55%	.25	50.507	$\leq .0001$	1.48
<i>Posttest</i>	1790	85%	.14			
<i>Free/Reduced Lunch Only</i>						
<i>Pretest</i>	895	56%	.25	34.307	$\leq .0001$	1.46
<i>Posttest</i>	895	85%	.13			
<i>No Free/Reduced Lunch Only</i>						
<i>Pretest</i>	2338	55%	.26	58.796	$\leq .0001$	1.51
<i>Posttest</i>	2338	86%	.13			
<i>Non-Minority Only</i>						
<i>Pretest</i>	1681	53%	.25	52.306	$\leq .0001$	1.63
<i>Posttest</i>	1681	86%	.14			
<i>Minority Only</i>						
<i>Pretest</i>	709	59%	.26	27.693	$\leq .0001$	1.25
<i>Posttest</i>	709	85%	.14			
<i>Multi-Ethnic</i>						
<i>Pretest</i>	843	56%	.26	34.427	$\leq .0001$	1.53
<i>Posttest</i>	843	87%	.12			

Figures 7, 8, and 9 provide a visual look at the increases. In general, the percentage increases were about 30% for each comparison group.

Figure 7: Algebra II Module 3
Pretest and Posttest Percent Correct Scores
All Students, Basic/Honors Comparison

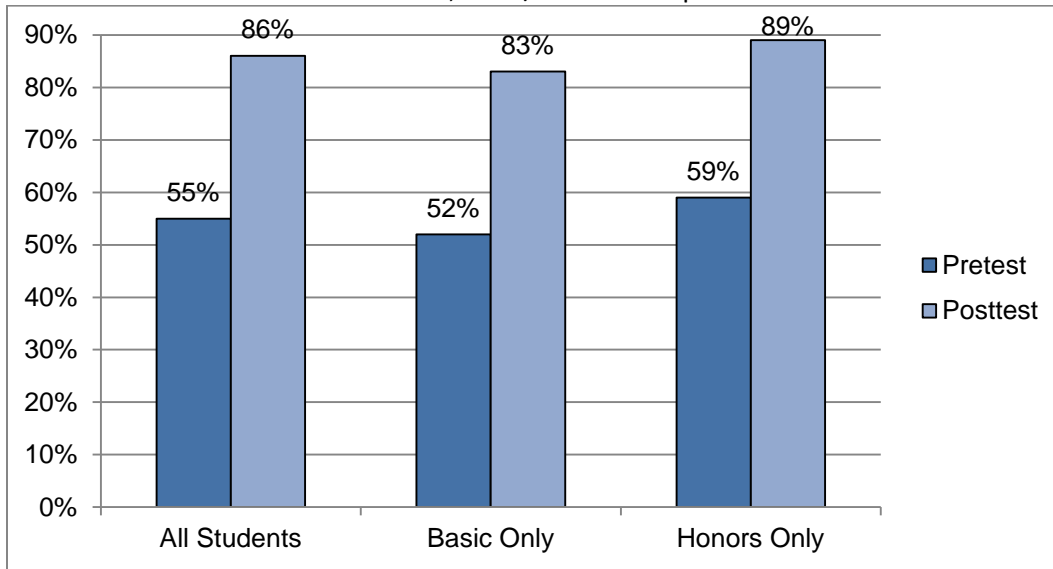


Figure 8: Algebra II Module 3
Pretest and Posttest Percent Correct Scores
Males/Females & Free/Reduced Lunch/No Free Reduced Lunch

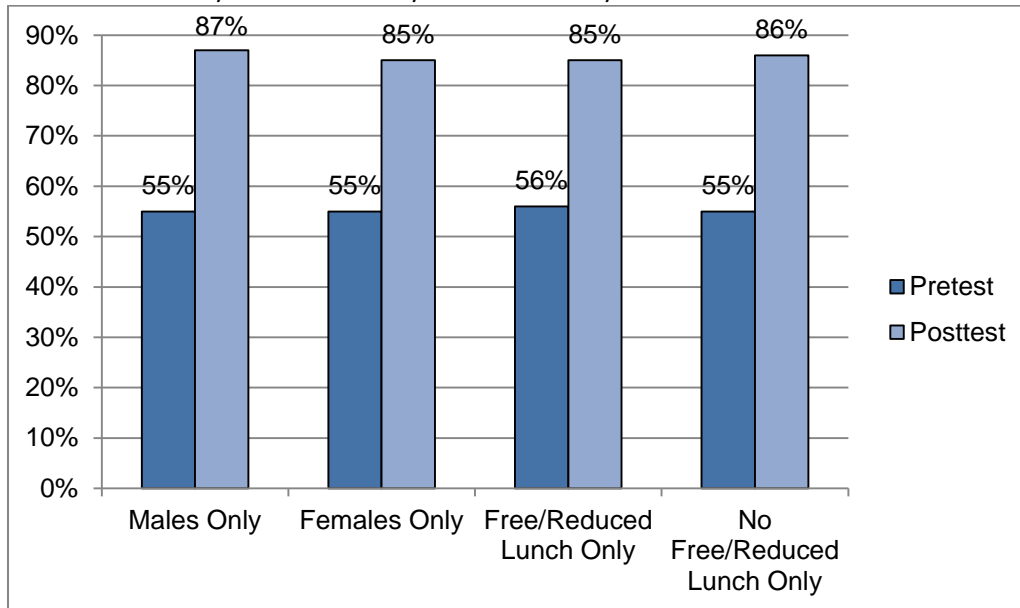
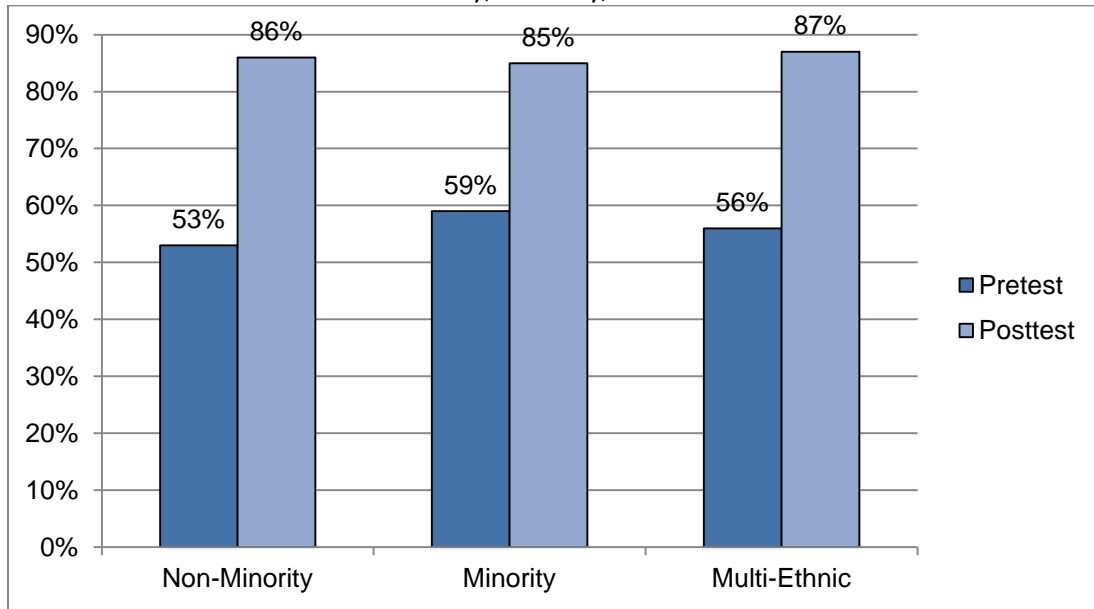


Figure 9: Algebra II Module 3
Pretest and Posttest Percent Correct Scores
Non-Minority, Minority, & Multi-Ethnic



Module 4

This module covers adding, subtracting, multiplying, and dividing radicals as well as solving radical equations on the real and complex plane. Table 9 shows that the increases from pretesting to posttesting were all statistically significant ($\leq .0001$) and the effect sizes were all large. As expected, honors students scored higher than basic students. Other than that, the descriptive data shows little difference between the various demographic groups.

*Table 9: Comparison of Pretest to Posttest Percent Correct Scores
Algebra II Instructional Module 4*

Group	Number of Students	Mean	Standard Deviation	t-Test	Significance	Effect Size
<i>All Students</i>						
<i>Pretest</i>	2724	43%	.25	76.731	$\leq .0001$	1.74
<i>Posttest</i>	2724	81%	.18			
<i>Basic Only</i>						
<i>Pretest</i>	1485	39%	.25	53.573	$\leq .0001$	1.71
<i>Posttest</i>	1485	77%	.19			
<i>Honors Only</i>						
<i>Pretest</i>	1239	46%	.25	55.513	$\leq .0001$	1.94
<i>Posttest</i>	1239	86%	.15			
<i>Males Only</i>						
<i>Pretest</i>	1214	43%	.26	50.812	$\leq .0001$	1.78
<i>Posttest</i>	1214	82%	.17			
<i>Females Only</i>						
<i>Pretest</i>	1510	42%	.24	57.686	$\leq .0001$	1.74
<i>Posttest</i>	1510	79%	.18			
<i>Free/Reduced Lunch Only</i>						
<i>Pretest</i>	750	42%	.25	40.047	$\leq .0001$	1.70
<i>Posttest</i>	750	79%	.18			
<i>No Free/Reduced Lunch Only</i>						
<i>Pretest</i>	1974	43%	.25	65.497	$\leq .0001$	1.79
<i>Posttest</i>	1974	81%	.18			
<i>Non-Minority Only</i>						
<i>Pretest</i>	1403	41%	.24	57.636	$\leq .0001$	1.89
<i>Posttest</i>	1403	81%	.18			
<i>Minority Only</i>						
<i>Pretest</i>	600	45%	.26	32.806	$\leq .0001$	1.57
<i>Posttest</i>	600	80%	.18			
<i>Multi-Ethnic</i>						
<i>Pretest</i>	721	43%	.25	39.157	$\leq .0001$	1.74
<i>Posttest</i>	721	81%	.18			

Figures 10, 11, and 12 provide a visual look at the increases. In general, the percentage increases were about 40% for each comparison group.

Figure 10: Algebra II Module 4
 Pretest and Posttest Percent Correct Scores
 All Students, Basic/Honors Comparison

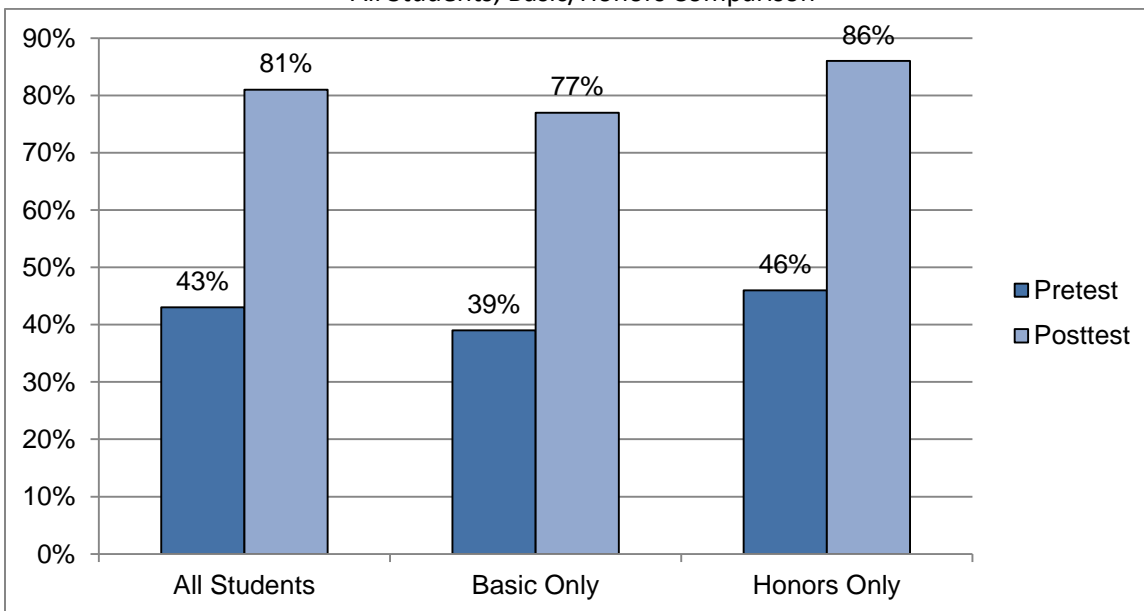


Figure 11: Algebra II Module 4
 Pretest and Posttest Percent Correct Scores
 Males/Females & Free/Reduced Lunch/No Free Reduced Lunch

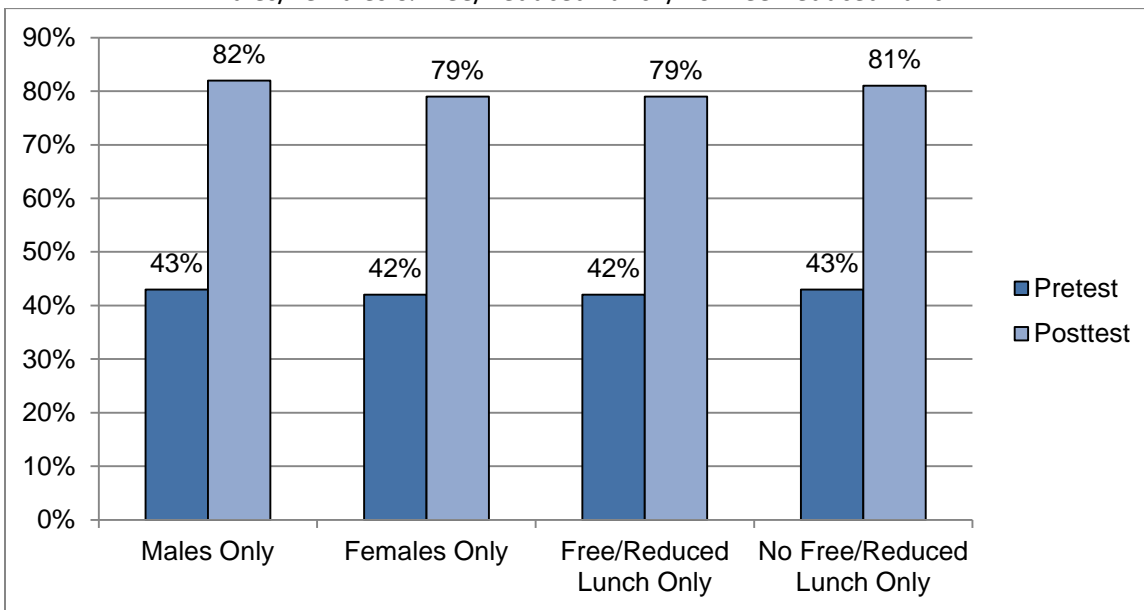
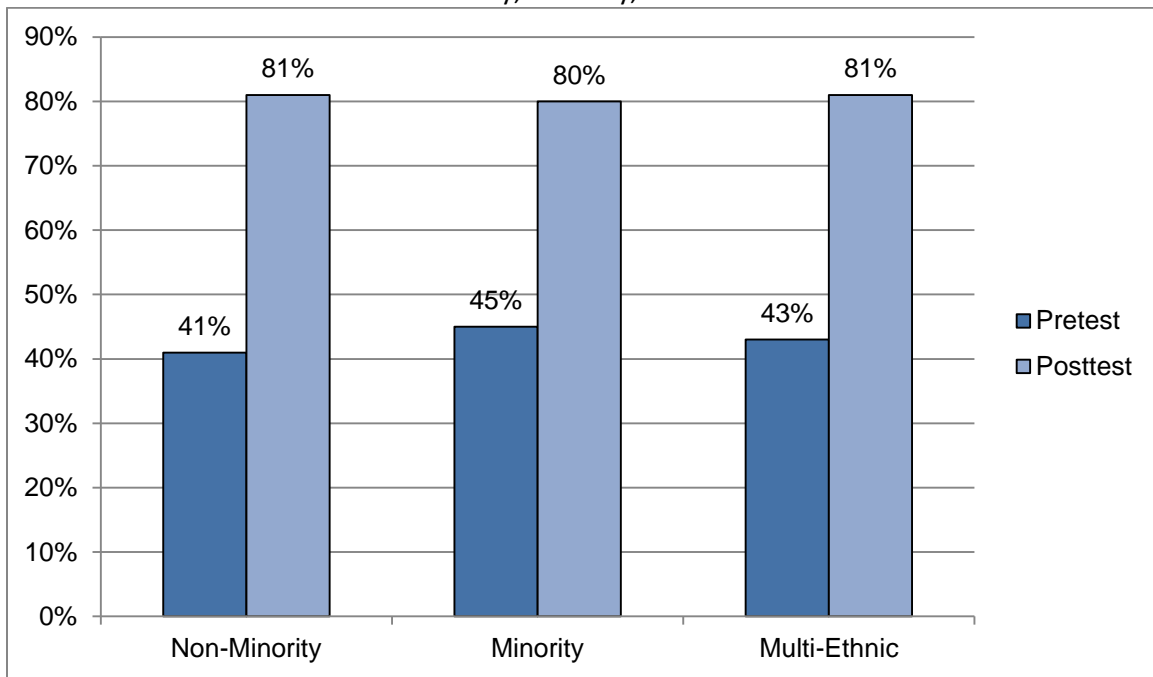


Figure 12: Algebra II Module 4
Pretest and Posttest Percent Correct Scores
Non-Minority, Minority, & Multi-Ethnic



Module 5

This module covers methods for graphing and solving quadratics as well as contains honors lessons for piecewise functions and non-linear systems. Table 10 shows that the increases from pretesting to posttesting were all statistically significant ($\leq .0001$) and the effect sizes were all large. The honors students scored higher than the basic students and there was little difference between the various demographic groups.

Table 5: Comparison of Pretest to Posttest Percent Correct Scores
Algebra II Instructional Module 5

Group	Number of Students	Mean	Standard Deviation	t-Test	Significance	Effect Size
<i>All Students</i>						
<i>Pretest</i>	2359	42%	.29	66.003	$\leq .0001$	1.75
<i>Posttest</i>	2359	83%	.16			
<i>Basic Only</i>						
<i>Pretest</i>	1292	40%	.29	45.535	$\leq .0001$	1.64
<i>Posttest</i>	1292	79%	.17			
<i>Honors Only</i>						
<i>Pretest</i>	1067	43%	.28	48.527	$\leq .0001$	1.99
<i>Posttest</i>	1067	87%	.14			
<i>Males Only</i>						
<i>Pretest</i>	1046	41%	.29	46.081	$\leq .0001$	1.84
<i>Posttest</i>	1046	84%	.16			
<i>Females Only</i>						
<i>Pretest</i>	1313	42%	.28	47.465	$\leq .0001$	1.73
<i>Posttest</i>	1313	82%	.17			
<i>Free/Reduced Lunch Only</i>						
<i>Pretest</i>	634	43%	.28	31.856	$\leq .0001$	1.67
<i>Posttest</i>	634	81%	.16			
<i>No Free/Reduced Lunch Only</i>						
<i>Pretest</i>	1725	41%	.29	57.972	$\leq .0001$	1.79
<i>Posttest</i>	1725	83%	.16			
<i>Non-Minority Only</i>						
<i>Pretest</i>	1229	40%	.27	51.729	$\leq .0001$	1.94
<i>Posttest</i>	1229	83%	.16			
<i>Minority Only</i>						
<i>Pretest</i>	514	45%	.30	26.218	$\leq .0001$	1.44
<i>Posttest</i>	514	82%	.17			
<i>Multi-Ethnic</i>						
<i>Pretest</i>	616	42%	.29	33.058	$\leq .0001$	1.82
<i>Posttest</i>	616	84%	.15			

Figures 13, 14, and 15 provide a visual look at the increases. In general, the percentage increases were about 40% for each comparison group.

Figure 13: Algebra II Module 5
 Pretest and Posttest Percent Correct Scores
 All Students, Basic/Honors Comparison

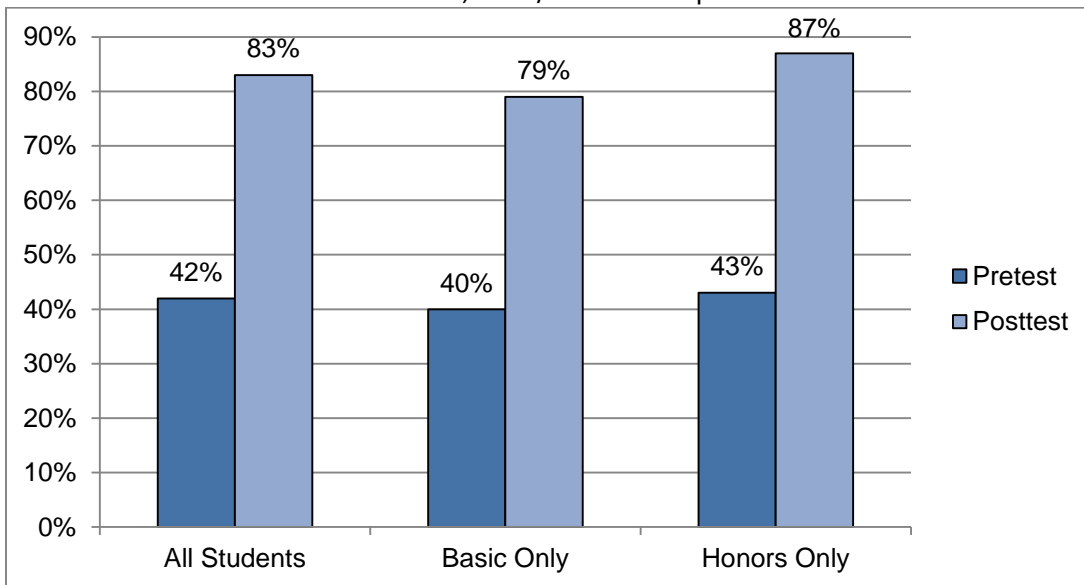


Figure 14: Algebra II Module 5
 Pretest and Posttest Percent Correct Scores
 Males/Females & Free/Reduced Lunch/No Free Reduced Lunch

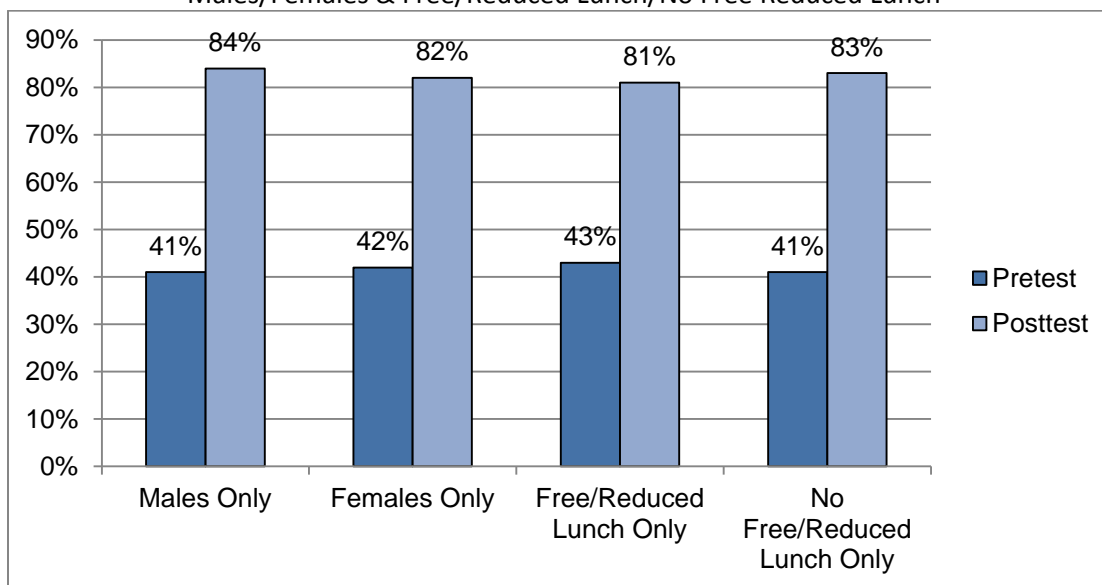
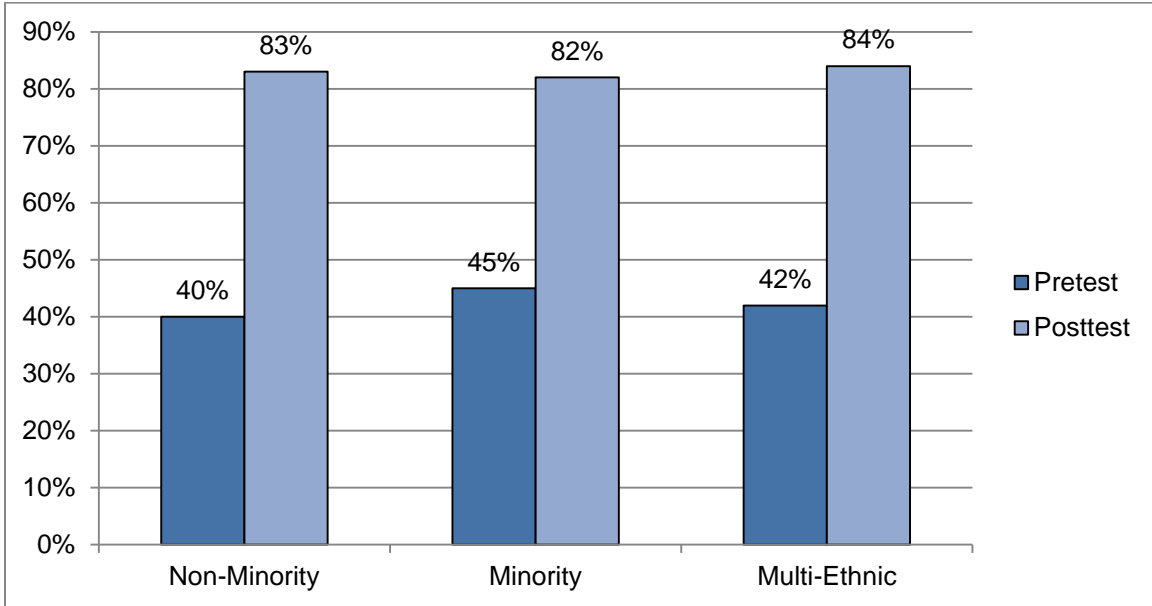


Figure 15: Algebra II Module 5
Pretest and Posttest Percent Correct Scores
Non-Minority, Minority, & Multi-Ethnic



Module 6

This module covers theorems for polynomials, graphing and solving polynomials, and an honors lesson for polynomial inequalities. Table 11 shows that the increases from pretesting to posttesting were all statistically significant ($\leq .0001$) and the effect sizes were all large. The honors students scored higher than the basic students, and it appears there was little difference between the various demographic groups.

*Table 11: Comparison of Pretest to Posttest Percent Correct Scores
Algebra II Instructional Module 6*

Group	Number of Students	Mean	Standard Deviation	t-Test	Significance	Effect Size
<i>All Students</i>						
<i>Pretest</i>	2605	43%	.25	80.038	$\leq .0001$	1.99
<i>Posttest</i>	2605	84%	.15			
<i>Basic Only</i>						
<i>Pretest</i>	1490	40%	.24	16.133	$\leq .0001$	1.99
<i>Posttest</i>	1490	80%	.15			
<i>Honors Only</i>						
<i>Pretest</i>	1115	45%	.26	53.138	$\leq .0001$	2.14
<i>Posttest</i>	1115	89%	.13			
<i>Males Only</i>						
<i>Pretest</i>	1160	42%	.25	52.719	$\leq .0001$	2.09
<i>Posttest</i>	1160	84%	.15			
<i>Females Only</i>						
<i>Pretest</i>	1445	43%	.24	60.288	$\leq .0001$	2.05
<i>Posttest</i>	1445	84%	.15			
<i>Free/Reduced Lunch Only</i>						
<i>Pretest</i>	619	40%	.23	40.771	$\leq .0001$	2.16
<i>Posttest</i>	619	82%	.15			
<i>No Free/Reduced Lunch Only</i>						
<i>Pretest</i>	1986	43%	.25	69.998	$\leq .0001$	2.07
<i>Posttest</i>	1986	85%	.14			
<i>Non-Minority Only</i>						
<i>Pretest</i>	1498	42%	.24	62.173	$\leq .0001$	2.10
<i>Posttest</i>	1498	84%	.15			
<i>Minority Only</i>						
<i>Pretest</i>	454	46%	.26	29.046	$\leq .0001$	1.79
<i>Posttest</i>	454	84%	.15			
<i>Multi-Ethnic</i>						
<i>Pretest</i>	653	42%	.25	42.027	$\leq .0001$	2.12
<i>Posttest</i>	653	85%	.14			

Figures 16, 17, and 18 provide a visual look at the increases. In general, the percentage increases were about 40% for each comparison group.

Figure 16: Algebra II Module 6
 Pretest and Posttest Percent Correct Scores
 All Students, Basic/Honors Comparison

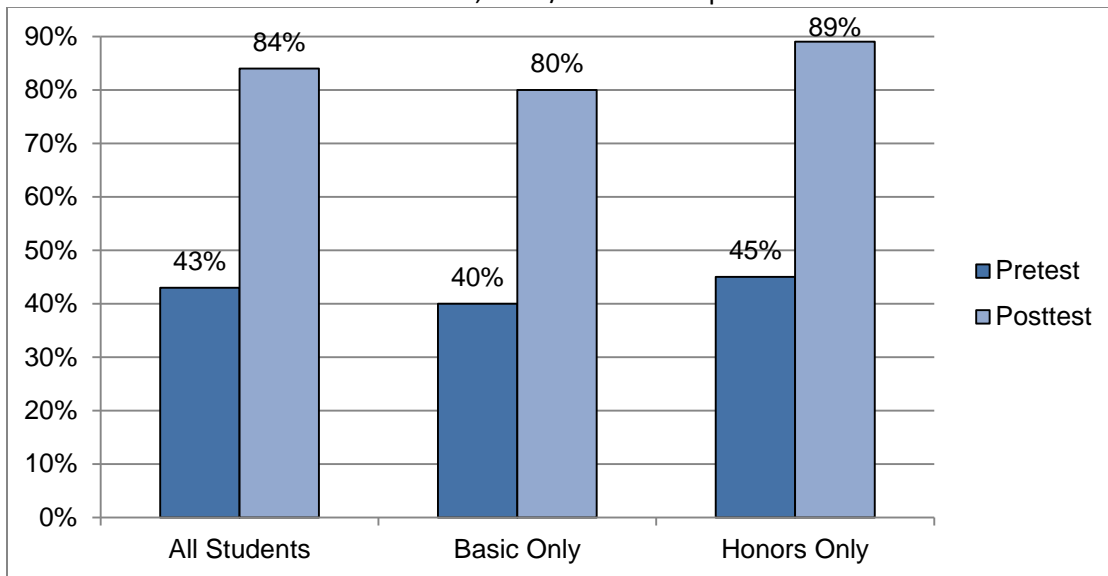


Figure 17: Algebra II Module 6
 Pretest and Posttest Percent Correct Scores
 Males/Females & Free/Reduced Lunch/No Free Reduced Lunch

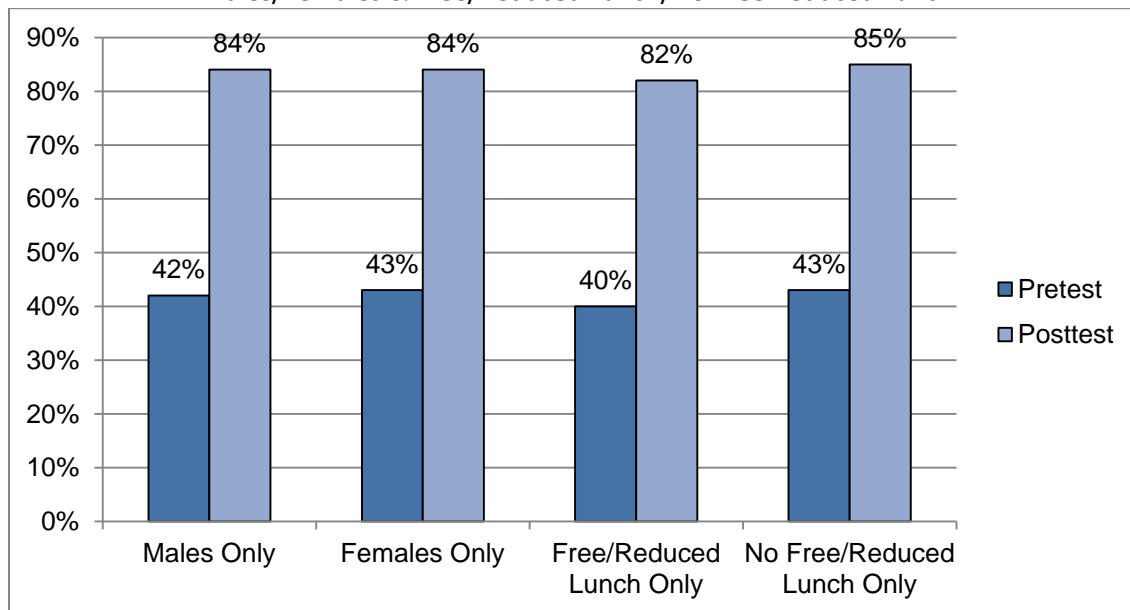
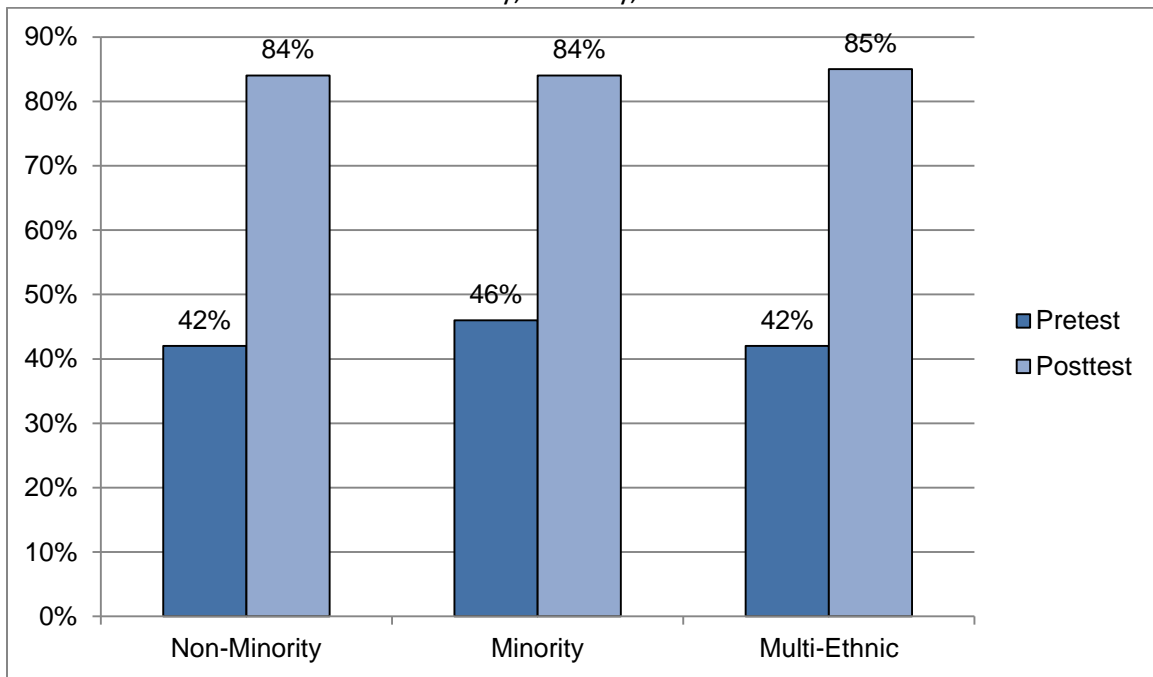


Figure 18: Algebra II Module 6
Pretest and Posttest Percent Correct Scores
Non-Minority, Minority, & Multi-Ethnic



Module 7

This module covers adding, subtracting, multiplying, and dividing rational expressions as well as solving rational equations. Table 12 shows that the increases from pretesting to posttesting were all statistically significant ($\leq .0001$) and the effect sizes were all large. As expected, the honors students scored higher than the basic students. Other than that difference, it appears there was little difference between the various demographic groups.

*Table 12: Comparison of Pretest to Posttest Percent Correct Scores
Algebra II Instructional Module 7*

Group	Number of Students	Mean	Standard Deviation	t-Test	Significance	Effect Size
<i>All Students</i>						
<i>Pretest</i>	2083	41%	.28	67.081	$\leq .0001$	1.81
<i>Posttest</i>	2083	83%	.17			
<i>Basic Only</i>						
<i>Pretest</i>	1171	38%	.27	49.180	$\leq .0001$	1.76
<i>Posttest</i>	1171	79%	.19			
<i>Honors Only</i>						
<i>Pretest</i>	912	45%	.29	45.685	$\leq .0001$	1.98
<i>Posttest</i>	912	89%	.12			
<i>Males Only</i>						
<i>Pretest</i>	921	40%	.29	45.146	$\leq .0001$	1.92
<i>Posttest</i>	921	85%	.16			
<i>Females Only</i>						
<i>Pretest</i>	1162	41%	.27	49.743	$\leq .0001$	1.83
<i>Posttest</i>	1162	83%	.18			
<i>Free/Reduced Lunch Only</i>						
<i>Pretest</i>	485	39%	.27	32.998	$\leq .0001$	1.86
<i>Posttest</i>	485	81%	.17			
<i>No Free/Reduced Lunch Only</i>						
<i>Pretest</i>	1598	41%	.29	58.415	$\leq .0001$	1.81
<i>Posttest</i>	1598	84%	.17			
<i>Non-Minority Only</i>						
<i>Pretest</i>	1200	39%	.27	52.931	$\leq .0001$	1.87
<i>Posttest</i>	1200	82%	.18			
<i>Minority Only</i>						
<i>Pretest</i>	364	45%	.30	24.865	$\leq .0001$	1.62
<i>Posttest</i>	364	84%	.16			
<i>Multi-Ethnic</i>						
<i>Pretest</i>	519	43%	.30	33.424	$\leq .0001$	1.89
<i>Posttest</i>	519	86%	.14			

Figures 19, 20, and 21 provide a visual look at the increases. In general, the percentage increases were about 40% for each comparison group.

Figure 19: Algebra II Module 7
Pretest and Posttest Percent Correct Scores
All Students, Basic/Honors Comparison

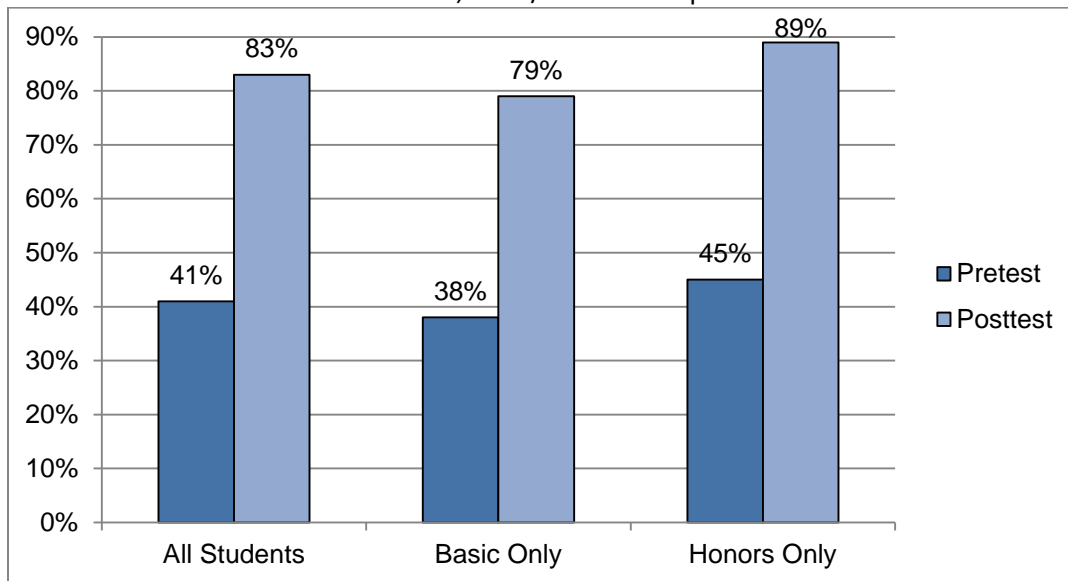


Figure 20: Algebra II Module 7
Pretest and Posttest Percent Correct Scores

Males/Females & Free/Reduced Lunch/No Free Reduced Lunch

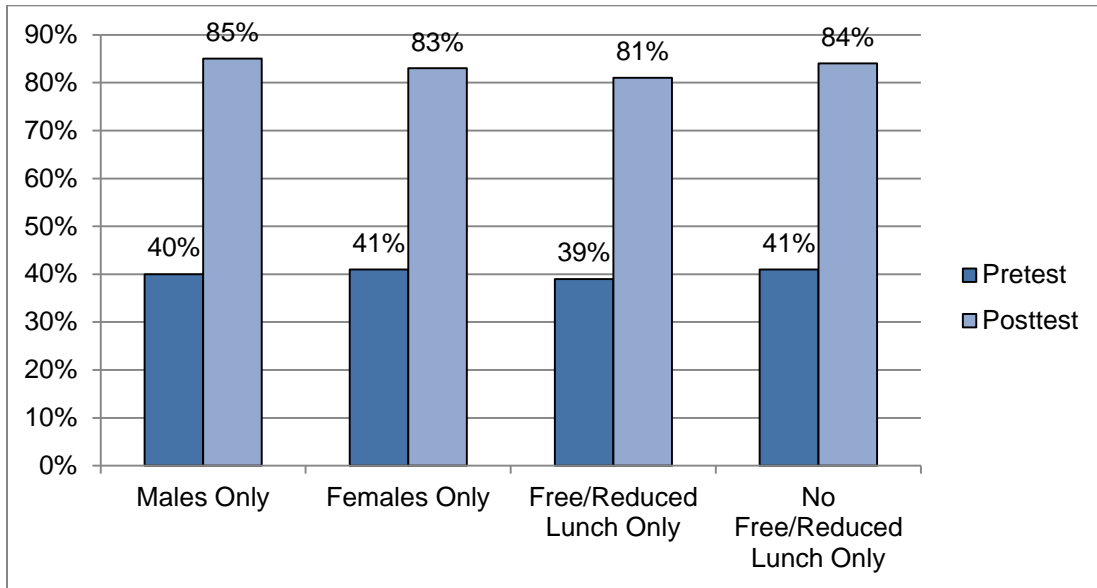
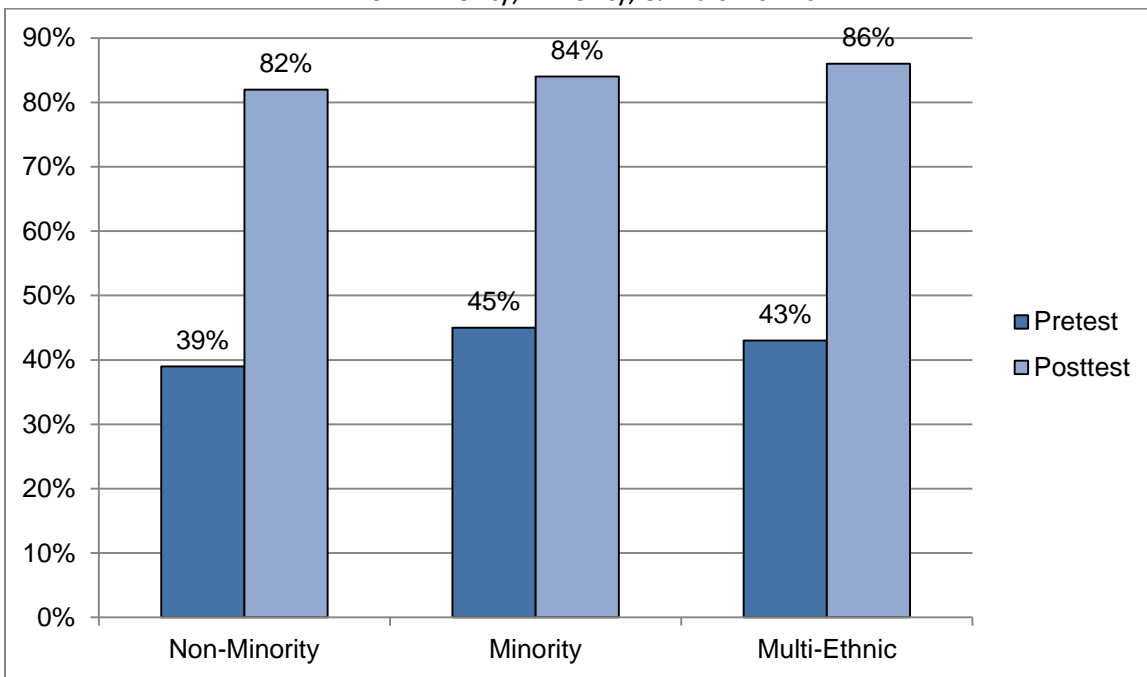


Figure 21: Algebra II Module 7
Pretest and Posttest Percent Correct Scores
Non-Minority, Minority, & Multi-Ethnic



Module 8

This module covers solving and graphing exponential and logarithmic equations. Table 13 shows that the increases from pretesting to posttesting were all statistically significant ($\leq .0001$) and the effect sizes were all large. As expected, the honors students scored higher than the basic students. Other than that difference, it appears there was little difference between the various demographic groups.

*Table 13: Comparison of Pretest to Posttest Percent Correct Scores
Algebra II Instructional Module 8*

Group	Number of Students	Mean	Standard Deviation	t-Test	Significance	Effect Size
<i>All Students</i>						
<i>Pretest</i>	1687	40%	.25	56.457	$\leq .0001$	1.78
<i>Posttest</i>	1687	78%	.17			
<i>Basic Only</i>						
<i>Pretest</i>	924	38%	.25	38.810	$\leq .0001$	1.65
<i>Posttest</i>	924	74%	.18			
<i>Honors Only</i>						
<i>Pretest</i>	763	43%	.25	41.692	$\leq .0001$	1.94
<i>Posttest</i>	763	83%	.15			
<i>Males Only</i>						
<i>Pretest</i>	736	40%	.26	37.641	$\leq .0001$	1.82
<i>Posttest</i>	736	80%	.17			
<i>Females Only</i>						
<i>Pretest</i>	951	40%	.24	42.293	$\leq .0001$	1.70
<i>Posttest</i>	951	76%	.18			
<i>Free/Reduced Lunch Only</i>						
<i>Pretest</i>	387	41%	.24	24.637	$\leq .0001$	1.64
<i>Posttest</i>	387	76%	.17			
<i>No Free/Reduced Lunch Only</i>						
<i>Pretest</i>	1300	40%	.25	51.002	$\leq .0001$	1.82
<i>Posttest</i>	1300	79%	.17			
<i>Non-Minority Only</i>						
<i>Pretest</i>	982	39%	.25	44.233	$\leq .0001$	1.78
<i>Posttest</i>	982	77%	.17			
<i>Minority Only</i>						
<i>Pretest</i>	298	43%	.25	21.066	$\leq .0001$	1.56
<i>Posttest</i>	298	77%	.18			
<i>Multi-Ethnic</i>						
<i>Pretest</i>	407	40%	.26	28.491	$\leq .0001$	1.85
<i>Posttest</i>	407	80%	.16			

Figures 22, 23, and 24 provide a visual look at the increases. In general, the percentage increases were about 40% for each comparison group.

Figure 22: Algebra II Module 8
 Pretest and Posttest Percent Correct Scores
 All Students, Basic/Honors Comparison

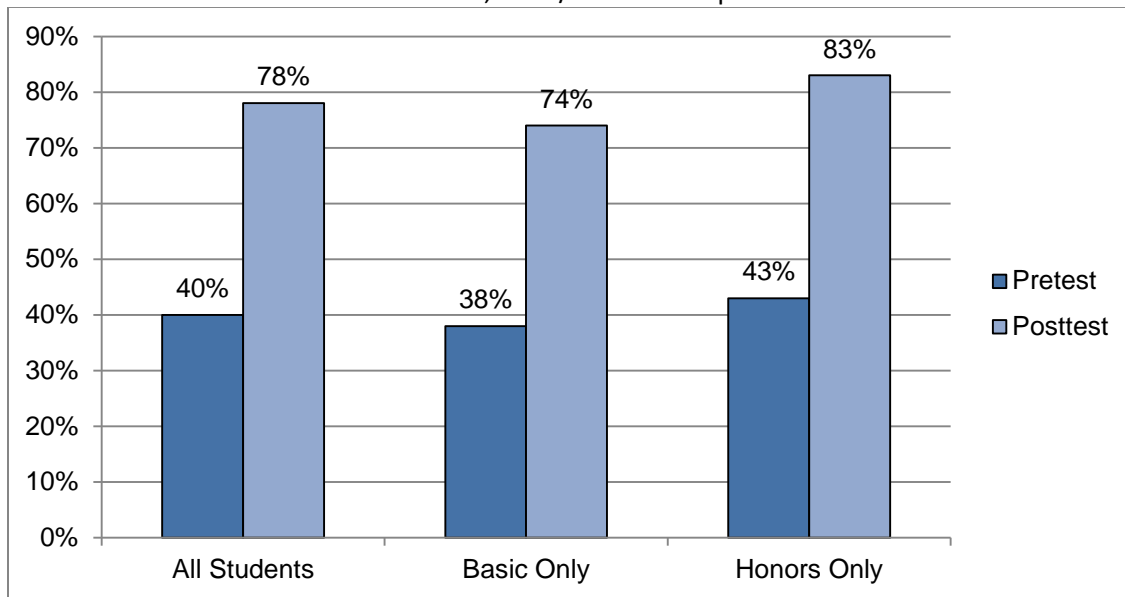


Figure 23: Algebra II Module 8
 Pretest and Posttest Percent Correct Scores
 Males/Females & Free/Reduced Lunch/No Free Reduced Lunch

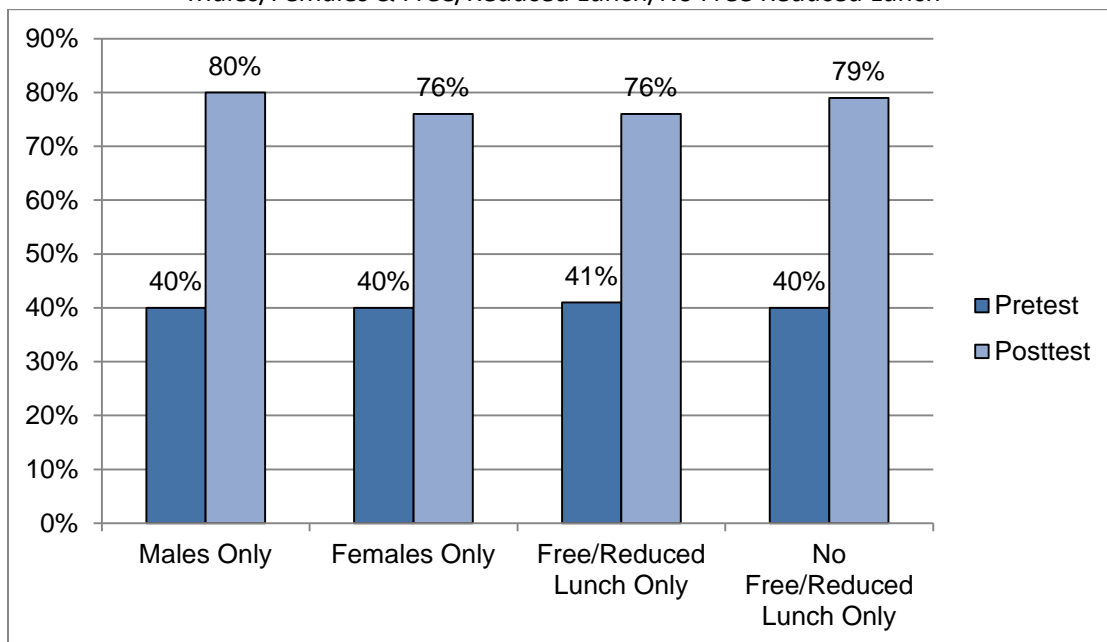
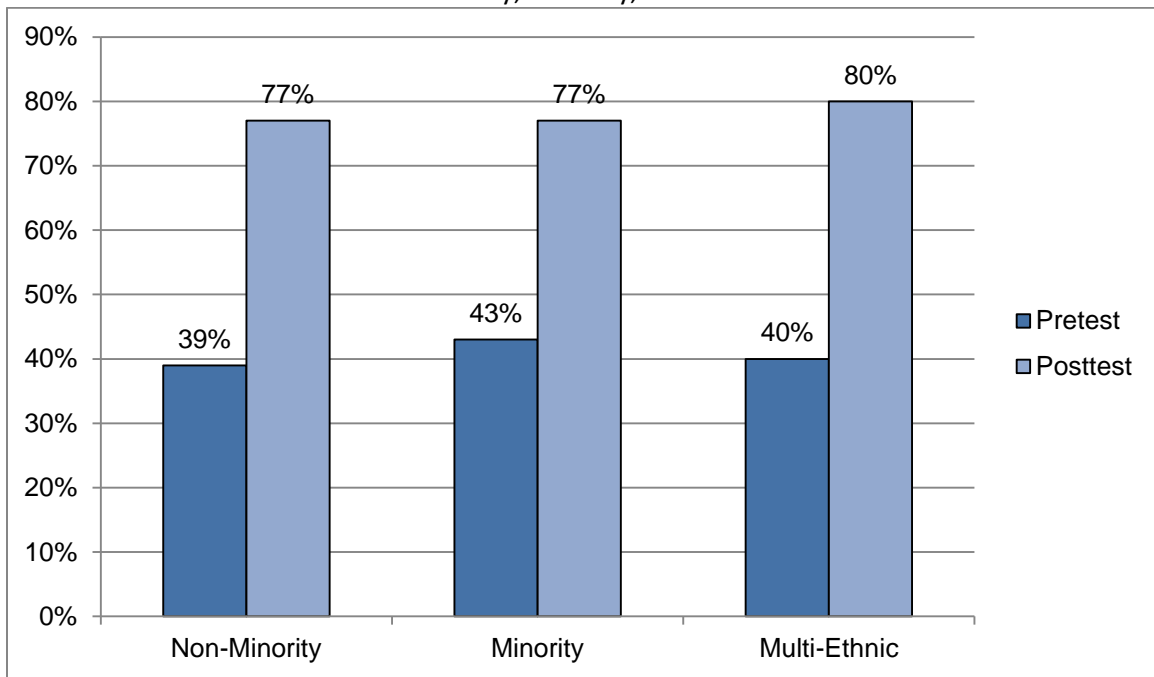


Figure 24: Algebra II Module 8
Pretest and Posttest Percent Correct Scores
Non-Minority, Minority, & Multi-Ethnic



Module 9

This module covers arithmetic and geometric sequences and series finding both recursive formulas and sums. Table 14 shows that the increases from pretesting to posttesting were all statistically significant ($\leq .0001$) and the effect sizes were all large. As expected, the honors students scored higher than the basic students. Other than that difference, it appears there was little difference between the various demographic groups.

*Table 14: Comparison of Pretest to Posttest Percent Correct Scores
Algebra II Instructional Module 9*

Group	Number of Students	Mean	Standard Deviation	t-Test	Significance	Effect Size
<i>All Students</i>						
<i>Pretest</i>	1400	42%	.29	56.636	$\leq .0001$	2.02
<i>Posttest</i>	1400	88%	.14			
<i>Basic Only</i>						
<i>Pretest</i>	772	41%	.29	40.434	$\leq .0001$	1.95
<i>Posttest</i>	772	86%	.15			
<i>Honors Only</i>						
<i>Pretest</i>	628	43%	.30	39.878	$\leq .0001$	2.17
<i>Posttest</i>	628	92%	.11			
<i>Males Only</i>						
<i>Pretest</i>	608	39%	.29	40.302	$\leq .0001$	2.20
<i>Posttest</i>	608	89%	.14			
<i>Females Only</i>						
<i>Pretest</i>	792	44%	.29	40.364	$\leq .0001$	1.93
<i>Posttest</i>	792	88%	.14			
<i>Free/Reduced Lunch Only</i>						
<i>Pretest</i>	321	43%	.28	24.938	$\leq .0001$	1.91
<i>Posttest</i>	321	86%	.15			
<i>No Free/Reduced Lunch Only</i>						
<i>Pretest</i>	1079	42%	.30	51.008	$\leq .0001$	2.03
<i>Posttest</i>	1079	89%	.13			
<i>Non-Minority Only</i>						
<i>Pretest</i>	820	41%	.28	44.996	$\leq .0001$	2.12
<i>Posttest</i>	820	88%	.14			
<i>Minority Only</i>						
<i>Pretest</i>	245	47%	.31	20.050	$\leq .0001$	1.70
<i>Posttest</i>	245	88%	.14			
<i>Multi-Ethnic</i>						
<i>Pretest</i>	335	40%	.30	28.782	$\leq .0001$	2.12
<i>Posttest</i>	335	89%	.13			

Figures 25, 26, and 27 provide a visual look at the increases. In general, the percentage increases were about 40% to 45% for each comparison group.

Figure 25: Algebra II Module 9
 Pretest and Posttest Percent Correct Scores
 All Students, Basic/Honors Comparison

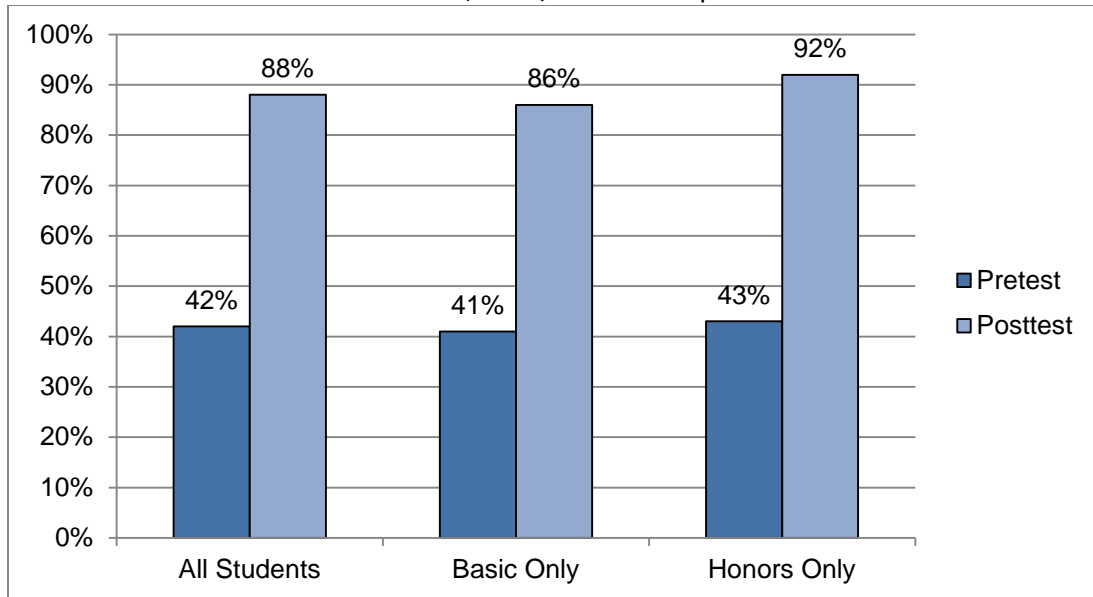


Figure 26: Algebra II Module 9
 Pretest and Posttest Percent Correct Scores
 Males/Females & Free/Reduced Lunch/No Free Reduced Lunch

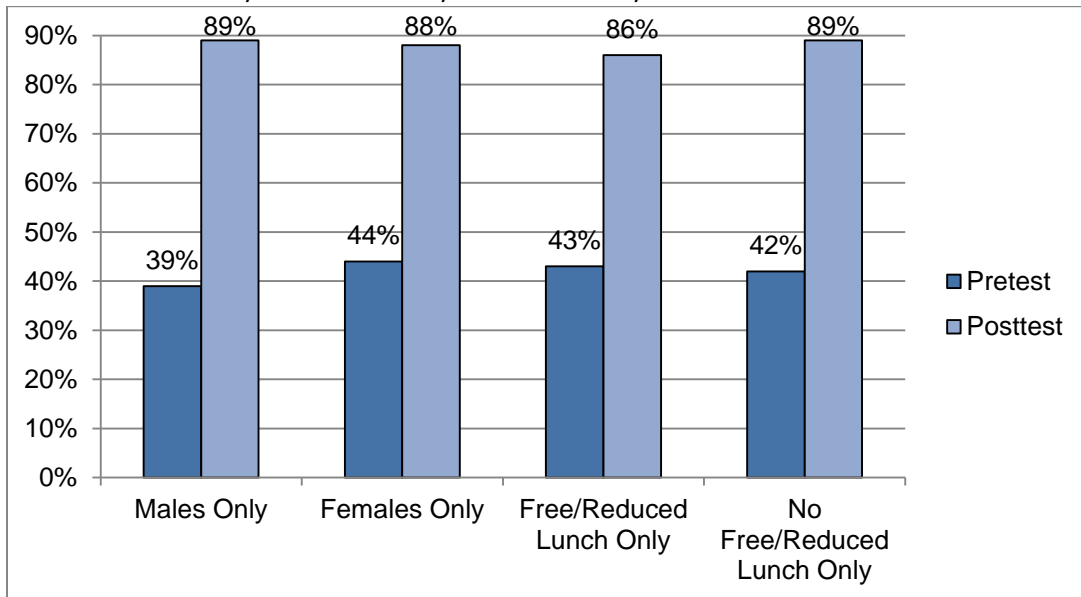
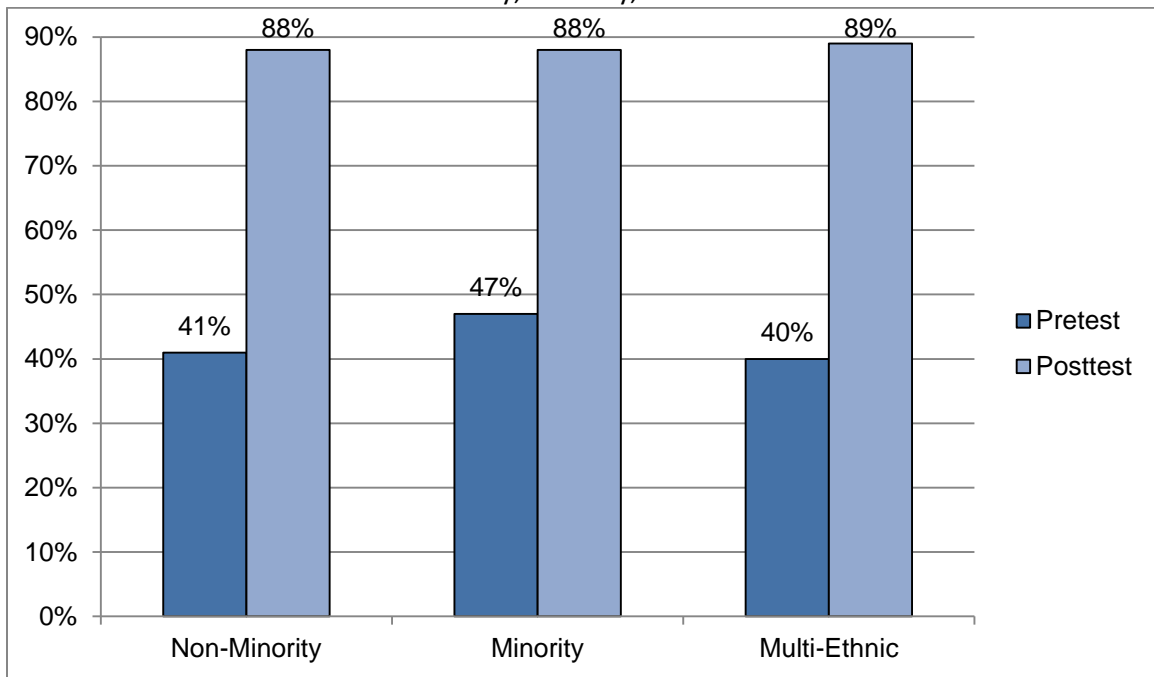


Figure 27: Algebra II Module 9
Pretest and Posttest Percent Correct Scores
Non-Minority, Minority, & Multi-Ethnic



Conclusions

The conclusions will review the data analyzed to answer each of the three questions that guided this study.

Question 1: *Do students enrolled in the **Florida Virtual School Algebra II** program increase their knowledge and skills in Algebra II?*

For each of the comparisons across the 9 modules, the increases were statistically significant ($\leq .0001$), indicating a difference that would occur by chance less than 1 out of 10,000 repetitions. The effect size, an even more significant estimate of the strength of a change, was very large for all of the modules. Perhaps of even greater significance is that the growth from pretesting to posttesting increased across the 9 modules.

The average percent increase for all students across the 9 modules is shown in Table 15.

Table 15: Gain Scores Across 9 Modules for All students

Pretest Percent	Posttest Percent	Gain
46%	82%	36%

The conclusion to question 1 is that the module pretest/posttest comparison show significant increases for each of the modules and thus for the total Algebra II course.

Question 2: *Do students enrolled in basic or honors courses achieve similar gains in the **Florida Virtual School Algebra II** program?*

Overall, the honors students scored higher than the basic students on the pretests for all modules. The basic and honors students' average percent increases across the 9 modules are shown in Table 16.

Table 16: Gain Scores Across 9 Modules for All students

Group	Pretest Percent	Posttest Percent	Gain
Basic	43%	78%	35%
Honors	50%	87%	37%

Although honors students had higher average pretest and average posttest scores than basic students, both groups achieved similar average percentage gains across the 9 modules.

Question 3: Do students with differing demographic characteristics (gender, socio-economic, and ethnicity status) achieve similar gains when enrolled in the **Florida Virtual School Algebra II** program?

The average percent increase for male and female; higher socio-economic level and lower socio-economic level; and white, minority, and multi-ethnic students across the 9 modules are shown in Table 17.

Table 17: Gain Scores Across 9 Modules for All students

Group	Pretest Percent	Posttest Percent	Gain
Gender Groups			
Female	46%	81%	35%
Male	46%	83%	37%
Socio-Economic Groups			
Lower	46%	80%	34%
Higher	46%	83%	37%
Ethnic Groups			
White	45%	82%	37%
Minority	49%	81%	32%
Multi-Ethnic	47%	83%	36%

The conclusion to question 3 is that there seem to be very minor and non-consistent differences for gender, socio-economic status, and ethnicity. Students overall, regardless of demographic differences, made statistically significant and large effect size gains from pretesting to posttesting.

The overall conclusion based on the gain scores across the 9 module pretests and posttests is that all students made statistically significant and large effect size gains from pretesting to posttesting. Honors students scored higher than basic students, but the gains made by each group were similar. The demographic comparisons showed that the program is equally effective regardless of gender, socio-economic status, and ethnicity.