A Study on the Effects of 2011 Prentice Hall High School Math

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Executive Summary

It is clear that the establishment of a strong foundation of math skills early on is critical to students’ future participation in higher-level math courses as well as their academic and career success. Unfortunately, there is a wealth of information which suggests that U.S. secondary students are not being adequately prepared to meet the demands of future careers, especially since today’s workforce requires advanced skills in critical thinking and mathematics. For example, according to the recent National Assessment of Education Progress (NCES, 2010), only 26% of 12th graders are scoring at levels at or above “proficient” in mathematics. To help address the large gap in secondary students’ mathematics skills that is facing our nation’s youth, Pearson Publishers developed a new math program that blends print and digital formats to engage students, teach for understanding, and promote success in math. Based on Understanding by Design, the 2011 Prentice Hall High School Math program was developed to help students gain important skills and knowledge in the areas of Algebra 1, Geometry and Algebra 2.

Since the acquisition of higher level math skills is essential to ensure the future educational and economic success of youth, programs that can help in the development of such skills need to be looked at carefully to determine the extent to which they help students attain such skills. Planning, Research, and Evaluation Services (PRES) Associates, Inc. completed a two year study on the effectiveness of the 2011 Prentice Hall High School (PHHS) Math program in helping secondary students attain critical math skills. This randomized control trial (RCT), which commenced in the Fall of 2009, was conducted in Algebra 1 and Geometry classrooms (n=1069) during the 2009-2010 school year and in Geometry and Algebra 2 classrooms (n=1035) during the 2010-2011 school year. Over the course of two years, 38 high school math teachers and 129 classes (72 treatment and 57 control) participated in the RCT. Math teachers were spread across 6 schools in the states of Rhode Island, New Jersey, Ohio, Idaho, and Washington. This report presents summative findings from both years of the RCT.

What follows is a summary of the key findings from the study arranged by research questions.

1. Does math ability improve as a result of participation in the Prentice Hall High School Math programs?

Students using PHHS Math showed significant learning gains over the course of the study. In particular, students showed significant improvement in math performance overall across Algebra 1, Geometry, and Algebra 2 on both the multiple-choice (designed primarily to measure math computation and interpretation) and open-response tests (designed primarily to measure problem-solving and reasoning skills). When tests for each content area were examined separately, results showed significant growth within all subject areas. PHHS Algebra 1 students grew by 38 percentile points, PHHS Geometry students grew by 33 to 34 percentile points, and PHHS Algebra 2 students grew by 22 to 23 percentile points from pre- to post-testing.

2. Do changes in math performance among Prentice Hall High School Math students vary by different types of students and levels of implementation?

All subgroups significantly improved from pre- to post-testing. Students using PHHS Math and who were female or male, in special education or not, receiving free/reduced lunch or not, and of various
ethnic/racial backgrounds, math levels, and grade levels, showed significant learning gains over the course of the study.

Exploratory analyses on the relationship between overall levels of PHHS Math implementation of key program components and student math performance showed that students whose teachers implemented the major components of Prentice Hall High School Math with moderate to high fidelity showed greater improvement than students of teachers who did not use all the major program components on a regular basis. Moreover, analyses also showed that students whose teachers used Prentice Hall High School Math technology components on a regular and consistent basis (i.e., with high fidelity) showed greater improvement than students of teachers who did not use the PHHS technology on a regular basis. Thus, preliminary findings suggest that using the PHHS Math program as outlined in the implementation guidelines, including the technology, can enhance student learning.

3. Do different patterns emerge before and after students use Prentice Hall High School Math?

Given the small subset of students who changed conditions (i.e., from control during 2009-10 to PHHS Math in 2010-11 and vice versa), researchers were able to explore if there was a change in growth patterns before or after usage of PHHS Math. Results showed a significant relationship among students who were initially treatment students and became control students in year 2. Specifically, math performance growth on the Overall Math Multiple-Choice Test was significantly greater during usage of PHHS Math (in the 2009-10 school year) as compared to their performance when they used another math program in year 2 of the study.

4. Does using the Prentice Hall High School Math programs result in increased student achievement as compared to other types of math programs?

Results showed significantly greater gains on the math tests of students who used Prentice Hall High School Math as compared to students who used other high school math programs. That is, PHHS Math students showed accelerated learning gains on the multiple-choice and open-response tests across Algebra 1, Geometry, and Algebra 2 content areas as compared to gains experienced by students using other math programs. It is noteworthy that such effects were observed despite: a) the lower levels of fidelity of implementation observed in year 2; and b) the loss of students who switched conditions following first year usage of PHHS Math.

When analyses are broken out by content area, results showed that PHHS Algebra 1 students had a significantly higher level of improvement from pre- to post-testing on the Algebra 1 multiple-choice and open-response tests as compared to students using other Algebra 1 programs. Among Geometry students in both years of the study, there was a significant difference on the Geometry multiple-choice test such that PHHS Math students demonstrated accelerated learning gains as compared to students using other Geometry programs. Results showed no significant differences on the Algebra 2 multiple-choice and open-response tests between PHHS Algebra 2 students and control students, after controlling for pretest differences\(^1\). Thus, PHHS Algebra 2 students and students using other Algebra 2 programs demonstrated similar math performance.

\(^1\) Given pretest differences, baseline performance was controlled for in analyses of Algebra 2 outcomes.
Effect size is a commonly used measure of the importance of the effect of an intervention (in this case, PHHS Math). All effect sizes were positive indicating a favorable effect of the PHHS Math program on student math performance. The effect sizes obtained can be classified as small (d=.21 for Overall Multiple-Choice: Combined Year 1 and Year 2 Sample; d=.08 for Overall Open-Response: Combined Year 1 and Year 2 Sample; d=.22 for Geometry: Combined Year 1 and Year 2 Sample; d=.22 for Algebra 1 Multiple-Choice; and d=.37 for Algebra 1 Open-Response). Moreover, the What Works Clearinghouse calculates an improvement index which represents the difference between the percentile rank of the average student in the intervention condition (i.e., PHHS Math) and that of the average student in the comparison condition. The improvement index for this study can be calculated to be approximately +6, a noteworthy figure. This also represents a higher improvement index than was obtained during the first year of the study (+5).

Comparisons were also made between year 1 (2009-10) and year 2 (2010-11) findings to determine whether results were consistent during each year of the study. Similar to year 1, results for year 2 showed that PHHS Math students outperformed students using other math programs as measured by the Overall Multiple-Choice and Open-Response tests. Such consistency of positive effects in favor of the PHHS Math program over the course of two years lends support to the conclusion that the PHHS Math program has a positive impact on student performance relative to other math programs. It is also noteworthy that effect sizes obtained in year 2 are higher than those observed during the first year of the study. The effect sizes for the PHHS Math program on student math performance during year 2 were .22 for the Overall Open-Response test and .32 for the Overall Multiple-Choice test. These effect sizes are higher than those obtained in year 1 (.13 for both tests), suggesting that stronger effects were evident as teachers and a subsample of students had more experience with PHHS Math.

5. Do effects of Prentice Hall High School Math on student math performance vary as a function of different student characteristics and different types of control programs?

Differences between PHHS Math students and control students in the following subgroups were examined: grade, gender, math level, free/reduced lunch status, and ethnicity. Results among the combined sample from year 1 and year 2 showed significant differences between PHHS Math students and control students who were female, White, Hispanic, on free/reduced lunch, and in grades 9 and 10. In all cases, PHHS Math students showed greater learning gains such that PHHS Math students who were female, White, Hispanic, receiving free/reduced lunch, and in grades 9 and 10 showed higher levels of performance on at least one of the Overall Math subtests as compared to control students who were in these subgroups.

Findings for free/reduced lunch students and students in the 9th grade are consistent with those observed last year. During year 1, African American students also showed positive subgroup effects; however during year 2, Whites and Hispanics using PHHS Math outperformed Whites and Hispanics using other math programs, and no significant differences were observed among African Americans. It is also interesting to note that while last year’s 10th graders showed a negative effect (i.e., control students in 10th grade outperformed treatment students in 10th grade), 10th graders in year 2 showed a positive effect. This reversal in effect may be due to teachers and a portion of the students gaining experience with the PHHS Math.
program so that benefits were realized during the second year.

Across all subject areas, a significant difference was also observed among high math performing students; PHHS Math students showed significantly greater growth than control students on the Overall Math multiple-choice and open-response test. These findings were consistent with those observed in year 1. Additionally, marginally significant differences were observed among mid-level students such that PHHS Math students of average ability had higher learning gains than control students of average ability. Students of low ability levels showed comparable rates of growth across both treatment and control programs.

Comparisons by control program showed positive effects with PHHS Math students demonstrating accelerated learning gains across all traditional basal programs in the study (control programs 1, 2, 3 and 4).

In sum, all significant subgroup differences found between treatment and control conditions were in favor of the PHHS Math program (i.e., PHHS Math students outperformed control students). In addition, the positive effects obtained on the PHHS Math program were observed across a number of different schools who used a variety of types of control programs. The consistency in findings across different curricula, outcome measures, study years and student populations combined with the fact that virtually all treatment effects observed were in favor of PHHS Math all lend credence to the conclusion that PHHS Math positively impacts student math knowledge and skills.

6. Does participation in the Prentice Hall High School Math programs result in other positive outcomes?

While the main focus of the PHHS Math program is to improve upon important math skills and understanding, other measures were included to explore if PHHS Math was associated with positive impacts on student and teacher attitudes, and classroom practices. Results were fairly consistent with those obtained in year 1 -- Prentice Hall High School Math had several positive effects on student and teacher attitudes. In particular, PHHS students felt that their teachers had a greater awareness of students’ level of understanding. In addition, significant positive changes were observed among PHHS Math students in terms of their educational aspirations and future plans for math course-taking. PHHS Math teachers also experienced increased levels of comfort with technology usage and knowledge or awareness of their students’ ability levels. In contrast, one significant difference in favor of the control programs was observed; students using other math programs felt more prepared for college math courses as compared to PHHS Math students.

Furthermore, while not statistically significant, treatment teachers generally felt more assistance from the PHHS Math program than control teachers. For example, PHHS Math teachers had more positive perceptions about the PHHS Math program’s impact on student skills than control teachers; specifically, a higher percentage of PHHS Math teachers felt that the PHHS Math program was useful in increasing students’ higher order thinking skills, ability to solve word problems, computational skills, and reading and writing skills as compared to teachers using other math programs. Treatment teachers also expressed that the PHHS Math program provided greater assistance in terms of: a)
assessing and monitoring their students’ progress, 2) saving time as it relates to lesson preparation, 3) providing requisite knowledge to teach lessons, and 4) providing individualized instruction, in particular for on-level and below-average students.

With respect to the impact of technology, results showed that the technology embedded within the PHHS Math program had a positive effect on student engagement and that the use of the PHHS technology enhanced student math understanding and learning.

7. **What do users of Prentice Hall High School Math think about the program?**

The majority of teachers and students liked the PHHS Math program, would like to continue using the program in subsequent years, and found the print and digital resources to be useful. Students who used Prentice Hall High School Math felt that math was explained more clearly as compared to control students. In the area of technology, students and teachers rated the PHHS Math program more favorably than control. However, control teachers rated their math program comparably or better in several other areas such as the usefulness of teacher resources, including enrichment resources as well as other teaching tools. Anecdotal feedback provided by teachers in the treatment condition indicated that they felt somewhat constrained by the implementation guidelines they were required to follow. Treatment teachers did not always appreciate that they were being strongly encouraged to use certain components of the PHHS Math program such as the technology and, accordingly, this may have influenced some of their ratings of the program. Conversely, teachers in the control condition had flexibility to deliver instruction as they typically have done and so were able to more fully customize their instructional delivery and utilization of resources. That said, provision of implementation guidelines and monitoring of fidelity of implementation were important design features but may have influenced their attitudes towards the program.

In sum, results from this two-year RCT show that students who use the PHHS Math program perform significantly better than students using other math programs. While many of the findings can be classified as small effects, it should be noted that such small effects are typical of applied research, especially curricular research involving comparisons across core curricula. Moreover, positive treatment effects were observed across different curricula, assessment measures, and subpopulations of students as well as study years. The fact that consistent positive effects were found all points to the conclusion that PHHS Math is an effective program that helps various types of students attain critical math skills.
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Project Background

“During most of the 20th century, the United States possessed peerless mathematical prowess—not just as measured by the depth and number of the mathematical specialists who practiced here but also by the scale and quality of its engineering, science, and financial leadership, and even by the extent of mathematical education in its broad population. But without substantial and sustained changes to its educational system, the United States will relinquish its leadership in the 21st century.” (U.S. Department of Education, 2008)

Strong foundational math skills are critical to students’ future participation and achievement in higher-level math courses and ultimately dictate academic and career success. This is well-illustrated by an excerpt from a recent National Mathematics Advisory Panel report (2008):

“Success in mathematics education also is important for individual citizens, because it gives them college and career options, and it increases prospects for future income. A strong grounding in high school mathematics through Algebra II or higher correlates powerfully with access to college, graduation from college, and earning in the top quartile of income from employment. The value of such preparation promises to be even greater in the future. The National Science Board indicates that the growth of jobs in the mathematics-intensive science and engineering workforce is outpacing overall job growth by 3:1.”

If the U.S. expects to succeed in the global economy and indeed continue to be seen as a world leader in economic and industrial areas, our students will need to improve drastically in mathematical skills. Unfortunately, it’s impossible to ignore the mounting information suggesting U.S. secondary students are not being adequately prepared to meet the demands of future careers in a workforce that requires advanced skills in critical thinking, problem solving and mathematics. For example, according to the recent National Assessment of Education Progress (NCES, 2010), only 26% of 12th graders are scoring at levels at or above “proficient” in mathematics. Moreover, on the latest Program for International Student Assessment (PISA, 2009), it was found that U.S. students in the Class of 2011, 32% of whom were proficient in mathematics, came in 32nd among the 65 nations that participated in PISA (Peterson, Woessman, Hanushek, & Lastra-Anadon, 2011).

Since the acquisition of higher-level math skills is essential to ensure the future educational and economic success of our students, programs that intend to develop such skills need to be looked at carefully to determine the extent to which they help students attain these necessary math skills. As aptly stated by U.S. Education Secretary Arne Duncan (2009), it is apparent that we cannot fail our students in math: “These NAEP results are a call to action to reform the teaching and learning of mathematics and other related subjects in order to prepare our students to compete in the global economy.”

Indeed, the No Child Left Behind Act of 2001 (NCLB) mandates that educational materials purchased with public funds must be proven by scientific research to improve student achievement in the classroom. To further support NCLB, in April 2006 the National Math Panel was created in order to

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2 Scientific research as used in this context refers to rigorous experimental or quasi-experimental studies that include outcome measures on student performance and are designed in a fashion so as enhance the ability to make causal inferences about the educational intervention of interest. That is, can a researcher say with some degree of confidence that any differences or lack thereof in student performance are a result of the educational program and not some other competing explanation?
use the best scientific research available “…to foster greater knowledge of and improved performance in mathematics among American students” (U.S. Department of Education, 2008). A major focus of the National Math Panel was the examination of scientifically based research and promising practices in mathematics instruction to prepare students in mathematics.

In order to address the decline in secondary mathematical skills plaguing our nation’s students, Pearson Publishers has developed a new math program – 2011 Prentice Hall High School Math – in the areas of Algebra 1, Geometry and Algebra 2, that engages students, teaches for understanding and promotes success in math by utilizing a blend of traditional print and new digital technology formats. This research-based instructional program is based on Understanding by Design (UbD). Through a backward design approach, UbD focuses on “Big Ideas” and “core tasks” to frame curricula and organizes smaller, necessary and related skills so that students can understand these overarching concepts and experience an enduring understanding. According to the publishers, the Prentice Hall High School math program brings together a wide breadth of ideas and processes that have been proven to be effective in helping students gain a deeper understanding of core facts, concepts and generalizations, while consistently addressing the particular learning and instructional requirements of all students. The Prentice Hall High School Math program was specifically developed to help all levels of students achieve proficiency in important math skills and knowledge.

Planning, Research, and Evaluation Services (PRES Associates) Inc., conducted a two-year study to examine the effectiveness of the 2011 Prentice Hall High School Math program in helping secondary students improve their mathematics skills and understanding in Algebra 1, Geometry, and Algebra 2. This randomized control trial (RCT), which commenced in the Fall of 2009, was conducted in Algebra 1 and Geometry classrooms during the 2009-2010 school year and in Geometry and Algebra 2 classrooms during the 2010-2011 school year. This report presents summative findings from both years of the RCT.

### Project Overview

The overarching purpose of this study was to rigorously evaluate the effectiveness of the 2011 Prentice Hall High School Math program in helping high school students attain understanding and skills in Algebra 1, Geometry, and Algebra 2. Specifically, this study was designed to address the following research questions:

- Does math ability improve as a result of participation in the Prentice Hall High School Math programs?
- Do changes in math performance among Prentice Hall High School Math students vary by different types of students and levels of implementation?
- Do different patterns emerge before and after students use Prentice Hall High School Math?

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3 PRES Associates, Inc. is an external, independent, educational research firm with over 20 years of experience in applied educational research and evaluation.
Does using Prentice Hall High School Math result in increased student achievement as compared to other types of math programs?

Do effects of Prentice Hall High School Math on student math performance vary as a function of different student characteristics and different types of control programs?

Does participation in Prentice Hall High School Math result in other positive outcomes (e.g., positive student attitudes towards math and so forth)?

What do users of the Prentice Hall High School Math programs think about the programs? What aspects of the programs do they find most useful? Least useful? What, if any, suggestions for program improvement do they have?

This report presents descriptive information and results of the two year RCT. The remainder of this report includes: 1) a description of the design and methodology; 2) sample and site information, including descriptions of PHHS Math implementation; 3) summative results of the evaluation; and 4) conclusions. In addition, an accompanying Technical Report presents detailed statistical results of all baseline, attrition and assessment analyses conducted, including the analytical goals and framework employed.

Design and Methodology

Research Design

The present study was designed to address all standards and criteria described in the What Works Clearinghouse (WWC) Study Review Standards (2008) and the Joint Committee on Standards for Educational Evaluation’s Program Evaluation Standards (1994). The research design consisted of a two-year randomized control trial, with random assignment of primarily teachers, and for 5 teachers random assignment of classes, to a treatment (i.e., use of Prentice Hall High School Math) or control group. Random assignment occurred at the class level for 5 teachers at two small school sites because there were no other Algebra 1, Geometry, or Algebra 2 teachers available. Other important design and methodological features include:

- During year 1 (2009-10), the study was conducted in 8th through 12th grade Algebra 1 and Geometry classes (n=1069). During year 2 (2010-11), the study was conducted in 9-12th grade Geometry and Algebra 2 classes (n=1035). To the extent that year 1 students took higher level math study classes during year 2, two years of data was

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4 A crosswalk which shows how this study meets the WWC’s review standards is provided in Appendix A.
5 Teacher/class level of random assignment was conducted for several reasons. From a research design perspective, it is desirable to conduct random assignment at the lowest level possible given both the nature of the intervention and the practical realities of the settings the research is being conducted in. In addition, using the lowest level of random assignment possible is a design strategy used to eliminate competing explanations for any observed differences and to enhance the ability of the study to make causal inferences.
6 Teachers were thoroughly debriefed at the onset of the study about the importance of avoiding contamination and there was no evidence of contamination found over the course of the study.
available for a subsample of students\(^7\).

- Teachers/classes were randomly assigned to the treatment or control conditions prior to the onset of the study. In the first year, comparisons were made between 20 treatment and 22 control Algebra 1 and Geometry teachers/classes. In the second year, the sample consisted of 17 treatment and 13 control Geometry and Algebra 2 teachers/classes.
- Clear site selection criteria were established along with accompanying rationale.
- Extensive background data was collected on instructional activities and materials used in classrooms so as to describe the context in which mathematics instruction took place.
- The threat of differential attrition was addressed via: 1) the initial site selection process\(^8\); 2) random assignment among teachers/classes within schools to help ensure that attrition is relatively constant across both treatment and control groups; and 3) the characteristics of students who left were statistically compared between treatment and control groups.
- Implementation guidelines and monitoring procedures\(^9\) were embedded to ensure the fidelity of treatment implementation. Furthermore, monitoring mechanisms were put into place to address potential threats to validity such as contamination (i.e., students not assigned to use PHHS who end up using PHHS) and attrition (i.e., students dropping out). These included site visits and teacher monthly activity logs.
- Assessments measuring each content area (Algebra 1, Geometry, and Algebra 2) were developed based on released items from existing state high school end-of-course exams and national standards. In addition, the ETS Algebra 1 End-of-Course Assessment was used. The assessments consisted of both multiple-choice and open-response test items that were aligned to content that is typical in high school Algebra 1, Geometry, and Algebra 2 courses.
- The study employed pre/post measures of, among other things: (1) student performance; (2) student attitudes regarding math; and (3) teacher characteristics, attitudes towards student learning, and perceptions of the PHHS Math program.
- Student assessments, surveys, and classroom observation forms are valid and reliable as shown by technical documentation and statistical analyses performed.
- The study employed the use of statistical controls as well as random assignment to establish initial group equivalence\(^10\).
- Analyses of assessment data were primarily conducted via multilevel models to take into account clustering and baseline differences. In addition, the teacher/class level of analysis employed matches the unit of random assignment.

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\(^7\) Data was also collected from new students enrolled in Year 2 study classes. Only one of year of data is available for such students.

\(^8\) Sites that historically had more than 20% student attrition were not used in the study.

\(^9\) Training provided and implementation guidelines reflect how the PHHS Math program should typically be used in schools.

\(^10\) Random assignment helps to create group equivalence. However, it must be noted that with small sample sizes random assignment in and of itself does not assure initial group equivalence (Lipsey, 1990).
Table 1 displays the timeline for the important study activities during both years of the RCT. More detailed information on these activities, as well as measures used, is discussed in the following section.

Measures

This section reviews the outcome and assessment measures that were administered, including descriptions of the items, and available reliability and validity information.

**STUDY ASSESSMENTS**

In order to enhance the sensitivity of the RCT to detect any effects associated with the PHHS Math program, four assessments were used: (1) ETS Algebra 1 End-of-Course Assessment-Form C; (2) a developed Algebra 1 open-response test; (3) a developed Geometry multiple-choice and open-response test, and (4) a developed Algebra 2 multiple-choice and open-response test. Following a thorough literature review of existing standardized, published assessments to identify tests that were valid, reliable, sensitive, as well as aligned to national math standards, it was determined that there were no readily available Geometry or Algebra 2 end-of-course assessments. Assessments available typically consisted of end-of-course exams that were created by state education departments. Therefore, assessments were developed for these content areas. These tests were created by PRES Associates and

| Table 1. Prentice Hall High School Math RCT: Timeline of Activities by Study Year |
|-----------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Training and Program Implementation Begins | ♦             | ♦             |                |                |                |                |                |                |                |               |
| Follow Up Trainings Occurred (3)  |                |                |                |                |                |                |                |                |                | Varied for each site |
| Assessments and Surveys Administered | ♦             | ♦             |                |                | ♦             |                | ♦             | ♦             |                | ♦             |
| Site Observations                 | ♦             | ♦             |                |                |                |                |                |                | ♦             | ♦             |
| Teacher Logs*                     | ♦             | ♦             | ♦             | ♦             | ♦             | ♦             | ♦             | ♦             | ♦             | ♦             |

| Training & Year 2 Program Implementation Begins | ♦             | ♦             |                |                |                |                |                |                |                |               |
| Follow Up Trainings Occurred (2-3)* |                |                |                |                |                |                |                |                |                | Varied for each site |
| Assessments and Surveys Administered | ♦             | ♦             |                |                |                |                | ♦             | ♦             |                | ♦             |
| Site Observations                 | ♦             | ♦             |                |                |                |                | ♦             | ♦             |                | ♦             |
| Teacher Logs**                    | ♦             | ♦             | ♦             | ♦             | ♦             | ♦             | ♦             | ♦             | ♦             | ♦             |

*Initial trainings were held in Spring or Summer of 2010.
**Note that teachers completed monthly teacher logs that monitor instructional activities and the use of program and other resources.
drew upon released test items from various state end-of-course assessments as well as the NCTM standards so as to align the content of the tests to these standards.

Furthermore, it was determined that while the ETS Algebra 1 End-of-Course Assessment would allow researchers to gather data on student math performance as it relates to Algebra 1, it did not give students adequate opportunities to explain their reasoning and to illustrate their analytical thinking process. As such, in addition to the ETS Algebra 1 End-of-Course Assessment, a supplemental assessment was developed that only included constructed response test items.

- The ETS Algebra 1 End-of-Course Assessment measures fundamental algebraic competencies (i.e., what students have learned regarding the core of algebra and how they can apply algebraic thinking to real-world problems). While certain questions call on students to perform simple operations, others require students to integrate key algebraic concepts, processes, applications, and skills. The test is aligned with the NCTM principles and standards and, therefore, most state standards.

Objectives measured include:
- Using algebraic symbols
- Understanding patterns and relations
- Using mathematical models
- Analyzing change

This assessment consists of 50 multiple-choice items. Reliability for a national sample of 20,506 students was found to be .87. Percent correct ranged from 17% to 81% and the standard error of the mean was 3.1.

- Developed Algebra 1, Geometry, and Algebra 2 tests: The Geometry and Algebra 2 assessments contained both multiple-choice and open-response items. These multiple-choice tests contained 50 items. The Algebra 1 open-response test consisted of 12 items, the Geometry open-response test consisted of 17 items, and the Algebra 2 test consisted of 22 items. However, all open-response tests were worth a total of 30 points. Test developers followed the NCTM standards and examination of typical Algebra 1, Geometry, and Algebra 2 state standards as blueprints during test development. Similar to the ETS Algebra 1 End-of-Course Assessment, the tests required students to manipulate expressions, model mathematical situations, recognize concepts, interpret data, engage in computation, and graph. Psychometric properties of the developed assessments are presented in Table 2.

<table>
<thead>
<tr>
<th>Test</th>
<th>Points</th>
<th>Alpha</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alg. 1 Open Response</td>
<td>30</td>
<td>0.74</td>
<td>5.6%</td>
</tr>
<tr>
<td>Geometry Open Response</td>
<td>30</td>
<td>0.82</td>
<td>6.7%</td>
</tr>
<tr>
<td>Geom. MC Post</td>
<td>50</td>
<td>0.81</td>
<td>6.4%</td>
</tr>
<tr>
<td>Algebra 2 Open Response</td>
<td>30</td>
<td>0.75</td>
<td>5.8%</td>
</tr>
<tr>
<td>Algebra 2 MC Post</td>
<td>50</td>
<td>0.72</td>
<td>6.2%</td>
</tr>
</tbody>
</table>

In addition to subject specific test scores, an overall score was created based on data from all subject tests (Algebra 1, Geometry, and Algebra 2) from both years of the study (Overall Math Score). In order to obtain more specific information on the areas

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11 Part of the team developing these assessments included a psychometrician (and former high school math teacher).
impacted by the PHHS Math program, multiple-choice items (primarily measuring math computation and interpretation) and open-response items (primarily measuring problem-solving and reasoning skills) were analyzed separately. For all analyses, percent correct was the metric used.

**Surveys**

**Student Surveys.** In an effort to examine other potential areas that may be influenced by PHHS Math, a student survey was developed primarily to measure:

- Perceived math ability (*e.g.* I’m good at math)
- Enjoyment of math (*e.g.* I look forward to my math class)
- Perceived relevance/usefulness of math (*e.g.* Math is a worthwhile, necessary subject)
- Math- and school-related effort and aspirations (*e.g.* I study hard for math tests)
- College readiness (*e.g.* When I leave this school, I will be academically prepared to do well in college math)

The survey also included items on parental knowledge and support, classroom experiences and, in the Spring survey, satisfaction with the math program. These scales were included in order to obtain measures of the impact of PHHS Math on affective student outcomes and to measure potential variables that may serve as covariates as needed (*e.g.*, parental support). While some items were created by PRES Associates, others were derived from additional measures with published reliability and validity.

Internal consistency of the scales measuring attitudinal constructs range from .63 to .92. High scores represent a very positive attitude or strong agreement (scales are from 1 to 5).

**Teacher Surveys.** Information was collected via surveys from all participating teachers. In addition to obtaining teacher background and demographic information, the survey was developed to measure:

- Current and past classroom and instructional practices
- Math-related preparation and knowledge
- Teacher knowledge of effective teaching practices (including those specific to math instruction)
- Organizational factors/context
- Attitudes about student learning and effective math instruction
- Attitudes about math curriculum

These measures were obtained to examine affective outcomes as well as to gather background information (*e.g.*, years of experience, education, etc.). Some items were obtained from existing scales, while others were developed for the study.

Internal consistency of the scales measuring attitudinal constructs range from .63 to .85. High scores represent a very positive attitude or strong agreement (scales are from 1 to 5).

**Classroom Observation Forms.** A classroom observation form was developed to guide observations. This form was largely based on existing protocols that have

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12 Portions of this survey were adapted from the: 2003 TIMSS Student Questionnaire-8th Grade; O’Neill and Abedi (1996) Reliability and Validity of a State Metacognitive Inventory (Los Angeles: National Center for Research on Evaluation, Standards, and Student Testing (CRESST)); the Indiana Mathematics Beliefs Scale; and the Fennema-Sherman Math Attitude Scale.

13 Items in this survey were developed by PRES Associates and modified from the Trends in International Mathematics and Science Study (TIMSS) 2003 Teacher Questionnaire Science Grade 8 (Washington, DC: National Center For Education Statistics) and the 2000 National Survey of Science and Mathematics Education Science Questionnaire (Rockville, MD: Westat).
been used across the nation. Modifications were made to reflect content and practices typical of high school math classes, as well as to examine implementation of key components of the PHHS Math programs. Researchers conducting site visits and using classroom observation forms were trained extensively until a high level of agreement (.90 and above) was demonstrated among observers on the various quantitative and qualitative items.

**Procedures**

To ensure that all treatment teachers participating in the study had sufficient knowledge and skills to successfully implement Prentice Hall High School Math, teachers were provided with both implementation guidelines and PHHS Math specific training prior to implementation. In addition, monitoring procedures (via monthly instructional logs completed by teachers, classroom observations and interviews) were developed to measure the extent to which teachers were implementing a similar instructional model as outlined by the Prentice Hall High School Math program implementation guidelines.

The following section presents the procedures used to assist teachers in implementing the PHHS Math program, the monitoring procedures used by evaluators to determine treatment fidelity, methods used to obtain program feedback, and the test administration and scoring procedures employed.

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14 The Classroom Observation Form was derived from the following protocols: Horizon Research’s Local Systematic Change Professional Development Classroom Observation Protocol, and the Texas Collaborative for Excellence in Teacher Preparation Classroom Observation Protocol.

**TRAINING**

The training model for the Prentice Hall High School Math study was designed to provide teachers with the necessary background and practical experiences to begin implementing the program with fidelity at the start of the 2009-2010 school year and continue using the program with increased confidence and familiarity through the 2010-2011 school year. It should be noted the focus of these trainings was not on general math professional development, but rather on the vision of the Prentice Hall High School Math program, the use of both print and digital materials and implementation of the essential components, and how the program could best be used to effectively help students learn mathematics.

Teachers met with a Pearson professional trainer for approximately 5-6 hours at the start of the 2009-2010 school year. During the training, trainers clearly described the philosophy of the program, provided an overview of all program components and clearly indicated core components teachers were required to use based on the implementation guidelines. The Pearson professional trainer also assisted teachers in registering classes online and specifically addressed technological component use, access and integration into each lesson. A strong emphasis was placed on which components, both digital and print, were key and required, versus those that were optional. Handouts (including the implementation guidelines) were also provided. These included materials lists, and specific instructions on lesson flow. Trainers also modeled a sample lesson in order to demonstrate how teachers should fully implement the program (this included lesson flow and language to use).

In addition to the initial in-depth training, three follow-up sessions were
conducted at each site during the 2009-2010 school year. The follow-up training sessions were somewhat less formal than the initial training and allowed opportunities for teachers to ask questions and receive additional training on program components that were not required. This is because by the time the follow up trainings occurred, many teachers had become comfortable and proficient using the required components of the program and were ready to begin incorporating many of the additional resources provided by the program. In the majority of cases, during Training Session Two (first follow-up training) the trainers observed the teachers using the Prentice Hall High School Math program in their treatment classes during the first part of the day and conducted the training later in the day. In the third and fourth training sessions, trainers focused primarily on the use of digital components based on what teachers indicated they needed or wanted additional training on. Table 3 shows training received by each site during the first year of the study.

Table 3. 2009-10 Training Sessions by Site

<table>
<thead>
<tr>
<th>Site</th>
<th>Training Session 1</th>
<th>Training Session 2</th>
<th>Training Session 3</th>
<th>Training Session 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site A</td>
<td>8/27</td>
<td>10/15</td>
<td>12/15</td>
<td>3/18</td>
</tr>
<tr>
<td>Site B</td>
<td>8/21</td>
<td>10/7</td>
<td>12/3</td>
<td>3/25</td>
</tr>
<tr>
<td>Site C</td>
<td>8/27</td>
<td>10/21</td>
<td>1/12</td>
<td>3/25</td>
</tr>
<tr>
<td>Site D</td>
<td>8/19</td>
<td>10/19</td>
<td>12/15</td>
<td>3/23</td>
</tr>
<tr>
<td>Site E</td>
<td>8/24</td>
<td>11/10</td>
<td>1/28</td>
<td>5/21</td>
</tr>
<tr>
<td>Site F</td>
<td>9/11</td>
<td>10/26</td>
<td>12/15</td>
<td>3/10</td>
</tr>
</tbody>
</table>

In preparation for the second year of the study, taking place during the 2010-2011 school year, the initial training occurred in the Spring or Summer of 2010, thereby allowing teachers who had been using the program time to experiment with additional components and technology over the summer, as well as to give two teachers new to the program a head start in familiarizing themselves with the implementation guidelines and core components of the Prentice Hall High School Math program well in advance of year 2 of the study. Two to three follow-up trainings also occurred in late summer of 2010 through the end of January 2011 for year 2 participating teachers. Liaisons and teachers were given the option to participate in a fourth follow up training during January of 2011, however all but one of the study sites declined this optional fourth training. Schools indicated the fourth training was unnecessary, as the majority of teachers had attended seven previous trainings and had been using the program with success for nearly two years.

The focus of the trainings conducted in year 2 was primarily to assist teachers in the exploration and utilization of advanced processes for implementing additional program components while continuing to refine their use of core components. The year 2 trainings were tailored to specific teacher requests and requirements and allowed for more one on one time between trainers and teachers. While the majority of the teachers participating in year 2 of the study had received four trainings during year 1 and had implemented the Prentice Hall High School Math program starting in the Fall of 2009, there were two exceptions. Two of the teachers participating in year 2 of the study were new to the Prentice Hall High School Math program and a portion of each training was devoted to one on one training with each teacher to help them get caught up to speed and to fully implement the program with ease. Trainers also spent time more time watching their classes and providing feedback and targeted training.
Table 4 shows training received by each site during the second year of the study.

Table 4. 2010-11 Training Sessions by Site

<table>
<thead>
<tr>
<th>Site</th>
<th>Training Session 1: Initial</th>
<th>Training Session2: Follow-up</th>
<th>Training Session3: Follow-up</th>
<th>Training Session4: Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5/27</td>
<td>9/3</td>
<td>10/11</td>
<td>1/2011</td>
</tr>
<tr>
<td>B</td>
<td>8/27</td>
<td>10/20</td>
<td>12/8</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>6/9</td>
<td>10/19</td>
<td>12/15</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>8/23</td>
<td>10/12</td>
<td>12/6</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>5/21</td>
<td>8/25</td>
<td>1/27</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>6/22</td>
<td>9/29</td>
<td>11/30</td>
<td></td>
</tr>
</tbody>
</table>

**IMPLEMENTATION GUIDELINES**

At the onset of the study Prentice Hall High School Math teachers were provided with detailed implementation guidelines outlining the essential program components and design basis of the Prentice Hall High School Math program. The implementation guidelines were developed by PRES Associates based on key program components and pedagogy as identified by Pearson product managers and editorial staff. Pearson content experts provided final input and revisions.

Implementation guidelines served as a detailed “map” during the initial training session and throughout the study, detailing specific fundamental components and addressing technology integration for use during lessons. Based on implementation guidelines, teachers were given concise instructions for utilizing core (and required) versus optional program elements in order to ensure the Prentice Hall High School Math program was implemented with fidelity over the course of the study.

The key components of the program include:

- Big Ideas
- Essential Understandings
- Essential Questions
- My Math Video
- Get Ready or Lesson Check
- Solve It
- Sample Problems
- Got It
- Independent Practice

For a full description of these key components, please see Appendix B.

**PROGRAM MONITORING**

**Teacher Logs.** Online teacher logs were used to monitor program implementation on a real-time basis and to identify potential influences, issues or local events that could potentially affect study results. Both treatment and control teachers were required to complete online logs on a monthly basis from September through June. The primary purpose of the online logs was to monitor program implementation and fidelity among Prentice Hall High School Math classes. Information pulled from online logs also allowed researchers to monitor the extent to which any contamination may have occurred between control and treatment classes, and provided data regarding the difference between instructional activities and content covered in control versus treatment classrooms. Such background information allowed for a detailed data source on what was occurring in treatment and control classrooms in terms of math instruction and practices. It also allowed researchers to identify areas of overlap in terms of content taught and instructional activities. The extent to which there are similarities and differences between classrooms can have an impact on observed differences between
treatment and control classes and effect sizes. Thus, it is important to take these factors into consideration when interpreting study results. Information obtained via these online logs included changes in student rosters, typical classroom activities, use of other print resources and related exercises (including homework and independent practice), the degree to which technology was used and in what ways, and coverage of math topics and content, and for treatment classes, use of key Prentice Hall High School Math program components, both print and digital.

Results showed that teachers had, on average, a 96% completion rate in the 2009-10 school year and 98% in the 2010-11 school year. The ranges were 60% to 100%. Study protocol required that teacher’s with missing online logs be contacted each month for follow up and compliance. In cases of continued noncompliance, school liaisons were contacted and asked to assist the teacher in completing the logs. This was an effective practice and overall log completion rates were very high.

Classroom Observation. Classroom observations were conducted for treatment and control classes during the Fall (October-November, 2009 and October-November, 2010) and the Spring (April-May, 2010 and April-May, 2011). Observation provided researchers the opportunity to better understand the instructional approaches and materials used by teachers with their students and to identify differences and similarities between classes taught by teachers that were randomly assigned to treatment or control conditions. Specifically, observations focused on how classroom activities were structured, what and how print and digital materials were used, and characteristics of the class including student engagement, classroom environment and culture, and teacher-student interactions. In addition, teachers were interviewed after the observations to obtain more specific information on the representativeness of the lesson, resources used, ability levels of the students, assessment practices, pacing, independent practices, test preparation strategies and feedback related to the program. The observations also allowed researchers to examine the extent to which class and teacher level differences could have influenced study results and to examine the threat of possible contamination between treatment and control classes.

Test/Survey Administration and Scoring

Assessments were administered during two time periods each school year in order to obtain pre-post data for each content area (Algebra 1, Algebra 2, Geometry), with one exception.

- **Year 1:** a) Fall (September through October 2009); b) Spring (May through June 2010).
- **Year 2:** a) Fall (September through October 2010); b) Spring (May through June 2011).

One school administered assessments four times over the course of the study (beginning and end of each semester) to classes that were only a semester long (a full year of content was covered in one semester). For the ETS Algebra 1 End-of-Course Assessment, the test publisher’s standard testing procedures were followed.

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15 Calculation based on 9 months in which teachers were asked to report on their activities.

16 Administration dates depended on the school’s start and end date. Teachers within each school followed a similar testing schedule. Generally, administration occurred within 1 month after the school year commenced (pretest) and within 1 month prior to the end of the school year (posttest).
For the developed assessments, test administration directions were provided to all teachers. Teachers were instructed to contact PRES Associates if they needed additional guidance related to assessment administration. The open-response test was scored by an external university student who was blind to group assignment.

Student and teacher surveys were completed during the same time periods as the assessments (i.e., Fall 2009, 2010 and Spring 2010, 2011 for year long courses and at the beginning and end of each semester for semester long courses).

**Site Selection Criteria**

Criteria for developing an initial list of schools to be contacted for possible inclusion in the study included geographical diversity across different states, public schools, and a minimum school size of 600 so that a sufficient number of teachers would be available for purposes of random assignment. A list of schools meeting the aforementioned criteria was contacted and, of those, 8 indicated initial interest. Of these, 6 met additional criteria for study participation as indicated below and were selected to participate in the research study.

- Schools had to teach Algebra 1, Geometry, and Algebra 2 across multiple class periods;
- Historically low student mobility rates (less than 20%) as a means of helping control for the threat of attrition;
- Willingness/commitment to fully participate in all aspects of the study (e.g., random assignment and data collection).

Other major criteria included: 1) that there be no other major math initiative(s) at the school; and 2) the typical math curricula employed by the school fell under the “comparison” programs which provided a contrast to the PHHS Math program.

**Sample Description**

**Site Characteristics**

Six schools participated in the study. Schools were located in rural, suburban, and urban areas and were geographically dispersed across the U.S in the states of Rhode Island, New Jersey, Ohio, Idaho, and Washington. A detailed case study of each of the schools is available in Appendix C.

Table 5 on the following page illustrates the school-wide characteristics of each of the participating sites. As shown, at four of the study sites school populations were ethnically diverse, and at four sites the majority of students were classified as economically disadvantaged. Characteristics specific to the study participants are provided in Table 6.
<table>
<thead>
<tr>
<th>School</th>
<th>School Size</th>
<th>Ethnic Breakdown</th>
<th>% of Limited English Proficient</th>
<th>% Economically Disadvantaged</th>
<th>% by Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Site A</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ohio</td>
<td>475</td>
<td>97% White, not Hispanic &lt;1% Hispanic &lt;1% American Indian 1% Black, not Hispanic 2% Asian/Pacific Islander</td>
<td>NR</td>
<td>14%</td>
<td></td>
</tr>
<tr>
<td>Grades 7-12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Site B</strong></td>
<td>167</td>
<td>69% White, not Hispanic 26% Hispanic 3% American Indian 0% Black, not Hispanic 2% Asian/Pacific Islander</td>
<td>NR</td>
<td>71%</td>
<td></td>
</tr>
<tr>
<td>Idaho</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grades 7-12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Site C</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Jersey</td>
<td></td>
<td>21% White, not Hispanic 20% Hispanic 0% American Indian 56% Black, not Hispanic 2% Asian/Pacific Islander</td>
<td>NR</td>
<td>61%</td>
<td></td>
</tr>
<tr>
<td>Grades 5-8 &amp; 9-12</td>
<td>HS = 556</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MS = 642</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Site D</strong></td>
<td>648</td>
<td>25% White, not Hispanic 75% Hispanic 0% American Indian 0% Black, not Hispanic 0% Asian/Pacific Islander</td>
<td>12%</td>
<td>63%</td>
<td></td>
</tr>
<tr>
<td>Washington</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grades 9-12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Site E</strong></td>
<td>601</td>
<td>7% White, not Hispanic 2% Hispanic 0% American Indian 90% Black, not Hispanic 0% Asian/Pacific Islander</td>
<td>NR</td>
<td>46%</td>
<td></td>
</tr>
<tr>
<td>Ohio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grades 6-12</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Site F</strong></td>
<td>1750</td>
<td>59% White, not Hispanic 23% Hispanic 1% American Indian 9% Black, not Hispanic 8% Asian/Pacific Islander</td>
<td>NR</td>
<td>58%</td>
<td></td>
</tr>
<tr>
<td>Rhode Island</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grades 9-12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>National Population</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>White-55.9% Hispanic-21.5% African Am.-17% Asian/Pacific Islander-5% Native American 1.2% Other 0.5%</td>
<td>11%</td>
<td>41.6%</td>
<td></td>
</tr>
</tbody>
</table>

Data on National Population was obtained from U.S. Department of Commerce, Census Bureau, Current Population Survey (CPS), and U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD). Figures represent distributions across all grade levels and reported for 2008. School data obtained from respective State Department of Education websites. NR=Not Reported
Student Characteristics

The final analytical sample consisted of 1539 students (644 control; 895 treatment) in 129 classes (57 control and 72 treatment). This sample consists of all students who participated in year 1 and took Algebra 1 or Geometry, and all students in year 2 who took Geometry or Algebra 2 (combined sample). Note that only students who were in the study during one or both study years, and did not change conditions, are included in this table and in the main outcome analyses.

Table 5 presents the demographic distribution among study participants. The sample was ethnically diverse, with a majority of students receiving free/reduced lunch (63%).

Of note is that while schools were asked to try to ensure students remained within the same condition, this did not always occur due to scheduling issues. In addition, many students participating in year 1 did not take or pass into a more advanced high school math course during the second study year. As a result, 19.7% of students participated in both years of the study and did not switch conditions. Since the majority of students participated in only one study year, separate analyses were conducted for each study year to determine if consistent findings were observed across both years. In addition, analyses were conducted on the combined sample of students from both study years as described in Table 6 to look at the cumulative effects of the program (all students in year 1 who took Algebra I/Geometry and all students in year 2 who took Geometry/Algebra 2).

### Table 6. Student Demographics Distributions*

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Control (n=644)</th>
<th>PHHS (n=895)</th>
<th>Total (n=1539)</th>
<th>National</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Percent</td>
<td>Count</td>
<td>Percent</td>
</tr>
<tr>
<td>Gender (χ²(1)=0.89, p=.35)</td>
<td>Male</td>
<td>301</td>
<td>48.9%</td>
<td>407</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>314</td>
<td>51.1%</td>
<td>469</td>
</tr>
<tr>
<td>Ethnicity (χ²(5)=5.57, p=.35)</td>
<td>White</td>
<td>249</td>
<td>43.2%</td>
<td>361</td>
</tr>
<tr>
<td></td>
<td>Hispanic</td>
<td>125</td>
<td>21.7%</td>
<td>207</td>
</tr>
<tr>
<td></td>
<td>African American</td>
<td>131</td>
<td>22.7%</td>
<td>214</td>
</tr>
<tr>
<td></td>
<td>Asian</td>
<td>30</td>
<td>5.2%</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Native American</td>
<td>23</td>
<td>4.0%</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>19</td>
<td>3.3%</td>
<td>16</td>
</tr>
<tr>
<td>Subpopulations</td>
<td>Free/Reduced Lunch Status</td>
<td>135</td>
<td>61.6%</td>
<td>322</td>
</tr>
<tr>
<td></td>
<td>Special Ed Status</td>
<td>24</td>
<td>4.7%</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Low Math Level</td>
<td>86</td>
<td>13.4%</td>
<td>101</td>
</tr>
<tr>
<td></td>
<td>Mid Math Level</td>
<td>403</td>
<td>62.6%</td>
<td>617</td>
</tr>
<tr>
<td></td>
<td>High Math Level</td>
<td>155</td>
<td>24.1%</td>
<td>177</td>
</tr>
</tbody>
</table>

*Counts (and percents) do not include missing information. Ability level was determined by the type of course taken. Honors students were classified as high, students in below level classes were classified as low, and students in on-level courses were classified as mid level.
Preliminary analyses were performed to examine whether baseline differences existed as a function of student demographics. Chi-square analyses on the demographic characteristics noted in Table 6 showed no significant differences, \( p < .05 \). Thus, the treatment and control students were similar with respect to demographic information.

Table 7 shows the grade level distributions of students in the analytical sample. During the 2009-10 school year, the majority of the sample was in 9th grade and taking Algebra 1 (60.7%). During the 2010-11 school year, the sample primarily consisted of 10th and 11th graders in Algebra 2 and Geometry classes. In addition, during the second year of the study, a significant relationship was observed such that a larger proportion of treatment students were in the 9th grade as compared to control students and a larger proportion of control students were in 10th grade as compared to treatment students.

To determine if pretest performance differences were observed among the combined sample, student level t-test analyses were conducted. Results revealed no significant differences on the overall test (math tests aggregated across the subject areas of Algebra 1 and Geometry in year 1 and Geometry and Algebra 2 in year 2). With respect to subject-specific tests, results showed no significant baseline differences between groups among Algebra 1 (year 1) and Geometry students (years 1 and 2), \( p > .05 \).

### Table 7. Grade Levels of Study Participants

<table>
<thead>
<tr>
<th>Year</th>
<th>Grade</th>
<th>Control Count</th>
<th>Control Percent</th>
<th>PHHS Count</th>
<th>PHHS Percent</th>
<th>Total Count</th>
<th>Total Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>YEAR 1 (2009-2010)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9th</td>
<td></td>
<td>45</td>
<td>9.3%</td>
<td>43</td>
<td>7.3%</td>
<td>88</td>
<td>8.2%</td>
</tr>
<tr>
<td>10th</td>
<td></td>
<td>288</td>
<td>59.6%</td>
<td>361</td>
<td>61.6%</td>
<td>649</td>
<td>60.7%</td>
</tr>
<tr>
<td>11th</td>
<td></td>
<td>124</td>
<td>25.7%</td>
<td>131</td>
<td>22.4%</td>
<td>255</td>
<td>23.9%</td>
</tr>
<tr>
<td>12th</td>
<td></td>
<td>22</td>
<td>4.6%</td>
<td>36</td>
<td>6.1%</td>
<td>58</td>
<td>5.4%</td>
</tr>
<tr>
<td><strong>YEAR 1 (2010-2011)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9th</td>
<td></td>
<td>50</td>
<td>12.4%</td>
<td>127</td>
<td>20.1%</td>
<td>177</td>
<td>17.1%</td>
</tr>
<tr>
<td>10th</td>
<td></td>
<td>189</td>
<td>46.8%</td>
<td>222</td>
<td>35.2%</td>
<td>411</td>
<td>39.7%</td>
</tr>
<tr>
<td>11th</td>
<td></td>
<td>142</td>
<td>35.1%</td>
<td>234</td>
<td>37.1%</td>
<td>376</td>
<td>36.3%</td>
</tr>
<tr>
<td>12th</td>
<td></td>
<td>23</td>
<td>5.7%</td>
<td>48</td>
<td>7.6%</td>
<td>71</td>
<td>6.9%</td>
</tr>
</tbody>
</table>

---

17 All details regarding analyses on baseline differences and attrition analyses are provided in the Technical Report.
18 “Significant” means that we can be 95% or more confident that the observed differences are real. If the significance level is less than or equal to .05, then the differences are considered statistically significant. If this value is greater than .05, this means that any observed differences are not statistically significant and may be interpreted as inconclusive. However, at times this may be referred to as “marginally significant.” In this case, the criterion is more liberal and means that we can be 90% or more confident that the observed differences are real.
see Table 8. However, among Algebra 2 students (year 2), results showed significant differences with control students showing higher levels of pretest performance than treatment students on the multiple choice and open responses tests, \( p < .05 \). Thus, groups were comparable in terms of pretest performance overall and within specific subject areas with the exception of Algebra 2.

Differences on other student characteristics were also examined. Results showed no significant differences between treatment and control students in perceived parental support, amount of English spoken at home, mother’s educational background, father’s educational background, school engagement, engagement in math problem solving/planning, perceived math ability, math anxiety, math enjoyment, math effort/motivation, and educational aspirations. Differences, however, were observed in perceived usefulness of math and perceived support from teacher, \( p < .05 \). Treatment students perceived greater support from their teacher and higher perceptions about the usefulness of math. As a result of these baseline differences, analyses of program effects controlled for these factors.

### Attrition Analysis

Both measurement attrition (i.e., missing data due to students not completing assessments) and dropout attrition (i.e., missing data due to students leaving the study) were examined. Details on the attrition analysis are presented in the accompanying Technical Report, and are summarized herein. There was an overall attrition of 9.4% in year 1 and 10.6% in year 2 due to students leaving school. While there were no significant relationships observed between students who “dropped

<table>
<thead>
<tr>
<th>Pretest*</th>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>( t )</th>
<th>Sig. Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEAR 1 &amp; 2: Overall Multiple-Choice Math</td>
<td>PHHS</td>
<td>608</td>
<td>26.71</td>
<td>9.9</td>
<td>0.66</td>
<td>0.51</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>387</td>
<td>27.19</td>
<td>12.06</td>
<td>0.66</td>
<td>0.51</td>
</tr>
<tr>
<td>YEAR 1 &amp; 2: Overall Open-Response Math</td>
<td>PHHS</td>
<td>565</td>
<td>3.41</td>
<td>3.46</td>
<td>0.66</td>
<td>0.51</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>353</td>
<td>3.58</td>
<td>3.06</td>
<td>0.66</td>
<td>0.51</td>
</tr>
<tr>
<td>YEAR 1: Algebra 1 Multiple-Choice Math</td>
<td>PHHS</td>
<td>382</td>
<td>27.31</td>
<td>8.19</td>
<td>1.00</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>266</td>
<td>27.98</td>
<td>8.57</td>
<td>1.00</td>
<td>0.32</td>
</tr>
<tr>
<td>YEAR 1: Algebra 1 Open-Response Math</td>
<td>PHHS</td>
<td>380</td>
<td>12.77</td>
<td>8.36</td>
<td>-0.13</td>
<td>0.90</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>256</td>
<td>12.68</td>
<td>8.72</td>
<td>-0.13</td>
<td>0.90</td>
</tr>
<tr>
<td>YEAR 1 &amp; 2: Geometry Multiple-Choice Math</td>
<td>PHHS</td>
<td>445</td>
<td>31.14</td>
<td>12.47</td>
<td>-1.24</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>344</td>
<td>30.09</td>
<td>11.10</td>
<td>-1.24</td>
<td>0.22</td>
</tr>
<tr>
<td>YEAR 1 &amp; 2: Geometry Open-Response Math</td>
<td>PHHS</td>
<td>417</td>
<td>19.62</td>
<td>14.93</td>
<td>-0.81</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>323</td>
<td>18.74</td>
<td>14.04</td>
<td>-0.81</td>
<td>0.42</td>
</tr>
<tr>
<td>YEAR 2: Algebra 2 Multiple-Choice Math</td>
<td>PHHS</td>
<td>337</td>
<td>23.03</td>
<td>9.24</td>
<td>3.61</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>190</td>
<td>26.03</td>
<td>9.05</td>
<td>3.61</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>YEAR 2: Algebra 2 Open-Response Math</td>
<td>PHHS</td>
<td>316</td>
<td>7.86</td>
<td>6.34</td>
<td>3.52</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>173</td>
<td>10.21</td>
<td>8.20</td>
<td>3.52</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>
out” and group during year 1, a significant relationship was observed during year 2 with a higher proportion of control students leaving school than treatment students. That said, no performance differences existed between students who remained in the study and those who left. Thus, while there were differences in the proportion of treatment and control students who left during year 2, their baseline performance levels were similar.

With respect to measurement attrition, chi-square analyses showed significant relationships between the proportion of students who provided and did not provide data and group for the 2009-10 study year only. Specifically, a higher proportion of control students did not provide multiple-choice and open-response pretests and posttests. Additional analyses were run to examine if there were any performance differences between those who completed tests and those that did not by group. Results showed that control students who provided pretests had higher posttest scores on the Algebra 1 and Geometry multiple-choice and open-response tests as compared to control students who did not provide pretest data. No relationship was observed among treatment students nor within the year 2 sample. Given the relatively small sample of students that did not provide pre and post data (approximately 10% or 100 students), these differences are unlikely to bias results.

Of note is that the discrepancy at post-testing is largely due to one teacher at school F who did not administer post-tests to his Algebra 1 control students during year 1. A long-term substitute teacher was assigned to his classes during the Spring semester and the substitute did not administer the assessments. Although the substitute was: 1) contacted in person and via email by researchers on several occasions well in advance of administration dates, 2) post-assessment logistics were explained to the substitute teacher in person (how to administer, how to return, etc.), and 3) the liaison was apprised of the situation and both the substitute teacher and the liaison assured researchers assessments would and had been administered, the assessments were not given to the control students.

Teacher and Class Characteristics

There were 38 high school math teachers who participated in the RCT over the course of two years. While most teachers (18) participated during both study years, 14 teachers participated in 2009-10 only and taught Algebra 1, and 6 teachers participated in 2010-11 only and taught Algebra 2. Teachers taught a total of 129 classes (72 treatment and 57 control) across both study years. While most teachers were randomly assigned to conditions, five teachers at schools A and B had classes that were randomly assigned and therefore, these teachers taught PHHS and another math program depending on the class period. Random assignment occurred at the classroom level because there were no comparison teachers available—these teachers were the only Algebra 1, Geometry, or Algebra 2 teachers at the schools.

Approximately 36% of teachers were female and 82% were Caucasian. In regards to educational background, 56% of teachers held a Bachelor’s degree and 44% of teachers held a Master’s Degree, primarily in Mathematics. Teacher experience ranged from 1 to 33 years, with the average number of years taught being 10.

With respect to differences among teachers, results showed no significant baseline differences among teachers in terms of knowledge of NCTM standards and latest research on student learning, preparation to teach math via “best practices” strategies, preparation to teach various math topics, hours of professional development received over the last three years, number of formal courses taken in mathematics, degree earned, and teaching experience, \( p > 0.05 \).

Classroom environment and implementation of various typical activities that occur in high school math classrooms
were also analyzed based on information collected from the classroom observations, teacher logs, and teacher surveys. Results showed no significant differences between treatment and control classrooms in terms of classroom management time, instructional time, independent practice, diversity of student activities, assessment use, and class climate, \( p > .05 \).

In summary, randomization was reasonably successful in producing equivalent treatment and control groups in terms of student, classroom, and teacher characteristics, and baseline student outcomes. However, given significant differences among a few variables, care was taken to include variables that were distinct between the treatment and control groups and that would improve on statistical precision as covariates in the analyses of program effects. Specifically, the following covariates were identified for inclusion in the multilevel model of program effects: (1) student perceptions of teacher support, (2) student perceptions of usefulness of math, (3) percent completion of math program, (4) school, and (5) for comparisons of Algebra 2, baseline performance.

**Instructional Curricula**

Researchers tried, to the extent possible, to select schools to participate in the study that used a control program that differed pedagogically from the intervention under study. Indeed, part of the site selection criteria included a review of the control curricula prior to approving a site for participation, to determine if the program was sufficiently distinct. For the PHHS Math RCT, participating schools were using primarily three curricula from other publishers. However, it is also important to note that teachers were all teaching similar math concepts and, due to state and local curricular guidelines which are typically aligned to state assessments, tended to cover similar content. Thus, there were similarities in content covered between treatment and control programs. The focus of this study was to examine the effects of an entire core curriculum and as such, it must be compared to other core curricula that teach the same content area.

**Prentice Hall High School Math Program**

The 2011 Prentice Hall High School Math program consists of titles in Algebra 1, Geometry, and Algebra 2. For the first year of the study, the Algebra 1 and Geometry titles were examined. During the second year of the study (2010-11), Geometry and Algebra 2 classes were examined so that researchers could investigate the cumulative effects of the PHHS program (i.e., from Algebra to Geometry, and from Geometry to Algebra 2).

The Algebra 1, Geometry and Algebra 2 programs offer targeted instruction for students by providing an “On-Level” and a “Foundations” series. The Foundations Series of the program is designed to provide extra support for students who need it. It is similar pedagogically and in appearance to the On-Level version, and the content of the Foundations series is similar to the content of the On-Level series. Of note is that the Foundations Series is not a reteaching or remediation supplement, but rather a more stepped out version of the On-Level program.

While the content varies among these different levels of the curricula, the pedagogical approach emphasized is the same. The 2011 Prentice Hall Algebra 1, Geometry and Algebra 2 programs are research-based instructional programs based
on Understanding by Design (UbD). The emphasis of UbD is on “backward design”, the practice of identifying the outcomes first in order to design curriculum units, performance assessments, and classroom instruction. Through this design approach, UbD focuses on “big ideas” and “core tasks” to frame curricula and organizes smaller, necessary and related skills so that students can understand these overarching concepts.

According to the publisher, each program also brings together a wide breadth of ideas and processes that have been proven to be effective in helping students gain a deeper understanding of core facts, concepts and generalizations, while consistently addressing the particular learning and instructional requirements of all students. Specifically “Big Ideas” are introduced at the beginning of each chapter and serve as the overarching concept for each lesson. Thinking and writing skills are emphasized throughout the chapters and students are encouraged to make connections between real world applications and the math concepts that are being presented. The Prentice Hall Algebra and Geometry programs are organized into 12 chapters broken down into anywhere from 4 to 10 lessons and the Algebra 2 program is organized into 14 chapters broken down into anywhere from 6 to 9 lessons. The programs consist of the following key components:

- **Big Ideas**: Organize and introduce the main themes that pertain to math topics being covered in the chapter.
- **Essential Understandings**: Build a framework for the Big Ideas and help make sense of the concepts that are being presented.
- **Essential Questions**: Help students process and apply the Essential Understandings
- **My Math Video**: Student made videos shown at the beginning of each chapter as a way to engage students in the content of the chapter through real-world applications.
- **Get Ready or Lesson Check**: Taps into prior knowledge and identifies prerequisite skills.
- **Solve It**: Opens lesson by providing a problem that emphasizes thinking and reasoning skills.
- **Sample Problems**: Includes reasoning call-outs and the “Got It”; problems show each step and have “Think” and “Plan” and sometimes “Think-Write” boxes that incorporate the thinking and reasoning strand of the program.
- **Got It**: Callouts that provide an important formative assessment tool.
- **Independent Practice**

To accomplish the goals of the Prentice Hall High School Math program, resources were designed to integrate digital technology, emphasize thinking and reasoning skills, and provide differentiated learning, all of which are essential components of the program.

Resources include:

**Student Resources**
- Student Edition
- Student Companion Worktext
- Practice and Problem Solving Workbook
- Student Edition on CD-ROM
- PowerAlgebra.com

**Teacher Resources**
- Teacher’s Edition with Teaching Resources CD-ROM

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20 Of note is that treatment teachers were asked to implement these key components on a regular basis. These key components are also documented in the Implementation Guidelines which is available in Appendix C.
A key feature of the program is that students are provided with a Student Companion Worktext, which gives them the opportunity to write in their own book and keep track of notes without having additional papers or folders. Generally the pacing for both of the program series (Foundations and On-Level) is about one lesson per day for a typical 50 minute class or about three weeks per chapter.

For a more detailed description of the program’s key features and materials, see Appendix B-Implementation Guidelines.

**CONTROL CURRICULA**

The type of control curricula used by teachers varied between sites. Table 9 shows the programs used at each of the sites. In general, schools used the same program for Algebra 1 and Geometry as they did for Algebra 2. The majority of Algebra 1 control teachers (ten out of fifteen) used program 1. Additionally there were four teachers spread over three sites using program 2. The remaining Algebra 1 teacher (at Site D) used a mixture of basal programs (see column “other programs”). Out of the eight Geometry control teachers who taught during years 1 and/or 2, six used program 1, one used program 2, and one used program 3 as their primary math curricula. Among the seven control Algebra 2 teachers, four used program 1, two used program 2, and one used program 1.

Control program 1 uses a modular approach to teaching math and incorporates a wide-range of activities including exploration, modeling, and communication of mathematics using a variety of tools including technology. Lessons are structured such that there is a clear “goal” for each lesson and lessons begin with an introduction activity followed by lesson instruction and independent practice. The content taught is different according to the subject area, but the program’s approach to math instruction and resources for all subjects is consistent. Control program 1 is slightly more investigative than other traditional, basal programs, and includes real-world applications and a number of hands-on explorations and labs throughout.

Control program 2 is similar to program 1 in both the blended approach to learning
and the modular, chapter based arrangement of lessons and inclusion of exploration, modeling and communication of mathematics using a variety of tools. The program emphasizes a balanced approach to blending teacher-centered instruction with student-centered instruction while addressing various levels of learners. Each lesson includes resources for teacher-centered and/or student-centered instruction with opportunities for students to collaborate and do investigations through a variety of conceptual lab lessons and other activities. While the program is a blend of basal and inquiry teaching approaches, it leans more towards basal instruction for the core, while providing the option to bring in additional investigations as desired.

Control program 3 is similar to program 1 and 2 in terms of general math concepts covered. It is however an older, blended approach program that lacks technological resources or the original supplemental components available at the time of publishing. It is chapter-based arrangement of lessons with embedded real life application (for 1995) throughout the text. Each chapter begins with an overview and includes topic exploration, mid chapter review and tests, special projects, extended application, chapter review and test. There is limited opportunity for technology related learning. While the program does attempt to integrate technology, compared to more recently published programs, control program 3 is constrained by relevance of technology available in 1995 versus 2011. The program also focuses on the integration of related mathematics (i.e. integration of geometry in algebra) and consistently provides integrated learning opportunities within each chapter. While the program is a blend of basal and inquiry teaching approaches, it leans heavily on basal instruction, while providing some opportunity for additional investigations.

In addition to the three programs used by the majority of participating control teachers, one Algebra 1 teacher at Site D used a mix of basal programs (2001 and 2009 editions). A few Algebra 1 teachers at Sites C and F also supplemented their primary control program with other math programs. These programs were also basal programs that covered similar content. Teachers used these additional resources for extra skill practice or investigative activities.

<table>
<thead>
<tr>
<th>Site A: OH</th>
<th>Program 1</th>
<th>Program 2</th>
<th>Program 3</th>
<th>Other Programs</th>
</tr>
</thead>
</table>
| Site B: ID | Algebra I – 2001  
Algebra II - 2004 | | | |
| Site C: NJ | Algebra I – 2007  
Geometry – 2007  
Algebra II - 2007 | | Algebra I – 2009 |
| Site D: WA | Geometry – 1995  
| Site E: OH | Algebra I – 2007* | | | |
Geometry – 2001/2004  

*At Site E, geometry classes were not included in the study and during year 2, only a treatment teacher participated in the study.
In general, the content covered by both control programs was similar. However, variation did exist in the order in which content was taught and in a few instances the content covered. The control curricula, including resources available, are described in more detail in Appendix D.

Comparisons between Prentice Hall High School Math and Control Program Content, Coverage and Practices

Table 10 shows the type of core math classes that participated in the study over the course of two years. As shown, the distribution of classes taught was similar between groups, $\chi^2(8)=2.88, p=.94$, especially among the different types of Geometry classrooms. In addition, while there was 1 more Algebra Honors class in the treatment group, there were 3 more below-level Algebra 1 classes and 2 more self-contained Special Ed Algebra 1 classes in the treatment condition than control. Thus, overall the discrepancies are not in favor of the treatment group.

<table>
<thead>
<tr>
<th>Math Class</th>
<th>Control</th>
<th>PHHS Math</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algebra 1 Spec Ed</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>8th Grade Algebra</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Below-Level Algebra 1</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>On-Level Algebra 1</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>Honors Algebra 1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Below-Level Geometry</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>On-Level Geometry</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Geometry Honors</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>On-Level Algebra 2</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Algebra 2 Honors</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

As a result of state and district scope and sequence guidelines prescribing what math content needed to be covered, treatment and control classes within schools generally taught similar content. While some topics were presented in a different sequence depending on the program used, the math concepts covered were somewhat comparable. Comparison on the percent of chapters/lessons completed during the school year showed that treatment and control teachers covered approximately over 60% of their respective math programs (control mean=65% and treatment mean=61%) by the end of the school year, $p>.05$. That said, it was also observed that among Algebra 1 classes, control classrooms tended to cover the quadratics equations/functions topic to a greater extent than treatment classes, $p<.05$. In addition, among Algebra 2 classrooms (year 2), control classes tended to cover polynomials and polynomial functions, rational functions, and matrices to a greater extent than treatment classes, $p<.05$. Note that these discrepancies are likely due to control teachers, who on average had been using their math program for several years, being able to cover more content as they were more familiar with their program and how to pace their instruction as compared to treatment teachers who were using the Prentice Hall High School Math. Nevertheless, percent of content covered was used as a covariate.

With respect to the textbooks and the pedagogical approaches employed by the various math curricula, there were notable differences between control and Prentice Hall High School Math programs. As previously noted, all schools used traditional, chapter-based, teacher delivered programs as their main control curricula. In comparison to the Prentice Hall High School Math program, the basal control group materials used by schools did not
incorporate technology to the degree that the Prentice Hall High School math program did. While both of the main control programs did have some digital resources, the teachers rarely incorporated them into the main lesson, nor were they often utilized by students for the practice, reference or differentiation activities they were designed for. In addition, while Prentice High School Math had digitally delivered lessons that most teachers utilized on a daily basis, the control curricula primarily involved teacher delivered lessons. The Prentice Hall High School Math program also allowed students to fully access their interactive lessons and texts from home. In contrast, the control programs allowed for general online access to lessons and chapters but were not interactive and overall it was reported that students or teachers in control classrooms rarely utilized these limited features.

When the pedagogy of the Prentice Hall High School Math program is compared to the control programs there is a notable difference in the primary philosophy behind each program. Specifically, Prentice Hall High School Math consistently delivers content and lessons driven by large, overarching concepts that span the gap between math concepts and real world applications; specific skills and activities support the larger concept. The PHHS Math program encourages students and teachers to begin each chapter by asking questions, whereas the control programs focus on a more traditional approach where questions are posed and students must come up with answers. While the skills and content are similar between programs, the inherent differences stem from the way the Understanding by Design model asks students to look at the big picture first versus the traditional pedagogy of the control programs which attempts to move students from small skills to a larger understanding.

This reverse design approach, in conjunction with the embedded technology, is the crux difference between the Prentice Hall High School Math program and the control programs.

In terms of specific instructional activities, there were no significant differences observed. Lessons in both control and treatment classes were relatively consistent with a few exceptions as noted below. Lessons usually started with checking homework and answering related questions. This was followed by a warm up or a brief quiz. Next teachers would introduce and begin the new lesson. Lessons included some lecture, discussion and guided practice. In classrooms with lower level learners guided practice tended to last slightly longer than in more advanced classes. Teachers would then assign independent practice. Depending on the length of the class students might have time to finish the majority of the assignment in class; if not, the independent practices was generally sent as homework. At sites where classes consisted of shorter periods versus longer blocks, independent practice work was usually sent as homework. There were a few schools that specifically assigned homework in addition to the independent practice assigned in class. This generally occurred at schools with longer class periods. The exception to this lesson format was that control teachers at one site generally did a brief investigative activity at the start of class instead of a warm up or quiz.

These were the only notable differences observed across schools in terms of math instruction. Appendix D contains a crosswalk between PHHS Math content and the control programs’ content. As is evident, there exists a close alignment, especially among the newer programs. This is largely
due to the educational community’s demand of publishers to include content that is aligned to national and state standards and state assessments used for purposes of measuring annual yearly progress as required by NCLB.

**Fidelity of Implementation**

Three levels of implementation (low, moderate, and high) were assigned for teachers’ implementation of: (1) key PHHS Math program components, (2) the percent of lessons completed, and (3) the overall implementation\(^ {21} \) of the PHHS Math program. Triangulation of the available information from both years of the study\(^ {22} \) showed that during the 2009-2010 school year one teacher and during the 2010-11 school year three teachers did not typically follow the implementation guidelines which outlined the key components of the PHHS Math program. In particular, these teachers did not consistently do Essential Understanding/ Questions, the Think/Plan/Write practice problems, Get Ready/Lesson Checks, or My Math Video. In addition, in the 2009-10 school year three teachers were unable to complete more than 50% of the PHHS Math program due to students’ low math level—these teachers needed to oftentimes engage in remediation activities and reteach important concepts prior to moving on. During the 2010-11 school year, six teachers were unable to complete 50% of the PHHS Math program (primarily in Algebra 2). This was due to a variety of circumstances that occurred during the second year of the study including: a) changes in curriculum mapping teachers were required to follow, causing them to have to utilize outside resources to meet district requirements (n=3); b) having classes in which the majority of students were behaviorally challenged and thus, it was difficult to get through the material (n=2); or c) first year implementation for one teacher at Site E. Notably, with exception of one teacher, many of these teachers were high implementers in year 1, but were unable to remain high implementers in year 2 due to extenuating circumstances. The lower levels of implementation observed in year 2 can negatively impact the detection of effects. Thus, any positive effects observed will have occurred despite lower than ideal implementation by some teachers.

When the average implementation for each of the key components is examined across both school years, results show that teachers tended to implement the chapter-based activities (Get Ready and My Math Video) and Think/Plan/Write problems with less frequency, therefore not engaging in these practices as outlined in the implementation guidelines. Indeed, the bulk of teachers who were classified as moderate implementers of the key program components failed to reach high implementation status because they did not implement these activities with regularity. As some teachers reported, this is most likely due to teachers to skipping the My Math video component, as their students did not find it very engaging. It should be noted that the majority of study teachers did initially show the My Math Video during year one, but given the limited amount of teaching time and for some teachers, the adverse student reactions, these teachers opted to skip them towards the end of the first year and for the entirety of the second year.

Appendix E provides a more detailed table describing the extent to which teachers

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\(^ {21} \) This was determined by averaging the percent of goals met on components and the percent of chapters taught and then categorizing this average as noted in Table 11.

\(^ {22} \) Information was analyzed from teacher logs, class observations, surveys, and exit interviews.
utilized the various PHHS Math program components. Of note during the first year of the study, is that while most teachers did well in blending digital and print materials, four teachers rarely used the digital resources due to a lack of suitable technology infrastructure at their school (2), or because they did not feel comfortable using the technology (2). However during year 2 of the study, the majority of teachers were moderate to high technology implementers. Indeed, the three lowest technology implementers used technology a minimum of three times per month with all other teachers using technology to a larger degree. For more information on how teachers implemented the PHHS Math program in their classrooms, see Appendix C: Case Studies.

Table 11. Level of PHHS Math Implementation by Study Year

<table>
<thead>
<tr>
<th>Level of PHHS Math Implementation</th>
<th>Completion of Key Program Components</th>
<th>Mean Percentage of PHHS Chapters Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-10 Treatment Classes (n=38)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>80% or higher (Consistent completion of 8-9 out of 9 PHHS components = 18 classes)</td>
<td>75% or higher = 21 classes</td>
</tr>
<tr>
<td>Moderate</td>
<td>60%-79% (Consistent completion of 6-7 out of 9 PHHS components) = 19 classes</td>
<td>60%-74% = 7 classes</td>
</tr>
<tr>
<td>Low</td>
<td>Less than 60% of goals met = 1 class</td>
<td>60% or less = 10 classes</td>
</tr>
<tr>
<td>2010-2011 Treatment Classes (n=34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>80% or higher (Consistent completion of 8-9 out of 9 PHHS components = 13 classes)</td>
<td>75% or higher = 5 classes</td>
</tr>
<tr>
<td>Moderate</td>
<td>60%-79% (Consistent completion of 6-7 out of 9 PHHS components) = 13 classes</td>
<td>60%-74% = 10 classes</td>
</tr>
<tr>
<td>Low</td>
<td>Less than 60% of goals met = 8 class</td>
<td>60% or less = 19 classes</td>
</tr>
</tbody>
</table>

Note that 95% of teachers implemented the key PHHS Math components with a moderate to high level of fidelity across the two years of the study.

No evidence of contamination was observed between teachers or in classrooms. That is, teachers did not use any components of the Prentice Hall High School Math program with control students. However, there was some movement of students from treatment to control classes (or vice versa) following the first semester at one school and from one school year to the next at all schools. While researchers asked, to the extent possible, to try to ensure treatment/control students remained within the same group during the second semester and during the second school year, this was not always accomplished due to scheduling conflicts. These students were excluded from all program effect analyses that are subsequently reported.

It should be noted that the potential for contamination was given careful consideration when determining the level of random assignment. Through years of research experience, PRES researchers have found that the benefits of random assignment at the classroom level (hence, controlling for school and teacher level factors) with careful monitoring of possible contamination, outweighs the risk of contamination. Procedures used to eliminate the threat of contamination included an in-depth study orientation with teachers, site visits made to both treatment and control classrooms to observe what was occurring in classrooms, and monthly teacher logs that monitored practices and materials used across both treatment and control classrooms.
Overall, treatment teachers implemented the key Prentice Hall High School Math program components with a moderate to high degree of fidelity. However, 56% of classes were unable to complete over 60% of the PHHS Math chapters (primarily in Algebra 2) during the 2010-11 school year due to several extenuating circumstances, including changes in curriculum mapping teachers were required to follow and slow pacing due to behaviorally challenged students. Thus, implementation fidelity was generally lower in year 2 than in year 1 which could negatively impact the detection of effects.

Results

This section is organized by the key evaluation questions and provides a summary of major findings first, followed by a more detailed account of the results. The findings described in this report provide a summary of overall conclusions that can be derived from the extensive analyses conducted. However, detailed descriptions of the statistical analyses performed along with detailed statistical results are provided in the accompanying Technical Report.

Summary of Results

1. Does math ability improve as a result of participation in the Prentice Hall High School Math programs?

Students using PHHS Math showed significant learning gains over the course of the study. In particular, students showed significant improvement in math performance overall across Algebra 1, Geometry, and Algebra 2 on both the multiple-choice (designed primarily to measure math computation and interpretation) and open-response tests (designed primarily to measure problem-solving and reasoning skills). When tests for each content area were examined separately, results showed significant growth within all subject areas. PHHS Algebra 1 students grew by 38 percentile points, PHHS Geometry students grew by 33 to 34 percentile points, and PHHS Algebra 2 students grew by 22 to 23 percentile points from pre- to post-testing.
2. **Do changes in math performance among Prentice Hall High School Math students vary by different types of students and levels of implementation?**

All subgroups significantly improved from pre- to post-testing. Students using PHHS Math and who were female or male, in special education or not, receiving free/reduced lunch or not, and of various ethnic/racial backgrounds, math levels, and grade levels, showed significant learning gains over the course of the study.

Exploratory analyses on the relationship between overall levels of PHHS Math implementation of key program components and student math performance showed that students whose teachers implemented the major components of Prentice Hall High School Math with moderate to high fidelity showed greater improvement than students of teachers who did not use all the major program components on a regular basis. Moreover, analyses also showed that students whose teachers used Prentice Hall High School Math technology components on a regular and consistent basis (i.e., with high fidelity) showed greater improvement than students of teachers who did not use the PHHS technology on a regular basis. Thus, preliminary findings suggest that using the PHHS Math program as outlined in the implementation guidelines, including the technology, can enhance student learning.

3. **Do different patterns emerge before and after students use Prentice Hall High School Math?**

Given the small subset of students who changed conditions (i.e., from control during 2009-10 to PHHS Math in 2010-11 and vice versa), researchers were able to explore if there was a change in growth patterns before or after usage of PHHS Math. Results showed a significant relationship among students who were initially treatment students and became control students in year 2. Specifically, math performance growth on the Overall Math Multiple-Choice Test was significantly greater during usage of PHHS Math (in the 2009-10 school year) as compared to their performance when they used another math program in year 2 of the study.

4. **Does using the Prentice Hall High School Math programs result in increased student achievement as compared to other types of math programs?**

Results showed significantly greater gains on the math tests of students who used Prentice Hall High School Math as compared to students who used other high school math programs. That is, PHHS Math students showed accelerated learning gains on the multiple-choice and open-response tests across Algebra 1, Geometry, and Algebra 2 content areas as compared to gains experienced by students using other math programs. It is noteworthy that such effects were observed despite: a) the lower levels of fidelity of implementation observed in year 2; and b) the loss of students who switched conditions following first year usage of PHHS Math.

When analyses are broken out by content area, results showed that PHHS Algebra 1 students had a significantly higher level of improvement from pre- to post-testing on the Algebra 1 multiple-choice and open-response tests as compared to students using other Algebra 1 programs. Among Geometry students in both years of the study, there was a significant difference on the Geometry multiple-choice test such that PHHS Math students demonstrated accelerated learning gains as compared to students using other Geometry programs.
Results showed no significant differences on the Algebra 2 multiple-choice and open-response tests between PHHS Algebra 2 students and control students, after controlling for pretest differences\(^{23}\). Thus, PHHS Algebra 2 students and students using other Algebra 2 programs demonstrated similar math performance.

Effect size is a commonly used measure of the importance of the effect of an intervention (in this case, PHHS Math). All effect sizes were positive indicating a favorable effect of the PHHS Math program on student math performance. The effect sizes obtained can be classified as small (\(d=.21\) for Overall Multiple-Choice: Combined Year 1 and Year 2 Sample; \(d=.08\) for Overall Open-Response: Combined Year 1 and Year 2 Sample; \(d=.22\) for Geometry: Combined Year 1 and Year 2 Sample; \(d=.22\) for Algebra 1 Multiple-Choice; and \(d=.37\) for Algebra 1 Open-Response). Moreover, the What Works Clearinghouse calculates an improvement index which represents the difference between the percentile rank of the average student in the intervention condition (i.e., PHHS Math) and that of the average student in the comparison condition. The improvement index for this study can be calculated to be approximately +6, a noteworthy figure. This also represents a higher improvement index than was obtained during the first year of the study (+5).

Comparisons were also made between year 1 (2009-10) and year 2 (2010-11) findings to determine whether results were consistent during each year of the study. Similar to year 1, results for year 2 showed that PHHS Math students outperformed students using other math programs as measured by the Overall Multiple-Choice and Open-Response tests. Such consistency of positive effects in favor of the PHHS Math program over the course of two years lends support to the conclusion that the PHHS Math program has a positive impact on student performance relative to other math programs. It is also noteworthy that effect sizes obtained in year 2 are higher than those observed during the first year of the study. The effect sizes for the PHHS Math program on student math performance during year 2 were .22 for the Overall Open-Response test and .32 for the Overall Multiple-Choice test. These effect sizes are higher than those obtained in year 1 (.13 for both tests), suggesting that stronger effects were evident as teachers and a subsample of students had more experience with PHHS Math.

5. **Do effects of Prentice Hall High School Math on student math performance vary as a function of different student characteristics and different types of control programs?**

Differences between PHHS Math students and control students in the following subgroups were examined: grade, gender, math level, free/reduced lunch status, and ethnicity. Results among the combined sample from year 1 and year 2 showed significant differences between PHHS Math students and control students who were female, White, Hispanic, on free/reduced lunch, and in grades 9 and 10. In all cases, PHHS Math students showed greater learning gains such that PHHS Math students who were female, White, Hispanic, receiving free/reduced lunch, and in the 9th and 10th grades had higher levels of performance on at least one of the Overall Math subtests as compared to control students who were in these subgroups.

Findings for free/reduced lunch students and students in the 9th grade are consistent with those observed last year. During year 1, African American students also showed

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\(^{23}\) Given pretest differences, baseline performance was controlled for in analyses of Algebra 2 outcomes.
positive subgroup effects; however during year 2, Whites and Hispanics using PHHS Math outperformed Whites and Hispanics using other math programs, and no significant differences were observed among African Americans. It is also interesting to note that while last year’s 10th graders showed a negative effect (i.e., control students in 10th grade outperformed treatment students in 10th grade), 10th graders in year 2 showed a positive effect. This reversal in effect may be due to teachers and a portion of the students gaining experience with the PHHS Math program so that benefits were realized during the second year.

Across all subject areas, a significant difference was also observed among high math performing students; PHHS Math students showed significantly greater growth than control students on the Overall Math multiple-choice and open-response test. These findings were consistent with those observed in year 1. Additionally, marginally significant differences were observed among mid-level students such that PHHS Math students of average ability had higher learning gains than control students of average ability. Students of low ability levels showed comparable rates of growth across both treatment and control programs.

Comparisons by control program showed positive effects with PHHS Math students demonstrating accelerated learning gains across all traditional basal programs in the study (control programs 1, 2, 3 and 4).

In sum, all significant subgroup differences found between treatment and control conditions were in favor of the PHHS Math program (i.e., PHHS Math students outperformed control students). In addition, the positive effects obtained on the PHHS Math program were observed across a number of different schools who used a variety of types of control programs. The consistency in findings across different curricula, outcome measures, study years and student populations combined with the fact that virtually all treatment effects observed were in favor of PHHS Math all lend credence to the conclusion that PHHS Math positively impacts student math knowledge and skills.

6. Does participation in the Prentice Hall High School Math programs result in other positive outcomes?

While the main focus of the PHHS Math program is to improve upon important math skills and understanding, other measures were included to explore if PHHS Math was associated with positive impacts on student and teacher attitudes, and classroom practices. Results were fairly consistent with those obtained in year 1 -- Prentice Hall High School Math had several positive effects on student and teacher attitudes. In particular, PHHS students felt that their teachers had a greater awareness of students’ level of understanding. In addition, significant positive changes were observed among PHHS Math students in terms of their educational aspirations and future plans for math course-taking. PHHS Math teachers also experienced increased levels of comfort with technology usage and knowledge or awareness of their students’ ability levels. In contrast, one significant difference in favor of the control programs was observed; students using other math programs felt more prepared for college math courses as compared to PHHS Math students.

Furthermore, while not statistically significant, treatment teachers generally felt more assistance from the PHHS Math program than control teachers. For example, PHHS Math teachers had more positive
perceptions about the PHHS Math program’s impact on student skills than control teachers; specifically, a higher percentage of PHHS Math teachers felt that the PHHS Math program was useful in increasing students’ higher order thinking skills, ability to solve word problems, computational skills, and reading and writing skills as compared to teachers using other math programs. Treatment teachers also expressed that the PHHS Math program provided greater assistance in terms of: a) assessing and monitoring their students’ progress, 2) saving time as it relates to lesson preparation, 3) providing requisite knowledge to teach lessons, and 4) providing individualized instruction, in particular for on-level and below-average students.

With respect to the impact of technology, results showed that the technology embedded within the PHHS Math program had a positive effect on student engagement and that the use of the PHHS technology enhanced student math understanding and learning.

7. What do users of Prentice Hall High School Math think about the program?

The majority of teachers and students liked the PHHS Math program, would like to continue using the program in subsequent years, and found the print and digital resources to be useful. Students who used Prentice Hall High School Math felt that math was explained more clearly as compared to control students. In the area of technology, students and teachers rated the PHHS Math program more favorably than control. However, control teachers rated their math program comparably or better in several other areas such as the usefulness of teacher resources, including enrichment resources as well as other teaching tools. Anecdotal feedback provided by teachers in the treatment condition indicated that they felt somewhat constrained by the implementation guidelines they were required to follow. Treatment teachers did not always appreciate that they were being strongly encouraged to use certain components of the PHHS Math program such as the technology and, accordingly, this may have influenced some of their ratings of the program. Conversely, teachers in the control condition had flexibility to deliver instruction as they typically have done and so were able to more fully customize their instructional delivery and utilization of resources. That said, provision of implementation guidelines and monitoring of fidelity of implementation were important design features but may have influenced their attitudes towards the program.
Detailed Results

Does math ability improve over the course of participating in the Prentice Hall High School Math programs?

**Overall Growth**

Learning gains in Algebra 1, Geometry, and Algebra 2 among students using PHHS Math was examined via paired sample t-tests. Data for both years of the study was combined to determine overall growth. Results showed significant growth in math performance on the Overall Math multiple-choice and open-response test data (i.e., aggregated across Algebra 1, Geometry, and Algebra 2 content areas), \( p<.05, d=.81 \) and \( d=.76 \) respectively. While all students showed significant growth, PHHS Math students showed the greatest level of growth on the open-response test (15 point increase) as compared to the multiple-choice test (11 point increase), see Figure 1. Conversion of these results to effect sizes shows that students grew 29 percentile points on the open-response test and 28 percentile points on the multiple-choice test over time, see Figure 2. These findings are consistent with those observed in year 1 when students grew by 33 percentiles on the multiple choice test and 38 percentiles on the open-response test.

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**Figure 1. Pre- and Post-test Overall\(^{24}\) Math Performance of PHHS Math Students: Combined Year 1 and Year 2**

**Students who used Prentice Hall High School Math showed significant growth in math performance overall across all subject areas (Algebra 1, Geometry, and Algebra 2) and study years (2009-2011).**

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**Figure 2. Percentile Gains on Overall Math Performance of PHHS Math Students: Combined Year 1 and Year 2**

**PHHS Math students showed significant learning gains; on average, math performance grew by 29 percentile points on the Overall Math multiple-choice test and 28 percentile points on the open-response test.**

\(^{24}\) Overall Math performance refers to the aggregated test data across all subject areas (Algebra 1, Geometry and Algebra 2).
**Growth in Algebra 1**

Examination of tests for each content area was analyzed separately. Results showed significant growth in Algebra 1 performance on both multiple choice and open response tests during the 2009-10 school year, \( p<.05, d=1.19 \) and \( d=1.18 \) respectively, see Figures 3 and 4. Conversion of results to effect sizes indicates that PHHS Math students grew by 38 percentile points on both the multiple-choice and open-response tests, see Figure 4.

**Prentice Hall High School Algebra 1 students showed significant growth in Algebra performance on both multiple choice and open response tests.**

**Growth in Geometry**

Since two years of data was available for Geometry classes, data was aggregated across both study years to determine the growth of students overall. PHHS Geometry students in 2009-10 and 2010-11 demonstrated significant growth in performance from pre- to post-testing, \( p<.05 \), \( d_{MC}=.94 \) and \( d_{OR}=.98 \). Analyses of effect sizes showed that PHHS Geometry students grew by 33 percentile points on the multiple-choice portion of the exam and by 34 percentile points on the open-response portion of the exam across both study years, see Figures 5 and 6. These effect sizes are consistent with those observed in year 1; during the 2009-10 school year, PHHS Geometry students grew by 36 percentile points on the multiple-choice portion of the exam and by 29 percentile points on the open-response portion of the exam.
Significant learning gains were also observed for Prentice Hall High School Geometry students on both multiple choice and open response tests across both study years.

PHHS Geometry students demonstrated gains of 33 percentile points on the multiple-choice test and 34 percentile points on the open-response test.

GROWTH IN ALGEBRA 2

Results for PHHS Algebra 2 students showed that their math performance grew significantly from pre- to post-testing during the 2010-11 school year, p<.05, dMC=.60 and dOR=.57. Furthermore, examination of effect sizes show that PHHS Algebra 2 students grew by 23 percentile points on the multiple-choice portion of the exam and by 22 percentile points on the open-response portion of the Algebra 2 test, see Figures 7 and 8.

PHHS Algebra 2 students demonstrated gains of 23 percentile points on the multiple-choice test and 22 percentile points on the open-response test.
Do changes in math performance among Prentice Hall High School Math students vary by different types of students and levels of implementation?

**Student Subgroups**

To examine whether the PHHS Math program was associated with improvements among students of various subgroups, exploratory analyses were conducted using the combined sample from the 2009-10 and 2010-11 school years so that a larger sample of subpopulations was available for analyses. Only the performance of treatment students in specific student populations (i.e., students receiving free/reduced lunch and students not receiving aid, males and females, special education students and non-special education students, and students of various ethnicity levels, math levels, and grade levels) was examined in these analyses. It should be noted that the sample sizes in some of the subgroups are small and there are unequal sample sizes between those in the subpopulations and those not for a number of variables. Therefore, with the caveat that these analyses are limited, this provides readers with preliminary, descriptive information on whether the program is associated with improvements among various subgroups. Figures 9 through 17 display the results for the various subgroups.

Results showed that Prentice Hall High School Math students in all subgroups significantly improved from pre- to post-testing on both the multiple-choice and open response tests. That is, females and males, special education students, students of various ethnic/racial backgrounds, students receiving free/reduced lunch and those not, and students of various math levels and grades showed significant learning gains, \( p < .05 \).

In addition, differential growth rates were observed for the following subgroups: math level, grade level, and ethnicity. Specifically, Asian or Native Americans (see “other” in graphs) showed the greatest levels of gains, followed by Whites and Hispanics, and African Americans showed the lowest levels of growth. PHHS high level math students also showed greater gains on the multiple choice and open-response tests than average and low-performing students. In addition, growth increased as grade levels decreased; that is, 9th grade students showed the greatest amount of gains followed by 10th, 11th and 12th grade students.

Of note is that these results were consistent with those observed in year 1. Students of all subgroups showed significant gains in 2009-10 as well.

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25 As a result of the limited sample sizes, analyses were conducted on the Overall Math measure (average across Algebra 1, Geometry, and Algebra 2) only. The reader is referred to the accompanying Technical Report for additional details.
Both females and males showed similar levels of significant improvement across multiple choice and open response math tests.

PHHS Math students receiving free/reduced lunch and those not receiving this assistance showed significant improvement on both multiple choice and open response tests.

Both special education and non-special education students who used PHHS Math showed significant learning gains over time on both exams.

Students of all ethnic backgrounds showed significant improvement on the multiple-choice test. In addition, Asian and Native Americans (those noted as “Other” due to small sample size) showed the greatest levels of growth, followed by Whites, Hispanics, and African Americans.
Similar results were observed on the Overall Math open-response test. In particular, while students of all ethnic backgrounds showed significant improvement, Asian and Native Americans ("Other") showed the greatest levels of growth, followed by Whites, Hispanics, and African Americans.

PHHS Math students at all grade levels showed significant growth on the Overall Math multiple-choice test. In addition, learning gains were related to grade levels such that 9th graders showed the highest levels of gains, followed by 10th, 11th and 12th graders.

Similarly, PHHS Math students of all grade levels showed significant growth on the Overall Math open-response test. Again, 9th grade students showed the greatest level of improvement from pre- to post-testing, followed by 10th, 11th, and 12th graders.

While PHHS Math students of all ability levels showed significant improvement over time on the multiple-choice test, high level PHHS Math students tended to show greater growth than average and low level math students.
Similarly, PHHS Math students of all ability levels showed significant growth on the open-response test. In addition, high level students tended to show greater growth than average and low level math students.

**IMPLEMENTATION LEVELS**

In addition to these analyses among subgroups of PHHS Math students, exploratory analyses on the relationship between overall levels of PHHS Math implementation of key program components and student math performance were conducted. These analyses provide information on whether the degree of implementation fidelity of PHHS components was associated with student performance. Note that data for both study years was aggregated to determine the overall impact of implementation level.

Results showed that there was a significant relationship between overall PHHS Math implementation levels and improved performance on the Overall Math open-response test. Specifically, students whose teachers used the Prentice Hall High School Math program with high and moderate fidelity showed the greatest gains in math performance as measured by the open-response test, \( p < 0.05 \), as compared to students of teachers who did not use the program with fidelity, see Figure 18. These findings are also consistent with those observed in year 1 when students whose teachers implemented PHHS with high fidelity showed the highest levels of growth. The consistency in results suggests that using the program as prescribed in the implementation guidelines can heighten student learning.

**Preliminary analyses showed that students whose teachers implemented the major components of Prentice Hall High School Math with high and moderate fidelity showed greater improvement than students of teachers who did not use all the major program components on a regular basis.**

**TECHNOLOGY USAGE**

In order to provide preliminary information on the relationship between usage of the PHHS Math technology and student math performance, analyses were performed. It should be noted that these are exploratory and non-causal. Data for both
study years was aggregated to determine the overall relationship between technology usage and changes in student performance.

Results showed a significant positive relationship between technology usage and student growth on both tests, $p<.05$. In particular, students whose teachers used the technology that accompanies the Prentice Hall High School Math program on a regular, consistent basis showed the highest levels of performance gains than students whose teachers used the technology to a lesser degree, see Figures 19 and 20. These findings suggest that usage of the PHHS Math technology can enhance student math performance.

**Figure 19. Difference in Performance by PHHS Technology Usage: Overall Math Multiple-Choice Test**

<table>
<thead>
<tr>
<th>Math Score</th>
<th>PHHS Technology Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>Low</td>
</tr>
<tr>
<td>32.71</td>
<td></td>
</tr>
<tr>
<td>41.71</td>
<td></td>
</tr>
<tr>
<td>Post</td>
<td>Low</td>
</tr>
<tr>
<td>60.27</td>
<td></td>
</tr>
<tr>
<td>61.71</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 20. Difference in Performance by PHHS Technology Usage: Overall Math Open-Response Test**

<table>
<thead>
<tr>
<th>Math Score</th>
<th>PHHS Technology Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>Low</td>
</tr>
<tr>
<td>15.57</td>
<td></td>
</tr>
<tr>
<td>15.23</td>
<td></td>
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<tr>
<td>Post</td>
<td>Low</td>
</tr>
<tr>
<td>32.07</td>
<td></td>
</tr>
<tr>
<td>37.14</td>
<td></td>
</tr>
</tbody>
</table>

Exploratory analyses showed that students whose teachers used Prentice Hall High School Math technology components on a regular and consistent basis (i.e., with high fidelity) showed greater improvement than students of teachers who did not use the PHHS technology on a regular basis. These findings suggest that usage of the PHHS Math technology can enhance student math performance.
Do different patterns emerge before and after students use Prentice Hall High School Math?

As previously noted, there was a small subset of students who changed conditions: a) from control during 2009-10 to PHHS Math in 2010-11 (n=96); and b) from PHHS Math during 2009-10 to control in 2010-11 (n=125). This allowed researchers to explore if there was a change in growth patterns before or after usage of PHHS Math. It should be noted that these analyses were limited by a small sample and different subject areas were taken during each school year (e.g., Algebra 1 in year 1 and Geometry in year 2). With these caveats in mind, results showed a significant relationship among students who were initially treatment students and became control students in year 2. Specifically, math performance growth on the Overall Math Multiple-Choice Test was significantly greater during usage of PHHS Math (in the 2009-10 school year) as compared to when they used another math program in year 2 of the study, $p<.05$, see Figure 21.

The aforementioned analyses focused on the extent to which PHHS Math is positively associated with student math performance. The following section presents analyses of how the math performance of students exposed to PHHS Math compares to the performance of students using other math programs.
Does using the Prentice Hall High School Math programs result in increased student achievement as compared to other types of math programs?

Prior to discussing the results found, it is important to understand the differences and similarities of the Prentice Hall High School Math and control curricula and classes. This will assist the reader in interpreting the results and effect sizes\(^{28}\), a measure of the importance of an intervention.

**Comparison of Prentice Hall High School Math and Control Classes**

As previously noted, generally PHHS Math and control classes were taught similar content with a few exceptions. For example, it was observed that among Algebra 1 classes (year 1), control classrooms tended to cover the quadratics equations/ functions topic to a greater extent than treatment classes. In addition, among Algebra 2 classrooms (year 2), control classes tended to cover polynomials and polynomial functions, rational functions, and matrices to a greater extent than treatment classes. As a result, percent completion of content was used as a covariate in all comparisons between treatment and control classes.

In addition, differences existed with respect to the pedagogy employed. In general, the control programs were primarily traditional, basal programs while the premise of the Prentice High School Math program is based on Understanding by Design and the associated focus on Big Ideas and Essential Understandings, along with an emphasis on thinking and writing skills. Furthermore, the Prentice Hall High School Math program integrated technology to a much a larger degree than control programs. For example, treatment classes had greater access to their math programs and additional assistance and practice via online problems outside the classroom through online resources. Moreover, portions of PHHS Math lessons were oftentimes delivered digitally whereas control classrooms were primarily teacher-delivered.

Although differences were noted, similarities between the control and treatment programs were also evident. Along with similar skills being taught across classrooms, the control and PHHS Math programs offered daily practice exercises to reinforce concepts taught during the lesson including guided practice and independent practice. Furthermore, both programs included a number of practice, review, and problem-solving exercises.

There were also no notable differences between the groups in terms of how the lessons were structured or delivered. While teaching styles varied for some teachers, the instructional sequence and practices employed was comparable across treatment and control classes, and from teacher to teacher. Generally lessons included a review of the previous day’s homework or prior lesson, and whole group instruction of the new concept which included teachers modeling the solution of the problem. This was typically followed by guided practice problems as a class and then practice as independent or pair work.

In summary, Prentice Hall High School Math and the control classrooms, with the exception of the program-based activities,
were similar to one another in terms of structure and content. Given this information and the fact that the duration of the study and exposure to the program occurred during two school years for approximately 20% of students, small to medium effect sizes, if any, were expected. Expanding the study over the course of two school years allowed for teachers to become better accustomed to the PHHS Math program and therefore, to be more familiar with the program, thereby reducing the learning curve experienced by teachers using a new curriculum during the first year. However, this greater experience may have been offset by the lack of full implementation of the PHHS Math program by a subset of teachers who were unable to complete a substantial portion of the program.

**Summative Results**

Multilevel modeling was conducted to examine whether there was a significant difference in overall growth of math skills (i.e., aggregated across Algebra 1, Geometry, and Algebra 2) between treatment and control students over the two years of the study (2009-2011). The use of multilevel models allowed researchers to account for statistical issues that can influence the validity of the results (i.e., dependency, etc.) and to equate the groups on important variables (e.g., perceptions of usefulness of math, teacher support, percent completion of content, and school).

Results showed that Prentice Hall High School Math students had higher learning gains on overall math performance (average performance across all subject areas) as compared to students using other math programs across two years (2009-2011). Effect size is a commonly used measure of the importance of the effect of an intervention (in this case, Prentice Hall High School Math). Both effect sizes were positive indicating a favorable effect of the PHHS Math program on student math performance (d=.21 for Overall Multiple-Choice and d=.08 for Overall Open-Response).

In order to better understand the effects observed as a result of exposure to PHHS Math, effect sizes can be translated to the percent of treatment students that can be...
expected to be above the average of the control group (see blue part of bar in Figure 23). As shown, students using PHHS Math are more likely to have scored above the average of control students across all subject areas (Overall Math). Notably, a greater impact was observed on the multiple-choice test as compared to the open-response test.

Figure 23. Percent of PHHS Students Above and Below Average Relative to Control Students: Combined Year 1 and Year 2

Results show that 58% and 53% of PHHS Math students scored above the average control student across all subject areas. In other words, PHHS Math students were 8 percentile points higher than the average of control students on the Overall Math Multiple-Choice test, and were 3 percentile points higher on the Overall Math Open-Response test than control students.

It should be noted that the WWC calculates an improvement index which represents the difference between the percentile rank of the average student in the intervention condition (i.e., PHHS Math) and that of the average student in the comparison condition. The improvement index can take on values between −50 and +50, with positive numbers denoting favorable results. Using the aforementioned effect sizes\(^{31}\), the improvement index for this study can be calculated to be approximately +6, a noteworthy figure. This also represents a higher improvement index than was obtained during the first year of the study (+5).

**RESULTS BY CONTENT AREA**

When tests for each content area were examined separately, results showed that during year 1, PHHS Algebra 1 students had a significantly higher level of improvement from pre- to post-testing on the Algebra 1 multiple-choice and open-response tests as compared to students using other Algebra 1 programs, \(p<.05\), see Figure 24.

Figure 24. Algebra 1 Performance of PHHS Math and Control Students: Year 1

Prentice Hall Algebra 1 students demonstrated greater improvement on the Algebra 1 multiple-choice and open-response tests as compared to students using other Algebra 1 programs.

Among Geometry students in both school years, results showed a significant difference such that PHHS Math students had greater levels of improvement than

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\(^{31}\) The domain average improvement index for each study is computed based on the domain average effect size for that study rather than as the average of the improvement indices for individual findings within that study. In the case of the present study, the improvement index was calculated for Overall Math Multiple-Choice and Open-Response tests (averaged).
students using other Geometry math programs as measured by the multiple-choice test, $p < .05$. Thus, while results from year 1 showed no significant differences, combining data from both years of the study and increasing the sample available for analysis allowed for a more sensitive examination; PHHS Geometry students outperformed students using other math programs on the multiple-choice test, see Figure 25.

Figure 25. Geometry Performance of PHHS Math and Control Students: Combined Year 1 & Year 2

Results showed a significant difference on the Geometry multiple-choice test such that PHHS students demonstrated accelerated learning gains as compared to students using other Geometry programs. In contrast, on the Geometry open-response test, PHHS Geometry students and students using other Geometry programs showed similar levels of improvement.

As previously noted, Algebra 2 classes were examined during the 2010-11 school year. Comparisons of baseline performance showed significant pretest differences such that control students performed significantly higher than treatment students. Thus, analyses performed on the Algebra 2 sample explicitly controlled for pretest differences so that groups were equivalent save for the intervention. It is also noteworthy that the sample available was considerably smaller than those in the aforementioned analyses of Algebra 1 and Geometry classes. Thus, these analyses are limited by a smaller sample and hence, less power to detect differences. With this caveat in mind, results showed no significant differences between PHHS Algebra 2 students and students using other math programs, $p > .05$, see Figure 26. That is, Algebra 2 post-test performance on the multiple-choice and open-response tests were similar for PHHS Math and control students, after controlling for pretest differences.

Figure 26. Algebra 2 Post-test Performance of PHHS Math and Control Students: Year 2

Results showed no significant differences on the Algebra 2 multiple-choice and open-response tests between PHHS Algebra 2 students and control students, after controlling for pretest differences. Thus, PHHS Algebra 2 students and students using other Algebra 2 programs demonstrated similar math performance.

33 As compared to the other analyses of main effects which relied on 3 level HLM models (time at level 1), the analyses of the Algebra 2 sample consisted of 2 level HLM models, controlling for baseline differences at level 1.

34 The Algebra 2 sample consisted of approximately 500 students and 13 teachers.
Within each of the subject areas, all effect sizes for statistically significant findings were positive indicating a favorable effect of the PHHS Math program on student Algebra 1 and Geometry performance. In addition, the effect sizes obtained can be classified as small (d=.22 for Geometry and Algebra 1 Multiple-Choice and d=.37 for Algebra 1 Open-Response). When effect sizes are translated to the percent of treatment students that can be expected to be above the average of the control group, results show that PHHS Math students were 9 to 14 percentile points higher than the average control student, see Figure 27. Since there were no significant differences among Algebra 2 students, effect sizes for this subgroup of students are not presented.

Figure 27. Percent of PHHS Students Above and Below Average Relative to Control Students: By Subject

Within subject-specific tests, results show that 59% to 64% of PHHS Math students scored above the average control student in Algebra 1 and Geometry. In other words, PHHS Math students were 9 percentile points higher than control students on the Algebra 1 Multiple-Choice test, 10 percentile points higher on the Geometry Multiple-Choice test, and 14 percentile points higher on the Algebra 1 Open-Response test.

RESULTS BY YEAR

Given that data on Overall Math (aggregated across subject areas) and Geometry were available for each of the two study years (2009-10 and 2010-11), analyses were performed to examine if growth rates were similar or distinct for each of the study years. That is, these analyses provide information on whether or not the positive results observed in year 1 were consistent with those observed in year 2; replication of findings allows for greater confidence in conclusions observed.

It should be noted that the aggregated Overall Math score consisted of different subject areas (Algebra 1 and Geometry in year 1, and Geometry and Algebra 2 in year 2). With this in mind, results for year 2 showed that similar to year 1, PHHS Math students had significantly higher growth rates on the Overall Math Multiple-Choice and Open-Response tests as compared to students using other math programs, \( p<.05 \), see Figures 28 and 29. Thus, results for each of the two study years were consistent. This consistency in results lends confidence in the conclusion that the PHHS Math program has a positive impact on student performance.

It is also noteworthy that effect sizes obtained are higher than those observed during the first year of the study. The effect sizes for the PHHS Math program on student math performance were .22 for the Overall Open-Response test and .32 for the Overall Multiple-Choice test. These effect sizes are higher than those obtained last year (.13 for both tests), suggesting that stronger effects were evident as teachers and a subsample of students had more experience with PHHS Math.
Similar to year 1, results for year 2 showed that PHHS Math students outperformed students using other math programs as measured by the Overall Multiple-Choice and Open-Response tests. Such consistency lends confidence in the conclusion that the PHHS Math program positively impacts student math learning.

Comparisons between the performance of Geometry students in year 1 and year 2 showed that whereas no significant differences were observed in year 1\(^{35}\), year 2 PHHS Geometry students demonstrated greater learning gains than students using other Geometry programs on the Geometry Multiple-Choice test, \(p < .05\), see Figure 30. Similar to year 1, no such differences were observed on the Geometry Open-Response test. Effect sizes observed for Geometry in year 2 were also larger than those in year 1 (\(d = .11\) for year 1 and \(d = .22\) for year 2). Thus, a larger positive impact was observed in the second year of the study, likely due to PHHS Math teachers and a subsample of students having more experience with the program.

In Geometry, while no significant differences were observed in year 1, during the 2010-11 school year PHHS Geometry students demonstrated accelerated learning gains as compared to students using other math programs on the multiple-choice test.

In sum, these findings along with other longitudinal studies researchers have conducted on educational curricula, suggest that a two year study produces stronger results than those observed in a one-year study as it evens the playing field between control and treatment groups. That is, whereas in a one-year study, treatment teachers and students experience a learning curve as they become accustomed to the new program which can negatively impact effect estimates, a two (or more) year study helps reduce this barrier since teachers and students are allowed more time to become familiar with the program. Thus, the two year study design promotes a clearer

\(^{35}\) As noted in the Year 1 Report, due to budgetary constraints, the Geometry sample was smaller in year 1 than year 2. Hence, lack of significant differences may have been due to lack of power.
comparison between groups and consistency in results over two years helps produce confidence in the conclusions observed.

**Do effects of Prentice Hall High School Math program on student math performance vary as a function of different student characteristics and different types of control programs?**

To examine if there were differences in performance between separate subgroups of PHHS Math and control students, subgroup effects were analyzed via multilevel modeling. Given the small sample sizes available for some subgroups, analyses were run using the Overall Math score for Algebra 1, Geometry, and Algebra 2 across the two years of the study (i.e., combined sample). Differences between PHHS Math students and control students in the following subgroups were examined: grade, gender, math level, free/reduced lunch status, and ethnicity. In addition, analyses were also conducted to examine if differences existed by type of control program used. As previously noted, multilevel models account for statistical issues that can affect the validity of the results. Furthermore, it is important to view these analyses as exploratory. Significant subgroup differences are discussed in the following sections.

**RESULTS BY STUDENT SUBPOPULATIONS**

Results showed significant differences between PHHS Math students and control students who were female, White, Hispanic, on free/reduced lunch, and in grades 9 and 10. In all cases, PHHS Math students showed greater math learning gains as compared to control students. Thus, PHHS Math students who were female, White, Hispanic, receiving free/reduced lunch, and in the 9th and 10th grades showed higher levels of performance on at least one of the Overall Math subtests as compared to control students who were in these subgroups. Moreover, in no case were significant differences observed in favor of the control group (i.e., all subgroup effects were positive).

It is noteworthy that findings for free/reduced lunch students and students in the 9th grade are consistent with those observed last year. During year 1, African American students also showed positive subgroup effects; however during year 2, Whites and Hispanics using PHHS Math outperformed Whites and Hispanics using other math programs, and no significant differences were observed among African Americans. It is also interesting to note that while last year’s 10th graders showed a negative effect (i.e., control students in 10th grade outperformed treatment students in 10th grade), 10th graders in year 2 showed a positive effect. This reversal in effect may be due to teachers and a portion of the students gaining experience with the PHHS Math program so that benefits were realized during the second year.

In sum, results by subpopulations show that the PHHS Math program had a positive impact on certain special populations. Figures 31-36 display these significant differences over time.

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36 It is important to view this analysis as exploratory for a number of reasons: (i) the treatment and control groups were not randomized by subgroups; (ii) the sample sizes for a number of the subgroups are quite small; and (iii) differences were obtained between the treatment and control groups at baseline for some of the subgroups. See the accompanying technical report for additional details and elaboration.
Female students who used the Prentice Hall High School Math program showed significantly greater growth on the Overall Math Multiple-Choice test as compared to females using other math programs.

White PHHS Math students showed accelerated learning gains on the Overall Math Multiple-Choice and Open-Response tests as compared to students who used other math programs. Thus, there was a closing of the initial gap in math performance.

Accelerated learning gains among Hispanics using PHHS Math were observed as well. While Hispanic control students had higher pretest scores, during post-testing Hispanic PHHS Math students caught up with control students.

Students receiving free/reduced lunch and who used PHHS Math showed significantly greater growth on the Overall Math multiple-choice test as compared to students who used other math programs. Indeed, while PHHS Math students receiving free/reduced lunch initially had lower scores than other low-income control students, they surpassed control students during post-testing.
PHHS Math students who were in 9th grade showed more significant growth on the Overall Math Multiple-Choice and Open-Response test than students who used other math programs.

PHHS Math students who were in 10th grade also showed accelerated learning gains on the Overall Math Multiple-Choice test as compared to 10th graders students using other math programs.

**Results by Math Level**

It is important to closely examine the extent to which math programs contribute to the continued progress of students at differing ability levels. With that in mind, students were categorized into math levels depending on the type of class they were in. Students who were in self-contained special education classes or were in remedial Algebra 1 or Geometry classes were classified as low ability students. Students in regular Algebra 1, Geometry or Algebra 2 classes were classified as mid-level students. Students in honors courses or in 8th grade Algebra (for advanced students) were classified as high-level students. Across all subject areas, a significant difference was observed among high math ability students in that PHHS Math students showed significantly greater growth than control students on the Overall Math multiple-choice and open-response test, \(p < .05\), see Figure 37. These findings were consistent with those observed in year 1. Additionally, marginally significant differences were observed among mid-level students such that PHHS Math students of average ability had higher learning gains than control students of average ability, \(p < .10\), see Figure 38. Students of low ability levels showed comparable rates of growth across both treatment and control programs.

High ability students who used PHHS Math students showed more improvement on the Overall Math Multiple-Choice and Open-Response tests as compared to students who used other math programs.
Among average ability students, a marginally significant difference was observed such that students who used PHHS Math showed more growth on the Overall Math Multiple-Choice and Open-Response tests than students who used other math programs.

**RESULTS BY CONTROL PROGRAM**

Results also showed significant differences between PHHS Math students and control students depending on the type of control math program. In particular, comparisons were made between students who used the PHHS Math program (a blended program which incorporates UbD and print and digital formats) as compared to students who used traditional basal programs [program 1, 2, 3 or a compilation of basal approaches (Algebra 1 program 4)].

Results from year 1 on the comparison between the compilation of basal programs used to teach Algebra 1 (4) and the PHHS Algebra 1 program showed a positive program effect as measured by the multiple-choice and open-response tests, after controlling for pretest differences, \( p<.05 \), see Figure 39. Additionally, similar to the prior year, results across the combined sample (from years 1 and 2) showed a positive program effect when PHHS Math was compared to control program 1 (a basal program) as measured by the Overall Open-Response test, \( p<.05 \), see Figure 40.

Moreover, whereas last year a negative effect was observed when PHHS Math was compared to control program 2, the data across both study years showed that PHHS Math students had significantly greater growth than users of program 2 on the Overall Math multiple-choice test, \( p<.05 \), see Figure 41. Comparisons between the PHHS Math program and the older basal control program (3) also yielded significant differences with PHHS Math students showing accelerated learning gains as compared to students using control program 3, \( p<.05 \), see Figure 41.
Students using the Prentice Hall High School Math program showed significantly better math performance on the Overall Math test across all traditional basal math programs (programs 1, 2, 3 and 4).

Does participation in PHHS Math result in other positive outcomes?

While the primary focus of the Prentice Hall High School Math program is to improve students’ Algebra 1, Geometry and Algebra 2 understanding and skills, the program incorporates a number of program components that may have an impact on other important aspects of math education, including affective attitudes. Measures were included in the RCT to explore whether use of PHHS Math was associated with changes in student attitudes towards math as well as changes in teacher practices and attitudes. What follows are the results from the second year of the study.37

**STUDENT ATTITUDES TOWARDS MATH**

*The PHHS Math program is better because I feel more encouraged to learn. I no longer feel confused because there are always more resources to better my understanding.* – PHHS Math Student

Comparison of data collected on math-related student attitudes showed a significant difference between PHHS Math students and control students on college readiness, \(F(1, 818)=7.80, p<.01\). In particular, control students felt that they were more academically prepared for college math courses than PHHS Math students. Note that this is inconsistent with the prior year’s results in which PHHS Math students indicated having a greater perception of college readiness than control students. No other significant differences were found in usefulness of math, math-related anxiety, math enjoyment, math effort and motivation, or engagement in math problem solving/planning as measured by the post-survey,38, \(p>.05\), see Figure 42. In general,

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37 Year 1 results are available in the September 2010 report on the Effects of PHHS Math.
38 Analyses controlled for pre-survey attitudes.
both treatment and control students demonstrated moderate levels of positive attitudes towards math.

Consistent with the prior year, when changes among treatment students only was examined, results showed that PHHS Math students demonstrated significant growth from pre to post-surveys on future plans in math, \( t(453)=3.77, p<.01 \), and educational aspirations, \( t(422)=5.55, p<.01 \), see Figure 43. That is, treatment students reported increases in their perceptions of how far they expected to go in school and in future math course-taking.

**Figure 43. PHHS Students’ Educational Aspirations and Future Math Plans: Pre-Post**

With exception of math-related anxiety, higher scores indicate more positive attitudes. Based on scale of 1-5.

*Significant at \( p<.05 \)

The PHHS Math program was better because you can understand the steps to getting the answer to the problems and also it explains more than the last math program. – PHHS Math Student

I like PHHS Math. It’s better because I can access it where ever I am and read and see problems done out for me to show how it's done. – PHHS Math Student

PHHS Math students also felt that their teacher was more aware of students’ level of understanding, \( F(1, 853)=3.55, p<.05 \), as compared to students using other math programs, see Figure 44. Unlike the prior year, when PHHS Math students experienced significantly greater support from their teachers, no such differences were observed in year 2.
Students were asked the extent to which their math program helped them in learning math skills and concepts. In contrast to the prior year when PHHS Math students tended to feel that their math program helped them learn math, no significant differences were observed in year 2, $p > .05$, see Figure 45. Thus, both treatment and control students felt that their math programs helped them learn math.

Figure 45. Student Perceptions of Impact of Math Program on Student Learning

PHHS Math students were also asked whether specific PHHS Math program components were helpful to their math learning. Figure 47 shows that the vast majority (over 85%) reported that the organization of the program around Essential Questions and the plethora of technology embedded within the program enhanced their understanding of math.

PHHS Math students were also asked whether specific PHHS Math program components were helpful to their math learning. Figure 47 shows that the vast majority (over 85%) reported that the organization of the program around Essential Questions and the plethora of technology embedded within the program enhanced their understanding of math.
In contrast to year 1 results, control students felt more prepared for college math courses as compared to PHHS Math students. However, similar to year 1, treatment students felt that their teachers had a greater awareness of their level of understanding. Moreover, significant positive changes were observed among PHHS Math students in their educational aspirations and future plans for math course-taking. PHHS Math and control students felt similarly with respect to the assistance provided by their math programs; both felt their math programs helped them to learn math and to become better problem solvers.

**Teacher Perceptions of Student Skills**

Teachers were also asked about the impact of the program on their students. As shown in Figure 48, while no significant differences were evident, treatment teachers tended to feel more strongly that the PHHS Math program academically challenged their students. Moreover, all PHHS Math teachers reported that their students clearly learned math and were challenged by the PHHS Math program.

The program is very scripted in some ways and that type of intentionality lends itself to both an improved student understanding of math, because all steps are shown and explained and it also provides specific feedback so that students know what they do not understand. – PHHS Math Teacher

This program has given most students an opportunity to succeed in math; the PHHS Math approach lets me get them at their level. – PHHS Math Teacher

I like that the kids have access to everything; I think there’s no excuse for them not to try or have their work done. – PHHS Math Teacher
When teachers rated the PHHS Math and control programs on the extent to which each program helped develop different skill areas, teachers showed no significant differences in their ratings, $p > .05$. However, similar to the prior year, PHHS teachers ratings with respect to the program increasing students’ higher order thinking skills, ability to solve word problems, and improving on students computational skills was higher than that of control teachers, see Figure 49.

**Figure 49. Teacher Ratings of Impact of Programs on Math Skill Areas**

There was more emphasis on problem solving which makes it easier for everyone, because it allows different ways to get at or solve a problem and all levels of students can do that. – PHHS Math Teacher

Participating teachers were also asked to rate how well their respective programs assisted students with reading and writing skills, as well as ELL students in particular. Again, while not statistically significant, treatment teachers reported a more positive impact by the PHHS Math program as compared to teachers using other math programs on students’ reading and writing skills, particularly as it relates to students with limited reading/writing skills, see Figure 50.

**Figure 50. Teacher Perceptions of Impact of Program on Reading/Writing Skills**

I like the Got Its, because students are forced to write and figure it out. – PHHS Math Teacher

While no significant differences were observed between treatment and control teachers with respect to the impact of their respective math programs on student skills, results showed that PHHS Math teachers generally had more positive perceptions about the PHHS Math program’s impact on student skills than control teachers. In particular, a higher percentage of PHHS Math teachers felt that the PHHS Math program was useful in increasing students’ higher order thinking skills, ability to solve word problems, computational skills, and reading and writing skills as compared to control teachers. Moreover, all PHHS Math teachers reported that their students clearly learned math and were challenged by the PHHS Math program.
**Preparation for Future Math Tests/Courses**

In addition, teachers responded to items about how well the PHHS Math and control programs prepared their students for future math courses and assessments. As shown in Figure 51, there was a higher level of agreement among treatment teachers who indicated that the PHHS Math program prepared their students to do well in future exams (including state and national exams) as compared to control teachers, though differences were not significant. Note that these positive findings are also consistent with year 1 results.

**Student Engagement**

Consistent with the prior year when asked the extent to which the math programs kept students engaged in math, results showed that in general, treatment teachers and students expressed that the PHHS Math program was more engaging than teachers and students using other math programs, see Figure 52. In particular, PHHS Math teachers reported that their students were more engaged, and a higher percentage of PHHS Math students reported enjoying the math in their program and felt that the content presented kept them interested in learning. That said, results were not statistically significant.

**All treatment teachers reported that the PHHS Math program helped prepare their students for future math courses and exams.**

I really like the standardized test prep questions; a lot of our students haven’t seen this and it really helps them prepare for state testing. – PHHS Math Teacher

I like the Exam View; I assess a lot and having that available is helpful, it allows me to assess and re-teach with ease so my students do better on the next test. – PHHS Math Teacher

I find the [PHHS] math program to be more useful and interesting than the previous books I have used in the past. – PHHS Math Student

I like the interactive visuals, of things moving, because I can’t show that on paper and it keeps students tuned in. – PHHS Math Teacher

With respect to student engagement, the majority of treatment teachers and students expressed that the PHHS Math was engaging and kept students interested in math.
CONNECTIONS WITH REAL WORLD AND OTHER SUBJECT AREAS

Though not significantly different, compared to the control programs, teachers rated the PHHS Math program higher with respect to helping students see connections between math and the real world, see Figure 53. In general, the majority of both treatment and control teachers reported that their respective math programs helped students make connections with other subject areas.

Figure 53. Teacher Perception of Program’s Impact on Students’ Ability to Make Connections

The Pearson Math program has more real life problems so I feel the math I’m learning is useful. – PHHS Math Student

The Solve Its are a strength of the program; they bring more practical use to the material and that’s a good thing. – PHHS Math Teacher

The majority of PHHS Math teachers (over 80%) reported that their math program helped their students to make connections between math and the real-world as well as other subject areas. That said, no significant differences were observed between treatment and control teachers.

IMPACT OF TECHNOLOGY

Since the PHHS Math program employs a blended approach of both digital and print materials, treatment teachers were asked whether use of the digital technology had any impact on students’ math understanding and interest. As shown in Figure 54, while over half of the treatment teachers felt the technology affected students’ math understanding, only 37.5% indicated that it helped keep students interested in math. It is notable that these findings are essentially the same as the prior year.

PHHS Math teachers again commented that the technology helped students to stay engaged with important math concepts and that this helped with their understanding, but that over time their interest with technology for the sake of technology diminished; that is, even though the novelty of the technology wore off and most teachers reported that there were no sustained increases in engagement over time, the technology was nevertheless engaging to students.

Figure 54. PHHS Teacher Perceptions of Impact of PHHS Math Technology on Students

The technology is something different and different is generally engaging; it is also interactive to some extent, as students are expected to respond after each problem with the Got Its and this holds them accountable.
for attending to the materials. – PHHS Math Teacher

Over ¾ of PHHS Math students reported that the technology used in math classes was interesting and kept them motivated in math, see Figure 55. Moreover, all differences between PHHS Math and control students were statistically significant and in favor of the PHHS Math technology, $t(898)=2.72, p<.05$, $t(900)=2.97, p<.05$, and $t(897)=3.54, p<.05$ respectively. Thus, according to students, the technology embedded within the PHHS Math program had a positive impact on student engagement and interest.

Figure 55. Student Perceptions of Impact of Technology

The PHHS Math technology is very good and helpful because we like to learn things in different ways, not only from the book. – PHHS Math Student

Using technology was very useful for me. It [PHHS Math Technology] helped me to understand the problem with the steps and examples that were given. – PHHS Math Student

I enjoy the technology of the new Pearson High School Math program because it keeps my attention and uses realistic examples which focus on the lesson. – PHHS Math Student

As noted in Figure 56, the majority of teachers felt that the PHHS Math technology had a positive impact on student math understanding. When comparisons were made between treatment and control teachers, results showed significant differences such that PHHS Math teachers reported that the technology embedded within their program helped enhance student’s understanding of math to a greater extent than control teachers, $t(26)=1.45, p<.05$ and $t(26)=1.66, p<.05$ respectively.

Figure 56. Teacher Perceptions of Impact of Technology

For some kids technology is a learning style and some perform better when they can manipulate things on their own and the technology allows them to do that. – PHHS Math Teacher

I like this program [PHHS Math] for the fact that it has all the digital resources; most of my students struggle with math, but most of them do better with technology. – PHHS Math Teacher

For some kids technology makes it easier to learn math, they don’t always have to hear me talk and it’s not always the same. – PHHS Math Teacher

Students are more engaged during my lessons with the [PHHS] digital path than they have been in the past. – PHHS Math Teacher
Results showed that the technology embedded within the PHHS Math program had a positive impact on student engagement and that the use of the PHHS technology enhanced student math understanding.

**Teacher Perceptions of Support Provided by Program**

Teachers were asked the extent to which their math program assisted them with their practices. Similar to year 1, while no significant differences were evident, treatment teachers expressed that the PHHS Math program assisted them to more effectively assess their students and monitor their students’ progress as compared to teachers using other math programs, see Figure 57. Anecdotally, PHHS Math teachers also reported that they had higher homework completion rates as compared to when they used the prior math program.

With respect to providing individualized instruction, including meeting the needs of different types of learners, there were no significant differences observed, *p > .05*. However, there were positive trends which showed that in general, the PHHS Math program provided greater assistance with individualized instruction, in particular as it relates to on-level and below-average students, as compared to control programs, see Figure 58. In contrast, control teachers reported greater assistance from their program in meeting the needs of their advanced students than treatment teachers. Of note is that these results were consistent with the prior year’s findings; teachers also found the PHHS Math program to provide greater support for students of various levels with the exception of advanced learners.

Figure 57. Teacher Perceptions of Program’s Assistance on Helping Them Monitor Student Progress and Understanding

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>PHHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allow you to effectively formally assess students understanding via tests and quizzes</td>
<td>91.7%</td>
<td>93.8%</td>
</tr>
<tr>
<td>Help you determine your students’ level of understanding during the lesson</td>
<td>91.7%</td>
<td>93.8%</td>
</tr>
<tr>
<td>Help you in assessing whether your students had the prerequisite knowledge to understand a new topic</td>
<td>83.3%</td>
<td>93.8%</td>
</tr>
</tbody>
</table>

Figure 58. Teacher Perceptions of Program’s Assistance on Individualization of Instruction

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>PHHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help you individualize instruction to the needs/developmental levels of the students</td>
<td>91.7%</td>
<td>93.8%</td>
</tr>
<tr>
<td>Help you provide individualized instruction to the “average” students</td>
<td>91.7%</td>
<td>93.8%</td>
</tr>
<tr>
<td>Help you provide individualized instruction to “below-average” students (e.g., remediated)</td>
<td>87.5%</td>
<td>63.3%</td>
</tr>
<tr>
<td>Help you provide individualized instruction to “advanced” students (e.g., enrichment/challenge)</td>
<td>10.0%</td>
<td>75.0%</td>
</tr>
</tbody>
</table>

My students run towards the middle, so that’s how I tend to teach and there are plenty of resources for that, but I think there are great resources for high and low students if/when I need them. – PHHS Math Teacher

It’s [PHHS Math program] good for everyone; it has the range for all learners even within the actual problems. – PHHS Math Teacher

[PHHS Math] program has really helped us to identify what skills students missed in previous math classes and that’s helped with my ability to teach them now. – PHHS Math Teacher
Teachers also reported on how well their program helped them in terms of lesson planning and preparation. As shown in Figure 59, more treatment teachers felt that the PHHS Math program saved them time in terms of lesson preparation and provided them with the requisite knowledge to teach lessons. In addition, both treatment and control teachers felt similarly about their respective programs’ assistance in pacing to meet objectives, selection/assignment of independent practice, and in the provision of good ideas for math-related activities.

**Figure 59. Teacher Perceptions on the Program’s Assistance on Lesson Planning/Preparation**

<table>
<thead>
<tr>
<th>Assistance Provided</th>
<th>Percent Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help you pace your class so that you could meet all your objectives before the end of the year</td>
<td>100.0%</td>
</tr>
<tr>
<td>Help you in the selection and assignment of independent practice</td>
<td>75.0%</td>
</tr>
<tr>
<td>Save you time as it relates to lesson preparation</td>
<td>75.0%</td>
</tr>
<tr>
<td>Provide you with the requisite knowledge to teach the lesson</td>
<td>75.0%</td>
</tr>
<tr>
<td>Provide you with good ideas for math-related activities</td>
<td>75.0%</td>
</tr>
</tbody>
</table>

The [PHHS Math] technology really helps me plan, because I can access resources anywhere; I can print what I need from anywhere. – PHHS Math Teacher

I was able to offer more opportunities for extra credit, because the [PHHS Math] program provided an abundance of resources. – PHHS Math Teacher

I love it that we have all these resources and that they are available online; I spent a lot of time looking for resources before this program and it has made it much easier for me with lesson planning, testing and tutoring. – PHHS Math Teacher

I like [PHHS Math] a lot; I like the way it’s presented, they’re very good about getting you started and then continuing the concept with further problems. – PHHS Math Teacher

**Similar to year 1, treatment teachers felt that the PHHS Math program assisted them with their practices. In particular, treatment teachers expressed that the PHHS Math program provided greater assistance than teachers using other math programs in terms of: a) assessing and monitoring their students’ progress, 2) saving time as it relates to lesson preparation, 3) providing requisite knowledge to teacher lessons, and 4) providing individualized instruction, in particular for on-level and below-average students.**

**Teacher Knowledge and Attitudes**

Teachers were also asked about their knowledge of students’ ability levels, preparation to teach math topics, comfort with technology, perceptions of effectiveness/usefulness of technology, pedagogical leaning (basal vs. inquiry), and classroom practices via the teacher survey. While no differences were observed between treatment and control teachers, analyses of change (paired t-test) among PHHS Math teachers showed two significant changes in their perceptions. Specifically, Pearson High School Math teachers experienced greater levels of comfort with technology usage and knowledge or awareness of their students’ understanding of math on the post-survey as compared to the pre-survey, t(15)=3.63, p<.05 and t(15)=2.81, p<.05 respectively. See Figure 60. Of note is that the findings on teacher knowledge of student understanding is consistent with the findings obtained from PHHS Math students; treatment students also felt that their
teachers had greater awareness of their level of understanding.

**Figure 60. Changes in PHHS Math Teacher Attitudes and Perceptions**

*I was introduced to some strategies I had not encountered before for solving problems and I found this helpful for me as a teacher; it creates a deeper understanding of the concept for me, which enables me to help students understand at a deeper level.*

— PHHS Math Teacher

In summary, results were fairly consistent with those obtained in year 1 -- Prentice Hall High School Math had positive effects on student and teacher attitudes. In particular, PHHS Math students felt that their teachers had a greater awareness of their level of understanding. In addition, significant positive changes were observed among PHHS Math students in their educational aspirations and future plans for math course-taking, and PHHS Math teachers experienced greater levels of comfort with technology usage and knowledge or awareness of their students’ ability levels. Furthermore, while not statistically significant, treatment teachers generally felt more assistance from the PHHS Math program than control teachers. For example, PHHS Math teachers had more positive perceptions about the PHHS Math program’s impact on student skills than control teachers; a higher percentage of PHHS Math teachers felt that the PHHS Math program was useful in increasing students’ higher order thinking skills, ability to solve word problems, computational skills, and reading and writing skills as compared to control teachers. Treatment teachers also expressed that the PHHS Math program provided greater assistance than teachers using other math programs in terms of: a) assessing and monitoring their students’ progress, 2) saving time as it relates to lesson preparation, 3) providing requisite knowledge to teacher lessons, and 4) providing individualized instruction, in particular for on-level and below-average students. With respect to the effect of technology, results showed that the technology embedded within the PHHS Math program had a positive impact on student engagement and that the use of the PHHS technology enhanced student math understanding. That said, one significant difference in favor of the control programs was observed; students using other math programs felt more prepared for college math courses as compared to PHHS Math students.

*This is likely due to the small sample size and inherent lack of power of these analyses.*
What did users of the Prentice Hall High School Math program think about the program?

**Student Perceptions of Overall Program**

Analysis of student surveys showed that while students in Prentice Hall High School Math classrooms enjoyed using the program, they did not like it any better than their previous math program, see Figure 61.

**Figure 61. PHHS Math Student Average Rating on the Extent to Which the PHHS Math Program Compares to Last Year’s Math Program**

In particular, while there was a lot of positive feedback with respect to the Prentice Hall High School Math program, and especially about the technology, there were also students who found the program more “confusing” because of the stepped out work they had to do to find solutions (e.g., the program asks students to plan out how they would find a solution rather than simply solving the problem). Thus, preference (or lack thereof) for the program may have more to do with differences in student learning styles and specifically how they prefer to learn. Below are sample comments that illustrate this varying feedback:

*I like how the Pearson program explains in steps how to successfully complete problems.* - PHHS Math Student

*I dislike the Pearson High School math program, because they make the work look difficult when the teacher makes it easier.* - PHHS Math Student

Treatment and control students were also asked about the extent to which they enjoyed their math program this year and whether they would like to continue using it. Figure 62 shows that almost 80% of students liked the PHHS Math program and wanted to continue using it in the subsequent year. However, such percentages were comparable to control students and no significant differences were observed on these survey items.

**Figure 62. Student Rating of their Math Program**

*I have a hard time learning from technology, therefore I prefer last year’s program compared to this one.* - PHHS Math Student

*I have a hard time learning from technology, therefore I prefer last year’s program compared to this one.* - PHHS Math Student

The workbook was really helpful and it made my senior year simpler. - PHHS Math Student

You should do this [PHHS Math program] for other schools; it will get students more involved. I hope it stays the same and that nothing will change; it’s perfect! - PHHS Math Student

I can’t wait until next year to use Pearson [PHHS Math] in my math class! - PHHS Math Student
PHHS students felt that math was more clearly explained as compared to control students, \( t(867)=2.289, \ p<.05 \), see Figure 63. There were no differences between groups on how appropriate the difficulty level of the program was and on the usefulness of sample problems included in the textbook.

Figure 63. Average Student Ratings of the Assigned Math Program

Higher scores indicate more positive attitudes. Based on scale of 1-5. *Significant at the \( p<.05 \) level.

It [PHHS Math] shows you how to solve problems really well. - PHHS Math Student

I think learning in this book [PHHS Math] is better than previous books, because it’s organized and got to the point by describing the section. - PHHS Math Student

[PHHS Math] is helpful because I can see step by step directions that I can use to solve a problem. - PHHS Math Student

Students who used Prentice Hall High School Math over the course of the school year perceived their math program more favorably than students using other math programs. In particular, they felt that math was explained more clearly as compared to control students.

Teacher Perceptions of Overall Program

Information obtained from treatment teachers indicated that, while over \( \frac{3}{4} \) of teachers using Prentice Hall High School Math were satisfied with their math program and felt it was an effective tool in mathematics instruction, a greater percentage of control teachers were satisfied with their program and felt it was an effective instructional tool, see Figure 64. However, a greater proportion of teachers using the PHHS math program (81.3%) said they would recommend their math program to other teachers as compared to control teachers (66.7%).

Figure 64. Teacher Attitudes on Math Programs

There’s a lot of resources and it’s [PHHS Math] laid out well with a ton of independent practice which I like. – PHHS Math Teacher

I wasn’t sure I would like this program [PHHS Math] at the beginning of the year, but I love it now and can’t imagine teaching without it! - PHHS Math Teacher
PERCEPTIONS OF TECHNOLOGY

Treatment students and teachers were asked how they felt about the technology included as part of the PHHS Math program. Figure 65 shows that approximately 88% of teachers and 82% of students enjoyed the online content and presentation materials included as part of the PHHS Math. The majority of students (84.9%) also indicated that they liked the technology they used as part of PHHS Math.

Figure 65. Treatment Students and Teachers Attitudes on PHHS Math Technology

The digital catches their attention and most of the time it’s a positive motivator. - PHHS Math Teacher

The technology does enhance student learning; when the students are on the laptops it’s more interactive and entertaining than a paper and pencil. - PHHS Math Teacher

I like that I can print some of the slides, that way the students don’t always have to take notes, but they still get them to study. PHHS Math Teacher

When specifically asked about the technology included in the Prentice Hall Math program, 75% of teachers agreed that the technology was easy to use and 73% felt it was an effective tool for math instruction. However, less than half of the treatment teachers (44%) felt that students enjoyed learning math more when using the PHHS technology, see Figure 66.

Figure 66. PHHS Teacher Attitudes about the Prentice Hall High School Math Technology

I think it’s [PHHS Math technology] a good idea, especially for a society that is growing in technology everyday. - PHHS Math Student

The digital helps with the repetition of things and my students need that, they really like the repetition. PHHS Math Teacher

Comparisons across treatment and control students showed that PHHS Math students rated the technology in their math program significantly higher than control students, t(741) = 4.091, p < .001. PHHS Math teachers also had higher ratings for the overall technology in the program (69%) as compared to control teachers (50%), see Figure 67.

Figure 67. Teacher & Student Attitudes about the Technology in Program
RESOURCES AND PROGRAM COMPONENTS

When asked to rate the specific resources within their respective math programs, treatment students rated the resources in the PHHS Math program higher than control students in all areas, including: math workbook; types of practice problems, text book and in-class activities, see Figure 68. Such differences were significant in the areas of the math workbook \( t(745)=5.278, p=.000 \), and in-class activities \( t(721)=2.462, p<.05 \).

The online workbook and activities were useful and helped a lot. – PHHS Math Student

Mixed results were found when teachers were asked about the resources within their respective math programs. Specifically, control teachers had higher ratings than treatment teachers in the areas of independent practice exercises, assessments, and the extent to which the program incorporated reading/writing into math, see Figure 69. That said, it should be noted that the majority of PHHS Math teachers did have positive attitudes about these resources as well. Indeed, anecdotal feedback obtained

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*Significant at the \( p<.05 \) level.
during qualitative data collection indicated that teachers felt that the availability and variety of resources, both digital and print, was one of the program’s strongest assets.

*I love the digital path for instruction and the amount of additional resources available in the all-in-one workbook.* – PHHS Math Teacher

With respect to the enrichment and remediation resources available with their programs, 100% of PHHS Math and control teachers found the remediation resources to be useful. Control teachers (100%) were more likely to feel that the enrichment resources were useful though as compared to PHHS Math teachers (76.9%), \(t(23)=-1.735, p<.10\), see Figure 70.

**Figure 70. Teacher Ratings of Program’s Enrichment and Remediation Resources**

![Graph showing teacher ratings of enrichment and remediation resources](image)

**Marginally Significant at p<.10**

*I think it’s [PHHS Math] better than other programs for students that need remediation; I even use the ELL worksheets as remediation; it helps give them more awareness of what’s going on.* – PHHS Math Teacher

Overall, the resources provided to teachers for purposes of professional development and planning by the PHHS program were rated as useful, although control teachers were more likely to rate the teaching tools as useful, see Figure 71.

**Figure 71. Teacher Ratings of the Teaching Tools provided by their Math Program**

![Graph showing teacher ratings of teaching tools](image)

The majority of treatment and control teachers felt that their math programs were easy to use and well-organized, see Figure 72. Anecdotal information obtained from PHHS Math teachers indicates that teachers especially liked the availability of all the resources, both digital and print and noted that it helped them customize lessons and assignments for students with ease and save time in planning. The majority of teachers indicated that they found the availability of resources online to be a big time saver and allowed flexibility related to when and where they did their planning.

**Figure 72. Teacher Attitudes about Ease of Use and Organization of Math Program**

![Graph showing teacher attitudes about ease of use and organization](image)

[PHHS Math] has given me more structure as a new teacher and that makes a big difference. – PHHS Math Teacher
The [PHHS Math] textbook and program in general, I like the flow of it; I can really pinpoint what I want to do for that day and hit the objectives dead on.” - PHHS Math Teacher

I will have no problem using this program for the next five years! – PHHS Math Teacher

Ratings of specific PHHS Math components indicated that the majority of teachers found key components of the program as useful, see Figure 73. Specifically, over 75% found the practice and problem-solving exercise, sample problems, Got Its, Lesson Check, Think/Plan/Write activities, Solve Its, and Essential Understandings/Questions as useful.

Figures 74-75 display the percent of teachers who found PHHS Math ancillary resources and online PowerAlegebra./Geometry.com resources useful. As shown, over 60% of teachers rated the All-in-One Teaching Resources, ExamView, Practice and Problem-solving Workbooks, Solve It/Lesson Quiz transparencies, Progress Monitoring Assessments, and the CD-ROMs with ExamView, Answers and Solutions, and the Teachers Edition as useful. Among the resources available on PowerAlegebra./Geometry.com, over 50% of PHHS Math teachers indicated that these resources were useful or very useful for all areas with the exception of the student generated videos.

My students felt that they were able to gain a better understanding of the concepts by having the avatars explanation as well as mine. PHHS Math Teacher
Figure 74. Teacher Ratings of PHHS Math Teacher Resources

- All-in-One Teaching Resources: 100.0%
- Practice and problem solving workbook: 100.0%
- Solve It/Lesson Quiz Transparencies: 100.0%
- ExamView Test Generator CD-ROM: 93.8%
- Answers and Solutions CD-ROM: 87.5%
- Progress Monitoring Assessment: 87.5%
- Teacher's Edition with Teaching Resources CD-ROM: 70.0%
- Teaching with TI Technology: 42.9%
- Student companion worktext: 25.0%
- TI-Inspire Lesson Support CD-ROM: 25.0%
- Spanish Student Edition: 16.7%
- Student companion worktext: 16.7%
- Student edition on CD-ROM: 0.0%

Percent Usefulness

Figure 75. PHHS Teacher Usefulness Ratings of the PowerAlgebra(Geometry).com Resources

- Online problems: 90.0%
- Teaching Resources with editable worksheets: 85.7%
- Online Homework and Workbook pages: 63.3%
- SuccessTracker online assessments and remediation: 77.8%
- Teacher's Edition online with Audio: 70.0%
- Vocabulary support: 69.2%
- Tutorial Videos: 63.6%
- Student Edition online with Audio: 60.0%
- Multilingual Support: 57.1%
- Portable Study Center: 50.8%
- Student generated videos: 33.3%
In year two, when teachers were asked to identify the three things they liked best about the PHHS Math program there were a variety of responses, but the following three items were consistently mentioned:

- Digital Component
- Amount and variety of resources provided
- Teachers Edition

In general teachers were extremely pleased with the digital components and the flexibility this allowed them in accessing the plethora of resources, including the online Teachers Edition. Teachers indicated that the variety of resources and the online availability helped with planning and time management in general.

_I love the numerous materials, the editable worksheets, the homework videos, the ability to sign up students that have Internet access for review, and practice; it was great._ – PHHS Math Teacher

_Being able to access my Teacher Edition from home, or even when I’m away from home, is huge!_ – PHHS Math Teacher

_At the start of the study I was overwhelmed by all the resources, but now I am so grateful they are there and that I can take advantage._ – PHHS Math Teacher

In addition to the program components that teachers liked, they also provided useful feedback related to program weaknesses and areas for improvement. The primary areas that teachers noted as needing improvement were similar to year one. For instance, they indicated the Student Companion workbooks were too difficult, specifically the way problems were stepped out using the yellow boxes. Teachers reported that students found this confusing and that in general it was very difficult to try to explain the process to students.

_The student companion needs a little work, the yellow boxes are distracting and makes it more confusing._ – PHHS Math Teacher

_The yellow box thing problems we work out are hard and confusing in the workbooks._ – PHHS Student

Again, similar to year one, teachers also reported that the timeout feature on the digital path, small size of the interactive path and technology bugs in general were frustrating, emphasizing that this affected student engagement and learning. Teachers cited the slowness of the online digital and timeout issues as the number one barrier towards fully implementing the digital path on a daily basis.

_The timeout is killing me here; if I go to talk to a student or we’re working through something on the white board I lose my place on the digital and it’s just a headache._ – PHHS Math Teacher

_I continue to complain about the size of the font on the online tutorial and the lack of ease in using it._ – PHHS Math Teacher

_I want to like the [PHHS Math] technology and I do, but it’s so slow and with my students that equates to boring and when they’re bored the behavioral issues get out of hand, so the technology doesn’t work in my room._ – PHHS Math Teacher

In summary, the majority of teachers and students liked the PHHS Math program, would like to continue using the program in subsequent years, and found the print and digital resources to be useful. In the area of technology, students and teachers rated the PHHS Math program more favorably than control. However, control teachers rated their math program comparably or better in several other areas such as the usefulness of teacher resources, including enrichment resources as well as other teaching tools.
Anecdotal feedback provided by teachers in the treatment condition indicated that they felt somewhat constrained by the implementation guidelines they were required to follow. Treatment teachers did not always appreciate that they were being strongly encouraged to use certain components of the PHHS Math program such as the technology and, accordingly, this may have influenced some of their ratings of the program. Conversely, teachers in the control condition had flexibility to deliver instruction as they typically have done and so were able to more fully customize their instructional delivery and utilization of resources. Given that this was an experimental study, provision of implementation guidelines and monitoring of fidelity of implementation was an important design feature that would enhance our ability to make causal inferences regarding the effects of this specific math program and not some variation thereof. That said, it should also be explicitly noted that teachers may feel constrained by the requirement to follow implementation guidelines and utilize specific program features and, as such, this may influence their attitudes towards the program.
Conclusion

The two-year randomized control trial designed to look at the effects of the Prentice Hall High School Math program on student learning showed that the PHHS Math program produced significant positive effects on student learning in the areas of Algebra 1 and Geometry. In particular, high school students using the program showed significant growth in math skills and knowledge from pre- to post-testing. Additionally, significant differences were observed between PHHS Math students and students using other math programs such that students using PHHS Math showed more improvement than control students overall (across Algebra 1, Geometry, and Algebra 2) and in Algebra 1 and Geometry specifically. PHHS Math students also performed significantly better than students using various traditional basal programs. Other noteworthy results are that all significant subgroup differences found between treatment and control conditions were in favor of the PHHS Math program (i.e., PHHS Math students outperformed control students), and similar patterns of positive effects were observed during the previous 2009-10 school year. Indeed, it should be emphasized that the consistency of positive effects in favor of PHHS Math across different curricula, subpopulations of students, subject areas, and multiple study years is noteworthy -- the consistency of positive effects in favor of the PHHS Math program over the course of two years lends support to the conclusion that the PHHS Math program has a positive impact on student performance relative to other math programs.

Findings from this study also suggest that the positive effects associated with using PHHS Math may work in a cumulative manner. That is, positive effects on student learning are stronger over time – this is illustrated by the fact that effect sizes were larger for year 2 as compared to year 1. Thus, stronger effects were evident as teachers and a subsample of students had more experience with PHHS Math. Furthermore, preliminary findings also suggest that using the PHHS Math program as outlined in the implementation guidelines, including the technology, can enhance student learning.

Results also showed that PHHS Math was associated with positive changes in student and teacher attitudes. Prentice Hall High School Math students felt greater teacher support than control students and showed positive changes in educational aspirations and future plans for math course-taking. PHHS Math teachers also experienced increased levels of comfort with technology usage and knowledge or awareness of their students’ ability levels. Results also showed that the technology embedded within the PHHS Math program had a positive effect on student engagement and that the use of the PHHS technology enhanced student math understanding and learning. That said, one significant difference in favor of the control programs was observed; students using other math programs felt more prepared for college math courses as compared to PHHS Math students.

In addition, the majority of teachers and students liked the PHHS Math program, would like to continue using the program in subsequent years, and found the print and digital resources to be useful. PHHS Math students rated the in-class activities, math workbook, and clarity in which math is explained significantly higher than control students. In the area of technology, students and teachers rated the PHHS Math program more favorably than control. However,
control teachers rated their math program comparably or better in several other areas such as the usefulness of teacher resources, including enrichment resources as well as other teaching tools. Additionally, some PHHS Math teachers found the timeout feature on the online components to be frustrating. In short, generally PHHS students and teachers had positive perceptions of the Prentice Hall High School Math program and its components.

In sum, results from this two-year RCT show that students who use the PHHS Math program perform significantly better than students using other math programs in the areas of Algebra 1 and Geometry. In addition, these findings along with other longitudinal studies researchers have conducted on educational curricula, suggest that a two year study produces stronger results by reducing the effect of a learning curve since treatment teachers and students are allowed more time to become familiar with the new program. Indeed, future research could be conducted on longitudinal state assessment data to examine the long term effects of this math program and how it relates to student performance on high-stakes state assessments. In addition, additional research focusing on the effects of PHHS Math on various subpopulations of students is needed given the promising, yet preliminary findings observed in this RCT.
References


Appendix A

Study Design Characteristics and WWC Review Standards
**Table A1: Crosswalk between Study Design Characteristics and WWC Review Standards**

<table>
<thead>
<tr>
<th>WWC Causal Evidence Standards</th>
<th>Study Characteristics</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Randomization:</strong> Were participants placed into groups randomly?</td>
<td>Teachers or classes were randomly assigned to control and treatment groups within schools. Classes within teachers were randomly assigned when there was no other teacher available within a school at the same subject area. Random assignment was conducted via SPSS Random Selection feature by PRES researcher.</td>
<td>Page 13</td>
</tr>
<tr>
<td><strong>Baseline Equivalence:</strong> Were the groups comparable at baseline, or was incomparability addressed by the study authors and reflected in the effect size estimate?</td>
<td>Randomization was reasonably successful in producing equivalent treatment and control groups in terms of student and teacher background characteristics. Still, a few differences (Algebra 2 pretest scores, coverage of content, perceptions of usefulness of math and teacher support) were observed and covariates were included in the multilevel models to statistically equate the two groups and to increase the power of these analyses. These are reflected in effect size estimates.</td>
<td>Pages 24-28</td>
</tr>
<tr>
<td><strong>Differential Attrition:</strong> Is there a differential attrition problem that is not accounted for in the analysis?</td>
<td>Both measurement and dropout attrition was examined. ▪ There was no evidence for differential dropout attrition (less than 7%). ▪ With respect to measurement attrition, there was some evidence for performance differences during year 1 only. In particular, control students who submitted pretest data had higher scores during post-testing than control students who did not provide pretest data. However, no such relationship was observed among the treatment students and no relationship was observed in year 2.</td>
<td>Pages 26-27</td>
</tr>
<tr>
<td><strong>Overall Attrition:</strong> Is there a severe overall attrition problem that is not accounted for in the analysis?</td>
<td>There was an overall attrition of 9.4% in year 1 and 10.6% in year 2 due to students leaving the study. Note that this was part of the initial site selection criteria; in order to minimize attrition, historical mobility rates were examined and sites with high attrition rates were eliminated from consideration.</td>
<td>Pages 26-27</td>
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<tr>
<td><strong>Disruption:</strong> Is there evidence of a changed expectancy/novelty/disruption, a local history event, or any other intervention contaminants?</td>
<td>There was no evidence of disruption or a local history event. Contamination among control group teachers was also not observed. Potential treatment contaminants included: 1) the less than desirable (low) implementation of the program in year 2, primarily among Algebra 2 teachers, and 2) the loss of students who switched conditions following first year usage of PHHS Math.</td>
<td>Pages 34-35</td>
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40 There are a number of reasons why random assignment to treatment conditions was done at the teacher/classroom level within schools. The most important reason for selecting this level of assignment is that such a design helps to establish causality by reducing the threat that school-level factors could have potentially contributed to differences between treatment and control groups. That is, school “A” might have had something else going on (besides the treatment) that may have influenced student performance on the outcome measures. Since treatment and control groups were within the same school, school-level explanations of differences were reduced. Another reason for within school assignment is that it is likely that the treatment and control groups will possess similar characteristics at the onset of the study and therefore enhance comparability. Third, one of the criteria put forth by WWC’s Study Standards is that treatment and control groups need to be drawn from the same local pool. The definition of local pool provided in this study refers to subjects within the same classroom or school. According to the criteria, randomization at the district level would not be drawing people from the same local pool. Note, while this may increase the potential threat of contamination this was contained by an in-depth study orientation, monthly teacher logs, and site visits. Notably while random assignment at the teacher/classroom level within schools helps researchers control for school level differences as potential explanations of observed differences between treatment and control groups, teacher level factors can also be present and are important predictors of student performance (Gersten, Lloyd, & Baker, 1998). Though random assignment at the teacher/class level should help address this, with smaller sample sizes it is less likely that group equivalence will be ensured. In order to address this potential threat to initial group equivalence, additional data was collected on teacher background and classroom practices and examined and taken into account in interpretation of results.
### WWC Causal Evidence Standards

<table>
<thead>
<tr>
<th>Study Characteristics</th>
<th>Reference</th>
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</thead>
<tbody>
<tr>
<td><strong>Intervention Fidelity:</strong></td>
<td>1. Appendix B 2. Pages 18-21</td>
</tr>
<tr>
<td>1. Documentation: Is the intervention described at a level of detail that would allow its replication by other implementers?</td>
<td></td>
</tr>
<tr>
<td>2. Fidelity: Is there evidence that the intervention was implemented in a manner similar to the way it was defined?</td>
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</tr>
<tr>
<td><strong>Outcome Measures:</strong></td>
<td>1. Pages 16-17 2. Pages 16-17</td>
</tr>
<tr>
<td>1. Reliability: Is there evidence that the scores on the outcome measure were acceptably reliable?</td>
<td>1. Reliability: The assessments employed are reliable and valid. The reliability estimates for the developed assessments (Algebra 1, Geometry, Algebra 2) range from .74 to .82. The reliability for the ETS Algebra 1 End-of-Course Assessment is .87.</td>
</tr>
<tr>
<td>2. Alignment: Is there evidence that the outcome measure was over aligned to the intervention?</td>
<td>2. Alignment: The developed tests measure math concepts and skills in the subject areas of Algebra 1, Geometry and Algebra 2 taught in typical high school classes. The test was aligned to national NCTM standards and items were drawn from released state assessments and in a few instances custom-developed to measure math class content. In addition, the tests offer a broad coverage of content matter and consist of multiple-choice and short answer response options. The ETS Algebra 1 End-of-Course Assessment measures fundamental algebraic competencies and is aligned with the NCTM principles and standards and, therefore, most state standards.</td>
</tr>
<tr>
<td>1. Outcome Timing: Does the study measure the outcome at a time appropriate for capturing the intervention's effect?</td>
<td>1. Outcome Timing: In general, post measures were taken within 1 month of the end of the last day of the class (semester-long courses were administered post-tests prior to the end of Fall or Spring semester). Pretest measures were taken within 1 month of the start of the math class.</td>
</tr>
<tr>
<td>2. Subgroup Variation: Does the study include important variations in subgroups?</td>
<td>2. Subgroup Variation: The sample includes variations in grade levels, gender, race/ethnicity, math ability, and free/reduced lunch status. Analyses were conducted by all subgroups, although small sample sizes among some subgroups means that results should be interpreted with caution.</td>
</tr>
<tr>
<td>3. Setting Variation: Does the study include important variations in study settings?</td>
<td>3. Setting Variation: Sites were in rural, suburban and urban settings and in 5 states across the U.S. All schools were public with an enrollment (167-1750 students) that is typical of schools at these settings (see Appendix C for site summaries).</td>
</tr>
<tr>
<td>4. Outcome Variation: Does the study include important variations in study outcomes?</td>
<td>4. Outcome Variation: While analyses were conducted on the entire sample of students in Algebra 1, Geometry, and Algebra 2, analyses were also conducted within each subject area separately. All analyses were also done separately for each type of test (multiple-choice and open-response). In addition, the impact of the program on student and teacher attitudes and classroom practices was also examined.</td>
</tr>
</tbody>
</table>
### Testing Within Subgroups:

1. **Analysis by Subgroup**: Can effects be estimated for important subgroups of participants?
2. **Analysis by Setting**: Can effects be estimated for important variations in settings?
3. **Analysis by Outcome Measures**: Can effects be estimated for important variations in outcomes?
4. **Analysis by Type of Implementation**: Can effects be estimated for important variations in the intervention?

<table>
<thead>
<tr>
<th>Study Characteristics</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Analysis by Subgroup</strong>: Effects were estimated via multilevel models for the subpopulations that we had sufficient data for (i.e., gender, ethnicity, math ability, etc.). Preliminary results among the combined sample from year 1 and year 2 showed positive program effects for students who were female, White, Hispanic, on free/reduced lunch, in grades 9 and 10, and high performing.</td>
<td>1. Pages 56-58</td>
</tr>
<tr>
<td><strong>2. Analysis by Setting</strong>: Preliminary analyses by setting consisted of examining program effects by program type. Preliminary results showed positive effects when PHHS Math was compared to each of the control programs. Specifically, PHHS Math students demonstrated accelerated learning gains as compared to students using control programs 1, 2, 3 and 4 (all traditional basal programs).</td>
<td>2. Pages 59-60</td>
</tr>
<tr>
<td><strong>3. Analysis by Outcome Measures</strong>: Effects were estimated for each subtest (Multiple-Choice and Open-Response), subject area (Algebra 1, Geometry, and Algebra 2), and study year. Results were generally consistent across both subtests, and positive effects were found for Algebra 1 and Geometry (not Algebra 2). Results also tended to be stronger, yet still positive in year 2 as compared to year 1.</td>
<td>3. Pages 50-55</td>
</tr>
<tr>
<td><strong>4. Analysis by Type of Implementation</strong>: Effects were estimated by variations in implementation. Preliminary findings suggest that using the PHHS Math program as outlined in the implementation guidelines, including the technology, can enhance student learning.</td>
<td>4. Pages 47-48</td>
</tr>
</tbody>
</table>

### Analysis:

1. **Statistical Independence**: Are the students statistically independent or, if there is dependence, can it be addressed in the analysis?
2. **Statistical Assumptions**: Are statistical assumptions necessary for analysis met?
3. **Precision of Estimate**: Is the sample large enough for sufficiently precise estimates of effects?

<table>
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<tr>
<th>Study Characteristics</th>
<th>Reference</th>
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</thead>
<tbody>
<tr>
<td><strong>1. Statistical Independence</strong>: Analysis of the intraclass correlations showed that dependency was an issue among this sample of students. However, this was addressed by using hierarchical linear modeling and inclusion of cluster-level covariates.</td>
<td>See Technical Report</td>
</tr>
<tr>
<td><strong>2. Statistical Assumptions</strong>: All underlying statistical assumptions were met.</td>
<td></td>
</tr>
<tr>
<td><strong>3. Precision of Estimate</strong>: Power analyses revealed that multilevel models have enough power to detect medium to large effects.</td>
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</tbody>
</table>

### Reporting:

1. **Complete Reporting**: Are findings reported for most of the important measured outcomes?
2. **Formula**: Can effects be estimated using the standard formula (or an algebraic equivalent)?

<table>
<thead>
<tr>
<th>Study Characteristics</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Complete Reporting</strong>: All main findings for the outcomes are presented in the Technical Report.</td>
<td>See Technical Report</td>
</tr>
<tr>
<td><strong>2. Formula</strong>: All effect sizes (Hedge’s g) for outcomes measures are calculated and presented in the report. The formula for calculating effect sizes of main program outcomes is presented in the Technical Report.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B:

Prentice Hall High School Math Implementation Guidelines
Introduction

Thank you for participating in the research study being conducted by PRES Associates on Pearson Prentice Hall's new high school math program. We believe your experience with our study will be rewarding and enjoyable. Not only will you contribute to cutting-edge research, but you will also benefit from first-rate professional development provided by Pearson professional trainers.

We understand that modifying former teaching practices and implementing a new math program might present challenges. Therefore, we greatly appreciate the time and effort you will be putting into making this study a success. We also realize that there may be obstacles and challenges as you begin to implement this program. Under these circumstances, we want and need to hear from you; we will guide you through those challenges. In fact, it is critical that any problems you encounter be addressed as soon as possible to ensure that this program is being implemented to its full potential. Feel free to contact PRES Associates via e-mail at studies@presassociates.com if you have any questions, problems or concerns.

The following provides answers to some common questions teachers may have related to this study. Please read through all of these questions/answers. Again, should you have further questions, please contact PRES Associates.

Why Is This Research Being Done?

As you are aware, the No Child Left Behind Act (NCLB) of 2001 requires that educational materials and strategies used by educators in the classroom must be proven by scientific research to improve student achievement in the classroom. Pearson Prentice Hall has developed a strong research model for determining that their programs are scientifically-based. As part of this ambitious research agenda, Pearson has contracted with PRES Associates, an external educational research firm, to conduct a rigorous quantitative research study on the effectiveness of the Pearson Prentice Hall High School Math program. This study will contribute to the growing research base behind Pearson math programs and the effectiveness of different approaches to math instruction.

Why Do I Need Professional Development?

It takes more than a good curricular program to increase students’ knowledge of mathematics. It also takes good teachers with a thorough understanding of the curriculum, who are supported by professional development, school administrators, and parents/guardians. To this end, it is hoped that through the professional development training sessions provided by Pearson on the use of its High School Math program, all teachers participating in the study will gain the knowledge and skills to successfully implement this program right from the start.

Planning, Research & Evaluation Services (PRES Associates) is an external, independent, educational research firm with an established track record in conducting large-scale, rigorous evaluations on the effectiveness of educational curricula.
As you will learn, this math program provides numerous teaching resources and supports. In order to implement this program successfully, it is essential that teachers have a thorough understanding of the resources provided by the program. Rather than having teachers figure it out on their own, professional trainers will guide you through this process, offering examples of when to use certain materials, how to manage and supplement classroom instruction, what types of assessments to administer, and so forth.

**Why Do I Need To Follow These Implementation Guidelines?**

The Teacher Implementation Guidelines were developed by researchers along with the creators of the Pearson High School Math program and clearly outline the essential components of the program that must be implemented in order for the program to be maximally effective. The guidelines are designed for teachers to use when implementing the new program in their “treatment” class(es). The guidelines point out key program components that *must* be implemented during math lessons. These key program components have the greatest influence on student learning and performance, and therefore need to be implemented. In addition, it is critical to ensure that all teachers are implementing a similar instructional model. That is, if teachers are modifying the program to an extent that it no longer resembles the original program, the study is no longer an accurate evaluation of the Pearson Algebra I program. In sum, by providing these implementation guidelines, we are attempting to (1) maximize the potential of this math program to help your students, and (2) ensure that the program is being implemented with fidelity across all teachers assigned to use this program. To reiterate, *it is essential that all teachers implement the program fully in their “treatment” classes as prescribed in the following implementation guidelines*. That being said, there are optional parts to the program as well as ancillary materials that provide you with the flexibility you need to address unique student needs or contexts. *We trust your professional judgment and ask that you try to implement the program as best you possibly can while meeting your instructional needs.*
Prentice Hall Math Program Components

Student Resources
- Student Edition
- Spanish Student Edition (available 2010-2011)
- Student Companion Worktext
- Practice and Problem Solving Workbook
- Student Edition on CD-ROM
- PowerAlgebra.com

Teacher Resources
- Teacher’s Edition with Teaching Resources CD-ROM
- Student Companion Worktext, Teacher’s Guide
- Practice and Problem Solving Workbook, Teacher’s Guide
- All-in-One Teaching Resources including:
  - Reteaching
  - Practice Worksheets
  - Guided Problem Solving
  - Standardized Test Prep
  - Enrichment
  - Quizzes and Tests
  - Cumulative Review
  - Chapter Project
  - Performance Task
  - English Language Learners (available 2010-2011)

- Solve It/Lesson Quiz Transparencies
- Progress Monitoring Assessment
- Teaching with TI Technology
- ExamView® Test Generator CD-ROM
- Answers and Solutions CD-ROM
- TI-nspire™ Lesson Support CD-ROM
- PowerAlgebra.com (see detailed description below)
- Professional Development at mypearsontraining.com

PowerAlgebra/Geometry.com – complete online support for students and teachers.
- Student Edition and Teacher’s Edition online with Audio
- Student generated Videos
- Vocabulary Support
- Dynamic Activities
- Online Problems
- Online Homework and Workbook pages
- MathXL® for School practice and review
- Tutorial Videos
- SuccessTracker online assessments and remediation
- Multilingual Support
- Teaching Resources with editable worksheets
- Portable Study Center
Guidelines for Implementing 2011 Prentice Hall Algebra I, Geometry & Algebra II

GENERAL IMPLEMENTATION INFORMATION:

- The Prentice Hall Algebra I program is a blend of digital and traditional print resources. Participating teachers should be prepared to fully integrate the digital path of the program as they teach. Specifically, teachers should have a means of projecting videos and other internet material for students in the classroom and are asked to use the online resources as frequently as possible.

- The Prentice Hall Algebra I program provides both an “On-Level” and a “Foundations” series. The Foundations Series of the program is designed for lower level or remedial Algebra I classes. It is similar pedagogically and in appearance to the On-Level version. Of note, all of the same content and standards are included in the Foundations series. The Foundations Series is not a reteaching or remediation supplement, but rather a more stepped out version of the On-Level program. The two programs should never be used simultaneously in the same classroom. It should be determined prior to the start of the school year which level of the program you will use with each of your classes. Again, the general rule of thumb is that if it is a lower level or remediation Algebra I class, then the Foundation series should be used. If the class has a range of learners at different ability levels or is a regular or enrichment class, the On-Level program should be used. If you find that you have pacing or other issues in relation to the specific program series you have chosen, it’s important that you contact PRES Associates immediately so that we can work with you to find an appropriate solution, since we prefer that you stay with your selected series (either the On-Level or Foundations series) from start to finish. The guidelines that follow will apply to both version.

- We ask that you use the Prentice Hall Algebra I program as your main resource for Algebra I instruction. That is, you should implement fully the key program components outlined in the guidelines below and use the Prentice Hall Algebra I as your primary math program.

PACING

- Generally the pacing for the program is about one lesson per day for a typical 50 minute class or about three weeks per chapter.
- Pacing guidelines are available for both block and regular schedule.
Key Program Components:

The following section outlines those lesson and program components that are considered essential to implementing the program successfully and must be completed each time they appear as you progress through the program.

NOTE: Many of the lesson components are available in both print and digital format. We stress the importance of using the digital online resources as often as possible. The technology available as part of the Prentice Hall Algebra I program is not just a supplement, but an integral part of program delivery.

- **Big Ideas:** The Big Ideas are the organizing ideas for the study of important areas of mathematics; algebra, geometry and statistics. Each chapter starts with Big Ideas that convey the mathematics topics you will be covering. You should direct students to these Big Ideas in their student texts.

- **Essential Understandings:** These help students build a framework for the Big Ideas and make sense of the concepts that are being presented. They appear throughout the student books. There are also Essential Questions that will help students apply the Essential Understandings.

- **My Math Video:** These short videos should be shown to students at the start of each chapter. They are used to engage students in the content of the chapter through real-world applications.

- **Get Ready or Lesson Check:** This is used to tap into prior knowledge and identify prerequisite skills (refers back to specific lessons if students need a refresher). You should use either the Get Ready or the Lesson Check to gauge student understanding for each lesson.

- **Solve It:** Each lesson opens with a Solve It problem. This is a great place to emphasize thinking and reasoning skills, which is an essential part of this program. Teachers can determine how they use Solve It (i.e. as a cooperative learning activity, warm-up or independently). The Solve It is available in print and digital form. It is highly encouraged that you use the digital format for the Solve-It problems.

- **Sample Problems:** Each lesson has a series of sample problems that include reasoning call-outs and the “Got It.” The practice problems show each step and have “Think” and “Plan” and sometimes “Think-Write” boxes that incorporate the thinking and reasoning strand of the program. The sample problems are an essential part of each lesson. It is particularly important for teachers to emphasize the reasoning in the problems as called out in the Think/Plan and Think/Write boxes. For purposes of the study we ask that you do the sample problems in each lesson. That said, teachers do have discretion in determining how many of the problems you need to do. It is preferred that this be done digitally, but print resources are also available.

- **Got It:** These callouts appear in both the teacher and student edition and should be completed each lesson. These are an important formative assessment tool for determining if students already understand the content. There is also “Got It” in the student companion. Other resources available to teachers for ongoing assessment in order to monitor student understanding include: lesson checks, mid-chapter quizzes, and chapter tests.

- **Independent Practice.** It is essential that students complete independent practice for each lesson, this can be assigned as homework or in-class based upon teacher discretion. Teachers
should use their professional judgment in determining how many independent practice problems are assigned to students. When assigning problems, however, it is considered essential that teachers assign the reasoning problems that have students “think about a plan.” In addition, teachers should select problems so that they represent a range of concepts, skills, and application.

- Additional practice problems are available in the two consumable workbooks also provided to students, including the: 1) student daily support workbook; and 2) student companion. Teachers are encouraged to have students fully use these consumable workbooks -- they will be replaced at the end of the school year.

The following section outlines program components and activities that you are strongly encouraged to implement:

- **Concept Bytes:** These are explorations that may use technology or include a hands-on activity. They can be used before lessons as an introduction or after a lesson as a review. It is strongly encouraged that you used the Concept Byte activity if you have the materials available to you.

- **Dynamic Activity:** for lessons that include a Dynamic Activity an icon located at the beginning of lessons will indicate that there is an activity and will tell you where the activity is located within the lesson.

- **Math XL:** This is one of the online components of the program that can be used for additional practice and includes a variety of math exercises. You can assign specific practice exercises or students can choose their own.

There are also a variety of optional program components and materials that should be used to the extent possible:

- Vocabulary Builder
- Standardized test prep materials
- Enrichment materials
- Progress Monitoring assessment

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42 The Foundations program comes with one consumable student workbook that is a combination of both the daily support and the student companion workbook.
Appendix C:

Case Study of Site Visits
CASE STUDY OF SITE VISITS

Site visits are critical in order to better understand the context in which a program is being used. In addition, environmental factors (e.g., school factors, local history effects) can influence the results of a study and it is necessary, at the very least, to document such factors. The case study of site visits is accomplished by triangulating the data from the site/classroom observations, post-observation interviews, and the implementation logs, and capturing the perspectives of various participants. The following provides information about each of the sites, collected from the participating teachers, school administrators, and our own school-related research.

School A

About the Schools: School A is a small public school located in a small, rural community in Ohio. The junior/senior high school is housed in an older, but well kept building with adequate technology capabilities. The school houses students in grades 7-12. During the 2009-2010 school year enrollment at School A was 376 and during the 2010-2011 enrollment was 475, with a student to teacher ration of 18 to 1, which is slightly higher than average for the state.

In 2011 Ohio used the Ohio Graduation Test (OGT) to test students in grade 10 in math; of 10th graders who took the OGT math test, 94.2% were proficient which is slightly higher than the state average of 74.8%. The student population is predominantly white:

- 97% White, not Hispanic
- <1% Hispanic
- <1% American Indian/Alaskan Native
- 1% Black, not Hispanic
- 2% Asian/Pacific Islander

Approximately 14% of the students at the school were eligible for free or reduced-price lunches. No data was available regarding number of students noted as Limited English Proficiency.

Study Participants: During year one, two teachers participated in the study, one teacher who taught Geometry and Algebra I and another teacher who taught Algebra I. During year two, two teachers participated in the study, one teacher who taught Geometry (the same teacher who taught Geometry in year one) and another teacher who taught Algebra II. Due to the lack of comparison teachers available at this school, classes were randomly assigned to conditions. In year one there were a total of five Algebra I classes participating in the study, two control and three treatment. For Geometry there were two treatment classes and three control. The 10 classes contained approximately 129 students, with an average class size of 14, and a range of 5 to 20. In year two there were a total of three Geometry classes participating in the study; two treatment and one control. For Algebra II there was one treatment class and two control. The 6

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43 It is important to note that, when interpreting information from such qualitative data collection techniques, the data reported consist of recurrent and shared themes that emerged. That is, comments from a single individual which are not reflective of a larger proportion of respondents are not identified as a finding or “theme.”
classes contained approximately 119 students, with an average class size of 19.8, and a range of 16 to 24.

In year one teachers characterized their classes as mixed, with some classes being high performing and others being average or low performing. Across treatment and control classes there was a relatively equal spread of low, high and average performing classes for both Algebra I and Geometry. Of note, there was one Algebra I treatment class that had a lower number of students and was therefore able to move at a slightly faster pace compared to the other Algebra I classes. There was also one Algebra I class with very low numbers, but more behavioral problems than the other classes and they moved at a slightly slower pace compared to the other classes. In year two teachers characterized their classes as mixed, with some classes being high performing and others being average or low performing. Across treatment and control classes there was a relatively equal spread of low, high and average performing classes for both Geometry and Algebra II. Overall classes in both years were noted as typical of the student population at the school and little to no behavioral problems existed, with the one exception as mentioned above.

Technology was emphasized and occurred daily in all of the treatment classes, but was used very infrequently in the control classes other than graphing calculator use.

**Math Curriculum and Resources**: Teachers in year one and two used the same basal math program copyright 2001 Algebra I, Geometry and Algebra II, as their control curriculum. Teachers indicated they generally followed the pacing guidelines and lesson plans as outlined in the book, but did not always teach the lessons exactly as specified, instead opting to customize the amount of guided practice, independent practice, review, etc. as was needed for their various levels of classes. For example, the more advanced classes might skip the review altogether and use additional word problems, while remedial classes might engage in the prescribed guided practice with additional independent problems worked through in a group format. Moreover, all three teachers reported supplementing for additional skills practice, games, etc. on occasion with resources collected over the years.

There were a few similarities between the control program used and the Prentice Hall High School Math. Similarities included opportunities for hands-on explorations and focus on real-world applications. However, in general the Prentice Hall High School Math program integrated technology to a much a larger degree than the control program. In addition, the control programs were structured in a more traditional way, while the premise of the Prentice High School Math program is based on “Understanding by Design” and the associated focus on “big ideas” and overarching themes that are addressed throughout, with an emphasis on thinking and writing skills.

No district pacing guidelines were in place and all three teachers paced their classes (treatment and control) based on the curriculum map and student needs. At times this caused some disparity in the pacing of the various classes. Use of technological resources was more a focal point of the lesson in treatment classes and rare in the control. This is likely due to the fact that the treatment program had built in technology resources while the control program did not. In treatment classes, teachers were observed following the Prentice Hall High School Math program exclusively and adhering to the implementation guidelines, with two exceptions. In year one,
one of the classes contained a very small number of students with behavioral problems which at times required omitting some of the interactive components of the Prentice Hall High School Math program, as the teacher reported it was too distracting and students would easily get off task. In year two there were two classes, one treatment and one control, which tended to need somewhat slower pacing due to student needs and tended to get slightly behind the other classes at times.

**Instructional Practices and Strategies:** Math instruction occurred throughout the day depending on the teacher. Classes lasted for 85-minute blocks and occurred every other day during the same time for the duration of each year. All students had sufficient copies of math resources (e.g., student textbooks) and the school’s technology resources were able to support online instruction in math classrooms.

Math instruction in control classrooms was relatively consistent. Teachers would begin instruction with a review of homework or the prior lesson, which included student questions and teacher problem modeling for approximately 10-20 minutes. Sometimes this included a brief quiz followed by discussion and questions. This was followed by an introduction and teaching of the day’s lesson for 10-20 minutes. The lesson usually included guided practice where the teacher would problem model and then students would work through a problem independently, followed by a group check. This was repeated several times for about 15 minutes. After the guided practice students would begin independent practice, sometimes working in pairs. The introductory lesson of each chapter usually included a vocabulary review at the start of the class.

Lessons in the treatment math classrooms were similar between classes of the same level, though instructional practices varied slightly from low performing classes to higher performing classes. While implementation guidelines were closely followed, there was some exclusion from time to time of certain components based on overall class ability, especially in the lower performing class in year one and the classes in year two that required slower pacing. Lessons started with the teacher setting the purpose for the day for about 5 minutes. This was followed by a quiz or Solve It to begin the lesson while also engaging in review for 5-10 minutes. After the quiz or lesson check the teacher would begin the lesson. This included the sample problems, the Got It’s and the Think/Write/Plan boxes, which took about 30-40 minutes. The introduction and the main lesson were delivered digitally, with the teacher pausing to interject and teach as needed. Students then finished by working independently, sometimes in pairs for the remainder of the class. Usually students had time in class to finish all their work, on the occasions when they didn’t, unfinished work was sent as homework (only about 50% of the time or less). Once every other week students would go to the computer lab to do the Dynamic Activity as the independent practice segment of the class.

**Homework:** Homework was somewhat consistent between treatment and control classes and adhered to the schools low homework policy, however control students were assigned less homework than their treatment counterparts. Treatment students had homework assigned approximately 1 day a week and occasionally took unfinished independent practice as homework (less than 50% of the time). Control students were similar to treatment students in terms of the frequency with which they took unfinished work as homework, but differed in that they did not have specific homework assigned. In treatment classes word problems were given as extra credit each day, while this did not occur on a regular basis in control classes.
Assessment: In terms of assessment, teachers gave control and treatment classes chapter and mid-chapter tests and quizzes. Of note, treatment during year one and two tended to have a short quiz on a daily basis, whereas control classes did not. Control classes did have short, daily quizzes, but not as frequently (2-3 times a week). Informal assessments occurred in all classrooms (e.g., observations, discussions, etc.). Similarly, tests included both open-response and multiple-choice questions in control and treatment classes. However, it should be noted that overall, treatment assessments tended to include slightly more word problems.

Comparability: In terms of comparability both the Prentice Hall High School Math and the control classrooms, with the exception of the program-based activities, were similar. For example, vocabulary and math computation was equally emphasized in both types of classes. In addition, both types of classes incorporated thinking and reasoning skills that made connections with real world applications, though as noted previously, this occurred slightly more in treatment classes. Some differences were also noted, specifically treatment classes tended to engage in more technology-based instruction that included big, overarching concepts and ideas related to math. As well, treatment classes had a greater access to their math programs outside the classroom via online resources and homework was assigned more often. Control classes were mostly teacher delivered with some technology incorporated on a monthly basis.

Highlights: While the types of classes each teacher at Site A taught were varied in terms of ability levels, all three participating teachers had a similar mix of low, high and average performing classes. Additionally, while class sizes tended to vary from average to very small in year one, both teachers were comparable in that they each had one very small class. In year two both teachers had class sizes that varied, but were mostly average in size. No contamination was noted, though as expected at the high school math level, the structure of math classes, whether treatment or control, was similar.

School B

About the Schools: School B is a small public school located in a small, tight knit, rural community in Idaho. The junior/senior high school is housed in an older, but well kept building with adequate technology capabilities. The school houses students in grades 7-12. During the 2009-2010 school year enrollment at School B was 181, with a student to teacher ratio of 13 to 1 and during the 2010-2011 school year enrollment at School B was 167, with a student to teacher ratio of 13 to 1.

In 2008, Idaho used the Idaho Standards Achievement Test (ISAT) to test students in grades 3 through 8 and 10 in math; of 8th and 10th graders who took the ISAT math test, 70% of 8th graders were proficient compared to the state average of 72% and 88% of 10th graders were proficient compared to the state average of 77%. The student population is predominantly white:

- 69% White, not Hispanic
- 26% Hispanic
- 3% American Indian/Alaskan Native
- 0% Black, not Hispanic
- 2% Asian/Pacific Islander
Approximately 71% of the students at the school were eligible for free or reduced-price lunches. No data was available on number of students noted as Limited English Proficiency.

**Study Participants:** During year one and two, the same two teachers participated in the study; one teacher taught Geometry and the other teacher taught Algebra I in year one and Algebra II in year two. Since there were no comparison teachers available, their classes were randomly assigned to conditions. There was one treatment and one control class for Algebra I, Geometry (year one and two) and Algebra II. The 8 classes contained approximately 138 students, with an average class size of 17, and a range of 10 to 23. Of note, the Algebra II treatment class was very small at the start of year two and continued to decline over the course of the year.

Teachers characterized their classes as average, with some high-performing and low-performing students. The one exception during year one was one treatment class, which the teacher characterized as average to high and one control class, which the teacher characterized as average to low. In year two classes were average, though each teacher tended to have one slightly higher class of the two. Classes were also noted as typical of the student population at the school and little to no behavioral problems existed. Technology was emphasized in all of the treatment classes, but was limited to graphing calculator use in the control classes.

**Math Curriculum and Resources:** Both teachers used the same basal math program copyright 2001 for Algebra I and Algebra II and copyright 2004 for Geometry, as their control curriculum. Both teachers indicated they generally followed the pacing guidelines and lesson plans as outlined in the book. Additionally, for their control classes, both teachers reported supplementing for additional skills practice, games, etc. on occasion with resources collected over the years.

There were a few similarities between the control program used and the Prentice Hall High School Math. Similarities included opportunities for hands-on explorations and focus on real-world applications. However, in general the Prentice Hall High School Math program integrated technology to a much a larger degree than the control program. In addition the control programs were structured in a more traditional way, versus the premise of the Prentice High School Math program which is based on “Understanding by Design” and the associated focus on “big ideas” and overarching themes that are addressed through an emphasis on thinking and writing skills.

No district pacing guidelines were in place and both teachers paced their classes (treatment and control) based on the main math program and student needs. Their goals were to complete or at least touch upon each chapter covered by the core math program. Use of technological resources was very comprehensive in the treatment classes and rare in the control. This is likely due to the fact that the treatment program had built in technology resources while the control program did not. In treatment classes, teachers were observed following the Prentice Hall High School Math program exclusively and adhering to the implementation guidelines. In the treatment geometry classes the teacher did include a few hands on activities that have been used each year and students look forward to, but these occurred only a few times over the course of the school year.

**Instructional Practices and Strategies:** Math instruction occurred throughout the day depending on the teacher. Classes lasted for 50-minute periods and occurred during the same time each day.
for the duration of the year. All students had sufficient copies of math resources (e.g., student textbooks) and technology resources were able to support online platforms in each math classroom.

Math instruction in control classrooms was relatively consistent. Teachers would begin instruction with review of homework or prior lesson, which included student questions and teacher problem modeling for approximately 5-10 minutes. This was followed by an introduction and teaching of the day’s lesson. The lesson instruction took most of the class time (approximately 20-30 minutes) and included guided practice. After the guided practice students would work alone or in pairs to complete the work. Unfinished work was generally sent for homework. One teacher tried to more consistently work in hands-on activities on a regular basis in their control classes.

Lessons in the treatment math classrooms were similar between classes, especially since both teachers were following the Prentice Hall High School Math program implementation guidelines explicitly. Lessons started with checking the previous day’s homework and answering questions or problem modeling as needed for 5 to 10 minutes. This was followed by an introduction to the lesson using either the Get Ready or the Lesson Check for 5 to 10 minutes. After that the teacher would use the Solve It as a way to get students to start thinking about the concepts they would be learning. Sometimes this included a brief class discussion or students giving personal examples of how the new concept applied to them. The teacher would then go through the sample problems for about 20 minutes. This was interspersed with the “Got Its” and set a parameter for guided practice. Students then finished by working independently, sometimes in small groups or pairs. Unfinished work went as homework. The lessons were delivered both digitally and directly by the teacher, with a relatively even blend between the two. Both teachers were very adept at freezing the technology to take a moment to elaborate on certain concepts or skills and then transitioning back to the technology delivery.

**Homework:** Homework was fairly consistent between treatment and control classes. Students had homework approximately four days a week for 20 – 30 minutes depending on how much of their work they were able to complete in class. Homework across all the classes included a variety of skill and word problems, with the control classes having slightly more of the skill based problems than the treatment.

**Assessment:** In terms of assessment, teachers gave control and treatment classes chapter and mid-chapter tests and quizzes, in addition to informal assessments (e.g., observations). Similarly, teachers provided tests with both the open-response and multiple-choice format for all of their classes.

**Comparability:** In terms of the comparability of control and Prentice Hall High School Math classrooms, with the exception of the program-based activities, classes were similar. In addition, both types of classes incorporated thinking and reasoning skills that made connections with real world applications. However, differences were also noted. Treatment classes tended to engage in more technology-based instruction that included big, overarching concepts and ideas related to math. As well, treatment classes had a greater access to their math programs outside the classroom via online resources. Control classes were entirely teacher delivered and therefore
were somewhat more tailored to individual student needs than the combination teacher and technology delivery found in treatment classes.

**Highlights:** Teachers at site B did a very comparable job teaching both the control and treatment programs to their students. While no contamination was noted, instructions was similar, in that both teachers had a great deal of teaching experience and were able to successfully deliver lesson material from either program in a concise and organized way that was not entirely different from control to treatment class, other than using distinct curricula.

**School C**

**About the Schools:** During year one, study participants at School C were made up of classes and teachers at both the middle and high school, which were located about a mile apart. During year two study participants at School C were made up of classes entirely at the high school. Both schools at Site C are relatively large sized public schools located in low to lower middle class suburban neighborhoods in New Jersey. The senior high school is housed in a well kept building that is neither especially old nor recently new. The middle school is housed in a much older building that was extremely well maintained and had been renovated to accommodate newer technology. Technology capabilities at the high school were adequate to very good and all classrooms were wired for online access. The high school houses students in grades 9-12 and the middle school houses grades 5-8. During the 2009-2010 school year enrollment at the site C high school was 626, with a student to teacher ratio of 13 to 1, which is slightly lower than average for the state. Enrollment at the middle school, during the 2009-2010 school year, was 649, with a student to teacher ratio of 13 to 1. During the 2010-2011 school year enrollment at the site C high school was 556, with a student to teacher ratio of 9 to 1, which is slightly lower than average for the state.

In 2010, New Jersey used the High School Proficiency Assessment (HSPA) to test students in grade 11 in math; of 11th graders who took the HSPA math test, 50% were proficient which is lower than the state average of 74%. In 2010 New Jersey also used the New Jersey Assessment of Skills and Knowledge (NJ ASK) to test students in grade 8 in math; of 8th graders who took the NJ ASK math test, 41.1% were proficient which is lower than the state average of 69%. The student population is predominantly African American:

**High School:**
- 21% White, not Hispanic
- 20% Hispanic
- 0% American Indian/Alaskan Native
- 56% Black, not Hispanic
- 2% Asian/Pacific Islander

**Middle School:**
- 22% White, not Hispanic
- 21% Hispanic
- 0% American Indian/Alaskan Native
- 55% Black, not Hispanic
- 2% Asian/Pacific Islander

Approximately 61% of the students at the high school and 63% at the middle school were eligible for free or reduced-price lunches. No data was available regarding number of students noted as Limited English Proficiency at either the middle or high school.
**Study Participants:** During year one, there were eight teachers total who participated in the study. There were seven Algebra I teachers, five treatment and two control and two participating Geometry teachers, one treatment and one control. Of note, the Geometry treatment teacher also taught one of the Algebra I treatment classes (an honors course) and one treatment class was made up of 8th grade Algebra I students at the middle school. In total there were 14 participating study classes, 6 control and 8 treatment. The 14 classes contained approximately 333 students, with an average class size of 24, and a range of 10 to 32. During year two, there were five teachers total who participated in the study. There were three Geometry teachers, two treatment and one control and two participating Algebra II teachers, one treatment and one control. In total there were 14 participating study classes, 6 control and 8 treatment. The 14 classes contained approximately 240 students, with an average class size of 17, and a range of 4 to 21.

For the most part during year one teachers characterized their classes as mixed, with two exceptions; there were two treatment honors classes that contained predominantly high performing students. There was also one special education treatment class that contained predominantly lower performing students. Overall in year two teachers characterized their classes as mixed, with a few exceptions; there were two geometry and two algebra II honors classes that contained predominantly high performing students. There was also one ELL geometry class as well as a geometry inclusion class that contained predominantly lower performing students. Overall classes were noted as typical of the student population, however math department expectations exercised a very low tolerance for behavioral problems, therefore while student behavior in the school at large may have been somewhat more unruly, there were few to no behavioral problems during math classes.

Technology was emphasized a great deal in the treatment classes, especially in the 8th grade Algebra I class. However, in control classes technology, other than PowerPoint presentations, was not utilized very often and teachers sighted the main reasons as being a lack of technological resources in general and the lack of technological resources built into their math program.

**Math Curriculum and Resources:** The control teachers used a basal math program copyright 2007. Teachers indicated that they followed the structure and sequence of their program for the most part. In certain instances teachers skipped topics or completed them out of order based on wanting to cover certain topics addressed in their state curriculum map. Control teachers reported across the board that they supplemented for additional skills practice, games, etc. on occasion with resources collected over the years or that they had developed themselves. In contrast, treatment teachers followed the structure of the Prentice Hall High School Math program with fidelity and included technology in nearly every lesson, with one exception. A treatment teacher in year two tended to supplement outside the Prentice Hall High School Math program slightly more than other treatment teachers in order to include additional games and extra credit projects. Other than this one exception treatment teachers did not indicate that they supplemented for additional practice, hands on activities or games and instead used only Prentice Hall High School Math resources.

There were a few similarities between the control program used and the Prentice Hall High School Math. Similarities include opportunities for hands-on explorations and built in differentiation for various levels of learners. Both programs also have strong student directed learning components. In general the Prentice Hall High School Math program focuses more on...
big ideas and overarching themes that require students to think and connect math skills to real world situations than did the control program. Another difference was that while the Prentice High School Math program included technology as a means of lesson delivery, the control program relied on traditional teacher driven instruction and did not incorporate interactive digital components on a daily basis.

Both control and treatment teachers indicated that they determined their pacing via the state curriculum map and student needs. It was noted by all teachers, both treatment and control, that sometimes topics were taught out of order or one or two chapters might be skipped in order to better meet the topics indicated on the curriculum map.

**Instructional Practices and Strategies:** Math instruction occurred throughout the day depending on the teacher. Classes lasted for 45 minute periods and occurred every day during the same time for the duration of the year. All students had sufficient copies of math resources (e.g., student textbooks).

Math instruction in the control classroom was relatively consistent. Teachers would usually spend the first five minutes doing a warm-up exercise. After this a review of the homework occurred for approximately 10 minutes. Next the teacher would introduce the lesson with a short exploration based activity which lasted anywhere from 10 to 20 minutes depending on the complexity of the hands on experience. Teachers would then move into the guided practice portion of the lesson for about 10 to 15 minutes. After which homework was assigned and students could take whatever time remained in class to work independently.

Lessons in the treatment math classrooms were similar between classes with one exception, as teachers were very conscience about following the implementation guidelines explicitly. It should be noted that treatment teachers in year one did a slightly better job of following implementation guidelines than teachers in year two, mostly based on year two teachers having a greater familiarity with the program and therefore a greater proclivity for modifying implementation based on perceived best practices. Other than the exception noted below, lessons started with checking the previous day’s homework and answering questions or problem modeling as needed for 5 to 10 minutes. This was followed by an introduction to the lesson using either the Get Ready or the Lesson Check for 5 to 10 minutes. After that the teacher would engage students with the Solve It in order to get them thinking about the concepts they would be learning. Sometimes this included a brief class discussion or students might draw conjectures based on their own experiences. The teacher would then go through the sample problems for about 20 minutes. This was interspersed with the “Got Its”. Students then finished by working independently, sometimes in small groups or pairs. Unfinished work went as homework. The lessons were delivered both digitally and directly by the teacher, with a relatively even blend between the two. While each teacher developed their own style in terms of moving between teacher directed instruction and digitally delivered material, they were all very adept at utilizing both teaching methods. There was one treatment teacher that was an exception to the above format, while following a similar teaching pattern as described above on the days a new lesson was taught, the teacher did different activities different days of the week. For example, where Monday through Wednesday would be teaching a new topic, Thursday would be a review day and Friday and assessment day. So while this teacher did similar activities and followed a
similar overall lesson flow as the other teachers, the lessons were divided up over the days of the week.

**Homework:** Homework assignment was similar between treatment and control classes. Because of shorter class periods it was common in all classes for homework to be assigned 2-3 times a week. There was one exception however, during year one, one treatment teacher consistently assigned homework four nights a week, but also made sure students had some time each day to begin the work in class. Homework consisted of both computation and word problems, however Site C was somewhat unique in that most teachers put an emphasis on word problems and writing about math in general. During year one and two, one treatment teacher assigned homework online through the Prentice Hall High School Math digital site four nights a week and occasionally on Fridays.

**Assessment:** In terms of assessment, control and treatment classes were pretty similar. Informal assessment (i.e. observation, checking homework, discussion, etc.) weekly quizzes and chapter tests occurred with equal regularity and in similar ways. One treatment teacher ended each lesson by having the students take the online quiz that was embedded in the Prentice Hall High School Math program. No standardized test prep was indicated. In both control and treatment classes Fridays were targeted as days when chapter tests usually occurred.

**Comparability:** In terms of overall comparability, both the Prentice Hall High School Math and the control classrooms were somewhat similar. Both control and treatment teachers placed emphasis on computation skills, but also encouraged word problems, especially writing about math and exploratory activities. Lessons in the treatment classes were more structured and included distinct lesson components that were centralized around a big concept; while control lessons were less structured but well-implemented and one teacher tended to include hands on activities on a more regular basis. While the treatment classes included technology as an integral part of every lesson, especially in one treatment classroom where students worked from laptops, the control class lessons and homework lacked use of technology other than basic graphing calculators and technology as a presentation tool.

**Highlights:** The math department in general at site C was very cohesive and teachers in both control and treatment classes were skilled in delivering the math curriculum. Behavioral issues were at a minimum and overall higher order thinking was encouraged in all classes, not just those designated as more advanced. Inclusion classes and special education classes kept pace with their counterparts and students in these classes were required to work through word problems and not just focus on computation, which was somewhat unique compared to similar classes at other sites. As well, teachers at this school, both control and treatment, put more of an emphasis on writing about math and solving word problems. There was no evidence of contamination.
School D

About the Schools: Site D is an average sized public school located in a small, rural town in Washington. Technological capabilities at this school were average to slightly below average in some classrooms. The school houses students in grades 9-12. During the 2009-2010 school year enrollment at School D was 629, with a student to teacher ration of 18 to 1, which is slightly lower than average for the state. During the 2010-2011 school year enrollment at School D was 648, with a student to teacher ratio of 15 to 1, which is on par with the state average.

In 2010, Washington used the Washington Assessment of Student Learning (WASL) to test students in grade 10 in math; of 10th graders who took the WASL math test, 36% were proficient which is lower than the state average of 42%. The student population is predominantly Hispanic:

- 25% White, not Hispanic
- 75% Hispanic
- 0% American Indian/Alaskan Native
- 0% Black, not Hispanic
- 0% Asian/Pacific Islander

Approximately 63% of the students at the school were eligible for free or reduced-price lunches, which is much higher than the state average of 38%. Approximately 9% of the student population was indicated as being of Limited English Proficiency.

Study Participants: During year one, there were four Algebra I teachers who participated in the study: three treatment and one control, and two Geometry teachers, one treatment and one control. In total there were nine participating study classes, three control and six treatment. The 9 classes contained approximately 202 students, with an average class size of 22, and a range of 7 to 30. During year two, there were two Geometry teachers who participated in the study, one treatment and one control, and three Algebra II teachers, two treatment and one control. In total there were eleven participating study classes, three control and eight treatment. The 11 classes contained approximately 241 students, with an average class size of 21.9, and a range of 12 to 30.

Most of the classes in the study were of mixed ability level, that is they were comprised of high, middle and low performing students, with a few exceptions. During both years of the study there was one treatment class that predominantly contained students with behavioral issues performing below level. Classes in the study were representative of the general student population.

Technology was not overly emphasized in either the treatment or control classes. While the technological capabilities at the school were consistent with what was needed to support math technology, most teachers in year one did not take advantage of these resources, however technology use in treatment classrooms increased in year two. Specifically during year one, one of the three treatment teachers utilized technology on a daily basis and during year two, two of the three treatment teachers utilized technology on a nearly daily basis.
**Math Curriculum and Resources**: The two control teachers used a very traditional basal math program copyright 1985. The one control teacher indicated that he primarily followed the lessons and plans prescribed by his main program, but used additional materials to supplement the lessons and provide some variation in problems and lesson format. The other control teacher explicitly followed the control program with little to no supplementation with the exception of a few special projects.

There were very few similarities between the main control program used and the Prentice Hall High School Math. While both programs covered similar topics they were very different in their overall pedagogy. The control program was very traditional and skill based with very few hands on or inquiry activities as opposed to the more inquiry based style of the Prentice Hall High School Math program. As well, unlike the Prentice Hall High School Math program it did not include many student directed lessons or activities and did not include digital components other than as a presentation tool.

No district pacing guidelines were in place and teachers paced their classes (treatment and control) based on the state standards and student needs. The math department as a whole tried to keep students at the same pace so that they could all complete a uniform master exam given to all students at course end. The use of technological resources was limited in all but one treatment classroom in year one and two treatment classrooms in year two, as noted above. In treatment classes, teachers were observed adhering to the implementation guidelines with the exception of one teacher who omitted the technological components from the lesson during both years, partly due to student behavioral issues.

**Instructional Practices and Strategies**: Math instruction occurred throughout the day depending on the teacher. Classes lasted for 55 minute periods and occurred every day during the same time for the duration of the year. All students had sufficient copies of math resources (e.g., student textbooks).

Math instruction in the control classrooms was relatively consistent. The teacher would usually spend the first five to ten minutes doing a warm-up exercise. After this they would quickly check the warm up and then move onto a review of the homework for approximately 5 minutes. Next the teacher would begin the lesson by lecturing for about 15 minutes while the students took notes. Then the teacher would take 15 minutes to do guided practice with the class using example problems from the assignment. The last 15 minutes were spent with students doing assigned problems as independent practice and the unfinished work was sent as homework.

Lessons in the treatment math classrooms were similar, with a few exceptions as noted below. In general teachers started each lesson by going over homework from the previous day’s lesson and going through related questions for about 5 to 10 minutes. The teacher would then teach the main lesson for 15 to 20 minutes after going through the homework. The last 15 minutes of the class were devoted to independent practice with students working on assigned problems. One treatment teacher had students do a short quiz everyday prior to starting the lesson; this took about 5 minutes and was made up of practice sets from Prentice Hall High School Math materials that the teacher had selected. In another treatment classroom the teacher spent the majority of the class doing guided practice and working through problems with the students. In
this class students only used the last five minutes to work independently; this was the same in year one and two.

**Homework:** Homework assignment was similar between treatment and control classes. Because of shorter class periods it was common in all classes for homework to be assigned nearly five times a week, though one treatment teacher indicated homework was assigned 3-5 times a week versus every night. For the most part homework consisted of computation problems in both treatment and control classes. Most teachers indicated that they often skipped the word problems as students found these frustrating, but did try to include some from time to time, with the exception of one control teacher in year two who expected honors students to complete word problems.

**Assessment:** In terms of assessment, control and treatment classes were pretty similar. Informal assessment (i.e. observation, checking homework, discussion, etc.), weekly quizzes and chapter tests occurred with equal regularity and in similar ways. One treatment teacher started each lesson by having the students take a quiz. This same teacher also tended to assess more often than the other teachers. No standardized test prep was indicated by either control or treatment teachers, other than what was built into their respective programs (both the control and treatment programs contained built in standardized test prep).

**Comparability:** In terms of overall comparability, both the Prentice Hall High School Math and the control classrooms were somewhat similar. Both control and treatment teachers placed a greater emphasis on computation skills versus word problems, with the control classes doing so to a greater degree than the treatment classes. Both control and treatment teachers tended to engage in inquiry based activities on a very limited basis and homework was assigned with equal frequency. Technology use was at a minimum across the classrooms with the exception of the one treatment teacher in year one and two treatment teachers in year two, who utilized technology on a very regular basis.

**Highlights:** In general, the teachers at Site D tended to lean towards a more traditional style of teaching with a strong emphasis on computational skills. Technology was not a focus at the school in general and this was evident in the math classrooms. Behavioral issues were at a minimum, with the exception of one class in year one and one class in year two. No evidence of contamination was indicated.

### School E

**About the Schools:** School E is an average size public school located in a lower class urban neighborhood in Ohio. The junior/senior high school is housed in an older building that is at the limits of occupant capacity. Due to the age of the building there was limited technological capabilities. The school houses students in grades 7-12 and specializes in the performing arts. During the 2009-2010 school year enrollment at School E was 668, with a student to teacher ration of 18 to 1, which is slightly higher than average for the state. During the 2010-2011 school year enrollment at School E was 601, with a student to teacher ratio of 20 to 1, which is slightly higher than average for the state.
In 2010, Ohio used the Ohio Graduation Test (OGT) to test students in grade 10 in math; of 10th graders who took the OGT math test, 90% were proficient which is higher than the state average of 80%. The student population is predominantly African American:

- 7% White, not Hispanic
- 2% Hispanic
- 0% American Indian/Alaskan Native
- 90% Black, not Hispanic
- 0% Asian/Pacific Islander

Approximately 46% of the students at the school were eligible for free or reduced-price lunches. No data was available regarding number of students noted as Limited English Proficiency.

**Study Participants**: During year one there were two Algebra I teachers who participated in the study, one treatment and one control. In total there were four participating study classes, one control and three treatment. The four classes contained approximately 98 students, with an average class size of 24, and a range of 22 to 26. There were no participating Geometry teachers at Site E in year one or two. During year two there was one treatment Algebra II teacher who participated in the study. In total there were three participating treatment study classes. The three classes contained approximately 96 students, with an average class size of 32, and a range of 27 to 36.

During year one and two most of the classes in the study were of mixed ability level, that is they were comprised of high, middle and a few low performing students, with one exception during year one; the control class was a high performing class with no special education students. As a rule students at Site E were average to high performing with few behavioral problems. Classes in the study were representative of the general student population.

During year one technology was not emphasized in either the treatment or control classes or in the treatment classes in year two due to lack of technological resources and capabilities. Some attempts to incorporate technology over the course of the study were evident in the form of once a month computer lab activities, but other than these infrequent occurrences, technology use was at a minimum.

**Math Curriculum and Resources**: The control teacher used a basal math program copyright 2001. It was indicated that while using the basal program as the main math curriculum some modifications were made for variety in terms of lesson structure so students did not become bored. For example independent practice might consist of a hands on activity one day, working in pairs another and regular independent practice on yet another day or instead of assigning all the practice problems prescribed by the main curriculum the teacher might incorporate teacher made materials with word problems. In contrast the treatment teacher followed the lessons as set forth in the Prentice Hall High School Math program with the exception of incorporating the technological components of the program. Moreover both teachers reported supplementing for additional skills practice, games, etc. on occasion with resources collected over the years and had students access Study Island or Accelerated Math once a month in the computer lab.
There were a few similarities between the control program used and the Prentice Hall High School Math. Similarities included opportunities for hands-on explorations and built in differentiation for various levels of learners. Both programs also have strong student directed learning opportunities and encourage students to think and write about math. In general the Prentice Hall High School Math program focused more on big ideas and overarching themes and in general required students to think and write about math more regularly than did the control program.

A district pacing map was in place and while both teachers indicated they did in part use this for pacing, they concurred that class pace was mostly based on student needs. In treatment classes, the teacher was observed following the Prentice Hall High School Math program exclusively and adhering to the implementation guidelines, with the exception of not incorporating the digital path, which wasn’t possible due to limited resources.

**Instructional Practices and Strategies:** Math instruction occurred throughout the day depending on the teacher. Classes lasted for 40 minute periods and occurred every day during the same time for the duration of each year. All students had sufficient copies of math resources (e.g., student textbooks). Of note, both treatment and control students used the Accelerated Math program about twice a week depending on what they were struggling with.

Math instruction in the control classroom was relatively consistent. The teacher would usually spend the first 5-8 minutes doing a warm-up, which included material from the previous day’s lesson. Next the checking of homework occurred for about 3-5 minutes. For the next 15-20 minutes the teacher would teach the lesson by going through a few sample problems and asking students to work along at their desks or come up to the board to model. The main lesson was followed by either a hands-on activity (1-2 times a week) or independent practice, which sometimes included pairs (1-2 times a week). Independent practice consisted of the even problems from the book and always included at least one or two story problems.

Lessons in the treatment math classrooms were similar in structure to the control class. Lessons started with the first three minutes of class designated for a brief review of the previous lesson followed by 5-10 minutes for questions on the homework. Students then did the Get Ready, which was immediately followed by 20 minutes for the teaching of the main lesson. The main lesson was delivered by the teacher in a lecture format that allowed for discussion and included guided practice, Got Its and Sample Problems. Students then did the Lesson Check. Either the Practice and Problem Solving Exercises, work from the Student Companion or the ELL worksheet was then assigned and students could use the few remaining minutes to begin on their work.

**Homework:** Homework assignment was similar between treatment and control classes. Because class periods did not allow for a great deal of in class independent practice homework was assigned four nights per week with 70% of treatment students and 90% of control students completing the homework. However, the control class in year one was given slightly more time in class to work independently on a regular basis and therefore had to devote slightly less time to completing homework each night.
Assessment: In terms of assessment practice there was some variation between the control and treatment classes. While informal assessment (i.e. observation, checking homework, discussion, etc.) and chapter tests occurred with equal regularity and in similar ways in all classes, there was some difference between the treatment and control classes when it came to standardized test prep. In the treatment classes students were given the general standardized test prep built into the Prentice Hall High School Math program as a “quiz” for every lesson it was available in; no other standardized test prep was provided for treatment students. Comparatively in the control class students were assessed informally using the Accelerated Math program along with the informal assessments mentioned above and OGT specific standardized test prep was provided using focus books with sample problems, notes, questions and full sample tests based on OGT items.

Comparability: In terms of overall comparability, both the Prentice Hall High School Math and the control classrooms were similar. For example, vocabulary, math computation and word problems were presented in both treatment and control classes and students in both treatment and control were given homework four nights a week. Technology was not especially evident in either classroom with the exception of Accelerated Math. There were however some disparities in the amount of independent in class practice that students engaged in, specifically control students had more time to work independently in class on a regular basis than did their treatment counterparts. As well, control students were specifically exposed to OGT standardized test prep, while treatment students received general standardized test prep built into the Prentice Hall High School Math program. Also, control students were more likely to engage in interactive activities on a weekly basis than were treatment students.

Highlights: In general, while Site E certainly placed importance on academic standards and achievements, the primary focus leaned heavily towards the arts. Schedules were often dictated by performing arts disciplines and it is was not rare for students to miss classes for rehearsals and/or performances. Study teachers were required to operate within very short class periods while still covering a breadth of material that would prepare students to both succeed in future math classes and do well on state testing in the 10th grade. In light of this both the control and treatment teacher were able to keep pacing on target. Student expectations in terms of homework were higher than at other sites and class time was more focused on instruction than supplemental student exploration or hands on activities, though as mentioned above, the control teacher was able to incorporate more of this with her class, which consisted of higher-level students. No contamination was noted during year one and student engagement and interest was high overall during both years.

School F

About the Schools: School F is a large public school located in a low to middle class, suburban community in Rhode Island. The junior/senior high school is housed in an older building, which serves the majority of students. There is also a separate, but adjacent building that houses students in the career and technical education school. The school houses students in grades 6-12. During the 2009-2010 school year, enrollment at School F was 1728, with a student to teacher ration of 17 to 1, which is somewhat higher than average for the state. During the 2010-2011 school year, enrollment at School F was 1750, with a student to teacher ratio of 14 to 1, which is slightly higher than average for the state.
In 2011, Rhode Island used the New England Common Assessment Program (NECAP) to test students in grades 6, 7, 8 and 11 in math. Data was not available for students in grades 6 through 8th, but of 11th graders who took the NECAP math test, 15% were proficient which is lower than the state average of 33%. The student population is predominantly white, but still ethnically diverse.

- 59% White, not Hispanic
- 23% Hispanic
- 1% American Indian/Alaskan Native
- 9% Black, not Hispanic
- 8% Asian/Pacific Islander

Approximately 58% of the students at the school were eligible for free or reduced-price lunches.

**Study Participants:** During year one, fourteen teachers participated in the study, two Geometry teachers, one treatment and one control and twelve Algebra I teachers, five treatment teachers and seven control. There was a total of 23 Algebra I classes participating in the study, 11 control and 12 treatment. For Geometry there were two treatment classes and two control. The 14 classes contained approximately 585 students, with an average class size of 24, and a range of 10 to 30. During year two, nine teachers participated in the study, six Geometry teachers, three treatment and three control and two Algebra II teachers, two treatment teachers and one control. There was a total of 13 Geometry classes participating in the study, 8 control and 5 treatment. For Algebra II there were six treatment classes and five control. The 24 classes contained approximately 572 students, with an average class size of 23.8, and a range of 15 to 30.

For the most part teachers characterized their classes as mixed, with some classes being high performing and others being average or low performing, with a few exceptions. During year one, one treatment and one control teacher taught only classes consisting of lower performing students. As well, one control and one treatment teacher taught only special education classes. There were also 2 honors courses (Algebra I and Geometry) in each group. During year two, two treatment and two control classes consisted of lower performing students. There were also 2 honors courses (Geometry and Algebra II) in each group. In sum, across treatment and control classes there was a relatively equal number of low, high and average performing classes for both Algebra I, Geometry and Algebra II. Overall classes were noted as typical of the student population and behavioral problems, to some extent, were considered normal in most classes.

Technology was emphasized and occurred daily in most all of the treatment classes, but was used very infrequently in the control classes other than graphing calculators with a few exceptions. During year one, one treatment teacher infrequently used technology due to inadequate resources in his room.

**Math Curriculum and Resources:** Control teachers used the same basal math program for Algebra I (copyright 2001 and 2004), Geometry (copyright 2004) and Algebra II (copyright 2001 & 2004), with one exception. During year one, two control teachers used, in addition to the aforementioned program, two other commercially published basal math programs to supplement
their main teaching resource. Overall in Algebra I and Geometry teachers indicated they generally followed the pacing guidelines and lesson plans as outlined in the books, but included teacher made resources or other worksheets, games, etc. collected over the years to supplement for hands on activities, remediation and extra practice with the following exceptions. During year one a control teacher used the materials loosely as a base for lessons, but because of the diverse nature of the students, created customized lessons that used resources from the main program and additional basal programs. Also during year one another control teacher used several basal texts to selectively customize each lesson to include hands on activities, skill practice, etc. In years one and two, one control teacher followed the book strictly and did not incorporate hands on activities.

There were a few similarities between the control program used and the Prentice Hall High School Math. Similarities included opportunities for hands-on explorations and focus on real-world applications. However, in general the Prentice Hall High School Math program integrated technology to a much a larger degree than the control program. In addition the control program was structured in a more traditional way, while the premise of the Prentice High School Math program is based on “Understanding by Design” and the associated focus on “big ideas” and overarching themes that are addressed throughout with an emphasis on thinking and writing skills.

The majority of the teachers paced their classes (treatment and control) based on the curriculum map, 18-week planner and student needs with two exceptions during year one. Two control teachers based their pacing completely on student needs. Use of technological resources was more a focal point of the lessons in treatment classes and very rare in the control, with the exception of graphing calculators. This is likely due to the fact that the treatment program had built in technology resources while the control program did not. In treatment classes, teachers were observed following the Prentice Hall High School Math program exclusively and mostly adhering to the implementation guidelines, although in year two treatment teachers had to supplement more often with outside resources in order to adhere to stricter curriculum mapping guidelines implemented by the district in year two of the study.

**Instructional Practices and Strategies:** Math instruction occurred throughout the day depending on the teacher. Classes lasted for 80-minute blocks and occurred every day during the same time. Some classes were every day for a semester, some spanned the duration of the year, others spanned the duration of the year, but occurred every other day. Algebra I honors classes lasted for one semester, with the remaining Algebra I classes broken down into two parts, a part “A” and a part “B”. While students generally took both parts of Algebra I, it was not always with the same teacher in second semester as they had during the first semester. As well, classes were not kept together from semester to semester (i.e. the students in period 1 Algebra I first semester might find themselves in Algebra I with entirely different classmates and a teacher in second semester). Therefore, most of the attrition is attributable to this site. In addition, students who failed “Part A” during the first semester did not take “Part B” during the second semester. Instead, students took a remedial math class\(^44\). Geometry classes were full year with a few classes that were semester only, and Algebra II classes were semester long. All students had

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\(^{44}\) These students were dropped from the study as they no longer were taking curricula being evaluated in the study (i.e., Algebra I).
sufficient copies of math resources (e.g., student textbooks or worksheets) and the school’s technology resources were able to support online instruction in most math classrooms.

Math instruction in control classrooms was relatively consistent. Overall teachers would begin instruction with a brief review of the previous day’s lesson or accept questions related to homework. If homework questions were presented the teacher would spend 5-20 minutes going over or answering them, problem modeling and helping students to reach the required level of understanding to feel confident in relation to the concept. There was one exception to this; during both years one control teacher started each lesson with a three question “mini-quiz” each day. These were not graded, but were used more as an informal assessment and class discussion followed the quiz based on how well students felt they did. In most classes this was followed by an introduction to the day’s lesson in a lecture or lecture with discussion format as the new lesson was taught for 30-40 minutes. The lesson usually included guided practice and questions posed by both the teacher and the students. At the close of the main lesson and guided practice, the teacher would hand out worksheets or have students begin working independently. Most teachers would allow students to help one another with a few exceptions. One control teacher rarely had students work together because of the associated behavioral problems. However, in many of the low performing classes, both treatment and control, partner work was permitted as teachers felt it created an environment in which students were more likely to stay on task and complete the assigned work. About half the teachers allowed students to choose their own partners and half selected the partners, based on social factors or utilizing a student as teacher model. Unfinished work was sent as homework. Only about 30% of the teachers in year one and 40% of the teachers in year two assigned additional homework that was not part of the independent practice, specifically this occurred more often in honors level classes.

In the treatment classrooms lessons were very similar, in part because most participating teachers followed the implementation guidelines and prescribed pacing and therefore the structure of the treatment lessons were extremely similar, with a few exceptions as noted below. Lessons started with the teacher going over the previous day’s homework/lesson and answering related questions, which generally included problem modeling for 10-20 minutes. This was followed by an introduction to the day’s lesson using either the Get Ready or the Lesson Check for 5 to 10 minutes. Next the teacher would utilize the Solve It as a way to get students engaged and thinking about the concepts they would be learning. Depending on the level of the class teachers would delve briefly (remedial classes) or more deeply (higher level classes) into the Solve It in order to exercise higher-level thinking and reasoning skills. Sometimes this included a brief class discussion or the teacher would encourage students to provide real life examples related to the concept. Teachers would then spend approximately 40-50 minutes going through the sample problems. Got Its were included during this portion of the class and helped to set the parameter for the guided practice. For the remainder of the class students worked independently, either using the textbook or workbooks while the teacher interacted with students one on one and helped as needed. If teachers saw the majority of students struggle with the same problem they might work through it in a guided practice format that involved the entire class, after which students would return to the independent practice. Generally unfinished work went as homework. The lessons were delivered both digitally and directly by the teacher, with a relatively even blend between the two, especially as the year progressed, with one exception in year one. Due to math room resources and the level of the students, one teacher did not incorporate many of the digital components. As well, some teachers (approximately 3 in year
one and 4 in year two) did mute the sound that accompanied the digital components from time to time, because their students found it too distracting.

**Homework:** Homework was somewhat consistent between treatment and control classes, however practices differed between teachers in general. About half the teachers in year one and year two (both treatment and control) spent the majority of the class teaching and allowed the last 15 minutes for students to work independently on the assigned problems, with any unfinished work going as homework. The other half of the teachers (both treatment and control) allowed more time in class to finish work and then specifically assigned additional homework 2-3 times a week. Consistent across all classes, on Fridays teachers did not assign homework or expect students to complete unfinished class work at home.

**Assessment:** In terms of assessment, both control and treatment teachers gave chapter and mid-chapter tests and quizzes, usually on Fridays. Informal assessments occurred in all classrooms (e.g., observations, discussions, etc.). Similarly, tests included both open-response and multiple-choice questions in control and treatment classes. However, it should be noted that overall treatment assessments tended to include slightly more word problems.

**Comparability:** In terms of comparability, both the Prentice Hall High School Math and the control classrooms, with the exception of the program-based activities, were similar overall. For example, vocabulary and math computation was equally emphasized in both types of classes. In addition, both types of classes incorporated thinking and reasoning skills, though as noted previously this occurred slightly more in treatment classes. Because of the overall school climate, hands on and exploratory activities were not emphasized in either the control or treatment classrooms. Some differences were also noted, specifically treatment classes engaged in more technology-based instruction that included big, overarching concepts and ideas related to math versus control classroom. As well, treatment classes had a greater access to their math programs outside the classroom via online resources. Control classes were almost entirely teacher delivered.

**Highlights:** Technology use at Site F was extremely limited in control classrooms while treatment classes utilized technology to a high degree. Overall the school climate was not very structured with last minute changes occurring to school wide schedules on a weekly basis. This tended to interrupt classes, including math and often times teaching plans had to be modified because of last-minute school-wide events. As well, the pass rate for most math classes was relatively low with the exception of honors classes, and transient students affected attendance rates overall. In year two the curriculum map for Geometry and Algebra II was significantly more prescriptive than in year one. No contamination was noted.
Appendix D

Key Features and Resources for Treatment and Control Programs
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<tr>
<td><strong>“Big Ideas” serve as the overarching concept for each lesson.</strong></td>
<td>Lessons typically consist of the following elements: 1) Lesson investigation to engage students and garner interest in the lesson topic 2) Introduction and lesson of new topics 3) Practice exercises 4) Built in assessment. Provides an emphasis on real-world applications and investigation activities.</td>
<td>Designed with student differentiation as a key component. Built in assessments, lab activities and real world problem solving. Lessons typically consist of the following elements: o Introduction to lesson and associated vocabulary o Example problems o Guided Practice o Practice Problems (includes problem solving) o Test Prep o Challenge Questions o Built in Spiral Review</td>
<td>In a typical chapter, students engage in an opening discussion relevant to the mathematics in the chapter. Lessons typically consist of the following elements: o Read a brief passage of real-life context for the mathematics o Develop understanding of mathematical ideas through examples and illustrations of mathematical procedures, o Work problems in guided practice o Independent practice (includes problem solving sections) Some lessons provide students with opportunities to engage in the following: o Cooperative learning activities o Problem solving o Estimation o Mental math The teacher’s edition also provides teachers with ideas for exploratory and discovery lessons, chapter projects, games, alternative approaches, and extensions. Assessment options include: o Warm-ups, guided and independent practice, re-teaching, practice, and enrichment worksheets, and a problem of the day for each lesson. o Section reviews, chapter reviews, chapter tests and standardized format tests are used for formal assessment of chapters. o Other tools for assessment include observation checklists and performance inventories and suggestions for math logs and portfolios.</td>
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<td>Thinking, writing and connections between real world applications and math concepts are emphasized.</td>
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<td>Organized into 12 chapters broken down into anywhere from 4 to 10 lessons.</td>
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<td>Lessons typically consist of the following elements: o Prior knowledge is tapped and prerequisite skills are identified with Get Ready or Lesson Check o Introduction to the lesson with emphasis on thinking and reasoning skills using Solve It o Practice Sample Problems and exercises o Built in assessment prior to independent practice in the form of Got It o Independent Practice At the start of the chapter, lessons also typically include the following elements: o The main themes for the chapter are introduced using Big Ideas o The Big Ideas are further developed through the Essential Understandings o Investigation occurs via the Essential Questions to help students garner interest in the chapter topics and process and apply the Essential Understandings o Students engage in real world applications pertaining to chapter topics via My Math Video</td>
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<tr>
<td>Provides an emphasis on real-world applications and investigation activities.</td>
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<tr>
<td>Program Resources</td>
<td>Student Resources</td>
<td>Teacher Resources</td>
<td>Digital Resources</td>
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| Prentice Hall High School Math | ▪ Student Edition  
▪ Student Companion Worktext  
▪ Practice and Problem Solving Workbook  
▪ Student Edition on CD-ROM  
▪ PowerAlgebra.com | ▪ Teacher’s Edition  
▪ Student Edition  
▪ Teacher Resource Package  
▪ Chapter Resource Books  
▪ Worked-Out Solution Key  
▪ Algebra Tile Investigations  
▪ Basic Skills Workbook – Diagnosis and Remediation (TE)  
▪ Practice Workbook with Examples (TE)  
▪ Standardized Test Practice Workbook TE  
▪ Warm-Up Transparencies and Daily Homework Quiz  
▪ Student Algebra Tile Kit  
▪ Overhead Algebra Tile Kit  
▪ Teaching Mathematics Using Technology  
▪ Explorations & Projects Book  
▪ Data Analysis Sourcebook  
▪ Functions Sourcebook  
▪ Extra Examples & Standardized Test Practice Transparencies  
▪ Answer Transparencies for Checking Homework  
▪ Alternative Lesson Opener Transparency Package  
▪ Notetaking Guide Transparencies  
▪ Diagnosis & Remediation Workbook  
▪ Spanish Resources  
▪ CD-Rom Package  
▪ eEdition Plus Online | ▪ Student & Teacher Edition  
▪ Student Generated Videos  
▪ Vocabulary Support  
▪ Dynamic Activities  
▪ Online Problems  
▪ Online Homework and Workbook pages  
▪ MathXL® Tutorial Videos  
▪ SuccessTracker  
▪ Multilingual Support  
▪ Teaching Resources with editable worksheets  
▪ Portable Study Center |
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<tr>
<td>Chapter 1 – Foundations for Algebra (includes variables, expressions, real numbers (addition, subtraction, multiplication, division, number line), distributive property, equations, patterns, and graphs)</td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td>Chapter 2 – Solving Equations (includes solving one-step, two-step, and multi-step equations, solving equations with variables on both sides, literal equations and formulas, ratios, rates, conversions, proportions, and percents)</td>
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<td>X</td>
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<tr>
<td>Chapter 3 – Solving Inequalities (includes inequalities and their graphs, solving inequalities (addition, subtraction, multiplication, division), working with sets, compound inequalities, absolute value equations and inequalities, and unions and intersections of sets)</td>
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<td>X</td>
<td>X</td>
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<tr>
<td>Chapter 4 – An Introduction to Functions (includes using graphs to relate two quantities, patterns and linear and non-linear functions, function rule, formulizing relations and functions, and sequences and functions)</td>
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<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Chapter 5 – Linear Functions (includes rate of change and slope, direct variation, slope-intercept form, point-slope form, standard form, parallel and perpendicular lines, and scatter plots and trend lines)</td>
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<td>X</td>
<td>X</td>
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<tr>
<td>Chapter 6 – Systems of Equations and Inequalities (includes solving systems by graphing, substitution, and elimination, applications of linear systems, linear inequalities, and systems of linear inequalities)</td>
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<td>X</td>
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</tr>
<tr>
<td>Chapter 7 – Exponents and Exponential Functions (includes zero and negative exponents, scientific notation, multiplying powers with the same base, multiplication and division properties of exponents, exponential functions, and exponential growth and decay)</td>
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<td>X</td>
<td>X</td>
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<tr>
<td>Chapter 8 – Polynomials and Factoring (includes adding, subtracting, and multiplying polynomials, multiplying binomials and special cases, and factoring $x^2 + bx + c$, $ax^2 + bx + c$, special cases, and by grouping)</td>
<td></td>
<td>X</td>
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</tr>
<tr>
<td>Chapter 9 – Quadratic Functions and Equations (includes quadratic graphs and their properties, quadratic functions, solving quadratic equations, factoring to solve quadratic equations, completing the square, the quadratic formula and the discriminant, and linear, quadratic, or exponential models)</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Chapter 10 – Radical Expressions and Equations (includes the Pythagorean Theorem, simplifying radicals, operations with radical expressions, and solving radical equations)</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Chapter 11 – Rational Expressions and Functions (includes simplifying rational expressions, adding, subtracting, multiplying and dividing rational expressions, dividing polynomials, and solving rational equations)</td>
<td></td>
<td>X</td>
<td>(also covers square root functions)</td>
</tr>
<tr>
<td>Chapter 12 – Data Analysis and Probability (includes matrices, frequency and histograms, measures of central tendency and dispersion, box-and-whisker plots, samples and surveys, permutations and combinations, theoretical and experimental probability, and probability of compound events)</td>
<td></td>
<td>Very limited coverage</td>
<td>Covers same concepts with exception of central tendency &amp; dispersion, experimental probability, &amp; probability of compound events.</td>
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## Table D4. Geometry Topics Covered in Treatment and Control Programs

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<tbody>
<tr>
<td><strong>Chapter 1 – Tools of Geometry</strong> (includes nets and drawings for visualizing geometry, points, lines and planes, measuring segments, measuring angles, exploring angle points, basic constructions, midpoint and distance in the coordinate plane, perimeter, circumference and area)</td>
<td>Covers similar topics with exception of nets &amp; drawings for visualizing geometry (also covers angle pair relationships)</td>
<td>Covers similar topics with the exception of nets and drawings for visualizing geometry</td>
<td>X (also covers straight edge &amp; compass constructions)</td>
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</tr>
<tr>
<td><strong>Chapter 2 – Reasoning and Proof</strong> (includes patterns and inductive reasoning, conditional statements, biconditionals and definitions, deductive reasoning, reasoning in algebra and geometry, proving angles congruent)</td>
<td>X</td>
<td>X (also covers introduction to symbolic logic)</td>
<td>Covers similar topics with the exception of biconditionals and definitions &amp; proving angles congruent</td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 3 – Parallel and Perpendicular Lines</strong> (includes lines and angles, properties of parallel lines, proving lines parallel, parallel and perpendicular lines, parallel lines and triangles, constructing parallel and perpendicular lines, equations of lines in the coordinate plane, slopes of parallel and perpendicular lines)</td>
<td>X</td>
<td>X</td>
<td>X (also includes Vectors)</td>
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</tr>
<tr>
<td><strong>Chapter 4 – Congruent Triangles</strong> (includes congruent figures, triangle congruence by SSS, SAS, ASA and AAS, using corresponding parts of congruent triangles, isosceles and equilateral triangles, congruence of right and overlapping triangles)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 5 – Relationships Within Triangles</strong> (includes midsegments of triangles, perpendicular and angle bisectors, bisector triangles, medians and altitudes, indirect proof, inequalities in one and two triangles)</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
<tr>
<td><strong>Chapter 6 – Polygons and Quadrilaterals</strong> (includes polygon-angle sum theorems, properties of parallelograms, proving that a quadrilateral is a parallelogram, properties of rhombuses, rectangles and squares, conditions for rhombuses, rectangles and squares, trapezoids and kites, polygons and the coordinate plane, applying coordinate geometry, proofs using coordinate geometry)</td>
<td>Covers similar topics with exception of polygons and the coordinate plane, applying coordinate geometry, proofs using coordinate geometry</td>
<td></td>
<td>Covers similar topics with exception of proofs using coordinate geometry</td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 7 – Similarity</strong> (includes ratios and proportions, similar polygons, proving triangles similar, similarity in right triangles, proportions in triangles)</td>
<td>X</td>
<td>X</td>
<td>X (also includes dilations)</td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 8 – Right Triangles and Trigonometry</strong> (includes Pythagorean theorem and its converse, special right triangles, trigonometry, angles of elevation and depression, vectors)</td>
<td>X</td>
<td>X</td>
<td>Covers similar topics with the exception of angles of elevation and depression</td>
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<tr>
<td><strong>Chapter 9 – Transformations</strong> (includes translations, reflections, rotations, symmetry, dilations, compositions of reflections, tessellations)</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Chapter 10 – Area (includes areas of parallelograms, triangles, trapezoids, rhombuses and kites, areas of regular polygons, perimeters and areas of similar figures, trigonometry and area, circles and arcs, areas of circles and sectors, geometric probability)</td>
<td>Covers similar topics with the exception of trigonometry and area</td>
<td>X</td>
<td></td>
<td>Covers similar topics with the exception of trigonometry and area</td>
</tr>
<tr>
<td>Chapter 11 – Surface Area and Volume (includes space figures and cross sections, surface area of prisms, cylinders, pyramids and cones, volumes of prisms and cylinders, volumes of pyramids and cones, surface areas and volumes of spheres, areas and volumes of similar solids)</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Chapter 12 – Circles (includes tangent lines, chords and arcs, inscribed angles, angle measures and segment lengths, circles in the coordinate plane, locus: a set of points)</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Chapter 13 – Loci (includes exploring loci in a plane and space, loci problem solving, loci and mathematical problems, loci and cross sections, the bigger picture of geometry)</td>
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<tr>
<td><strong>Chapter 1 – Expression, Equations &amp; Inequalities</strong> (includes patterns and expressions, properties of real numbers, algebraic expressions, solving equations, solving inequalities, absolute value equations and inequalities)</td>
<td>X (also includes rewriting equations and formulas)</td>
<td>Covers similar topics with the exception of solving equations, solving inequalities, absolute value equations and inequalities (also includes introduction to functions)</td>
<td>X</td>
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</tr>
<tr>
<td><strong>Chapter 2 – Functions, Equations &amp; Graphs</strong> (includes relations and functions, direct variation, linear functions and slope-intercept form, using linear models, families of functions, absolute value functions and graphs, two variable inequalities)</td>
<td>X</td>
<td>X</td>
<td>Covers a very limited amount of topics – includes only relations and functions</td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 3 – Linear Systems</strong> (includes solving systems using tables and graphs, solving systems algebraically, systems of inequalities, linear programming, systems with three variables, solving systems using matrices)</td>
<td>X</td>
<td>Covers similar topics with the exception of matrices (also includes parametric equations)</td>
<td>Covers similar topics with the exception of matrices</td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 4 – Quadratic Functions &amp; Equations</strong> (includes quadratic functions and transformations, standard format of a quadratic equation, modeling with quadratic functions, factoring quadratic expressions, quadratic equations, completing the square, the quadratic formula, complex numbers, quadratic systems)</td>
<td>X</td>
<td>X</td>
<td>Covers similar topics but not with the detail found in PHHS (e.g., quadratic equation, modeling with quadratic functions, factoring quadratic expressions, quadratic systems)</td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 5 – Polynomials &amp; Polynomial Functions</strong> (includes polynomial functions, polynomials, linear factors and zeroes, solving polynomial equations, dividing polynomials, theorems about roots of polynomial equations, the fundamental theorem of algebra, binomial theorem, polynomial models in the real world, transforming polynomial functions)</td>
<td>Covers similar topics with the exception of dividing polynomials</td>
<td>Covers similar topics with the exception of binomial theorem (includes curve fitting with polynomial models)</td>
<td>Covers similar topics with the exception of binomial theorem</td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 6 – Radical Functions &amp; Rational Exponents</strong> (roots and radical expressions, multiplying and dividing radical expressions, binomial radical expressions, rational exponents, solving square root and other radical expressions, function operations, inverse relations and functions, graphing radical functions)</td>
<td>Covers similar topics with the exception of binomial radical expressions (also includes graphing square root and cube root functions)</td>
<td>X</td>
<td>Covers similar topics with the exception of multiplying and dividing polynomials, binomial radical expressions (also covers exploring data: compound interest and exponential growth, properties of roots of real numbers)</td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 7 – Exponential &amp; Logarithmic Functions</strong> (exploring exponential models, properties of exponential functions, logarithmic functions as inverses, properties of logarithms, exponential and logarithmic equations, natural logarithms)</td>
<td>X (also includes number e and logistic growth functions)</td>
<td>X (also includes number e)</td>
<td>X (also includes number e)</td>
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<tr>
<td><strong>Chapter 8 – Rational Functions</strong> (including inverse variation, reciprocal function family, rational functions and their graphs, rational expressions, adding and subtracting rational expressions, solving rational equations)</td>
<td>Covers similar topics with the exception of reciprocal function family (also includes multiplying and dividing rational expressions)</td>
<td>X</td>
<td>Covets similar topics with the exception of reciprocal function family (also includes multiplying and dividing rational expressions)</td>
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<tr>
<td><strong>Chapter 9 – Sequence &amp; Series</strong> (mathematical patterns, arithmetic sequences, geometric sequences, arithmetic series, geometric series)</td>
<td>X</td>
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<tr>
<td><strong>Chapter 10 – Quadratic Relations &amp; Conic Sections</strong> (including exploring conic sections, parabolas, circles, ellipses, hyperbolas, translating conic sections)</td>
<td>X (also includes solving quadratic systems)</td>
<td>X (also includes solving nonlinear systems)</td>
<td>X</td>
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<tr>
<td><strong>Chapter 11 – Probability &amp; Statistics</strong> (permutations and combinations, probability, probability of multiple events, conditional probability, analyzing data, standard deviation, samples and surveys, binomial distributions, normal distributions)</td>
<td>Covers similar topics with the exception of analyzing data, standard deviation, samples and surveys</td>
<td>X</td>
<td>Covers similar topics with the exception of analyzing data, standard deviation, samples and surveys</td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 12 – Matrices</strong> (including adding and subtracting matrices, matrix multiplication, determinants and inverses, inverse matrices and systems, geometric transformations, vectors)</td>
<td>Covers similar topics with the exception of geometric transformations &amp; vectors</td>
<td>X (also includes networks and matrices)</td>
<td>Covers similar topics with the exception of geometric transformations &amp; vectors (also includes Cramer’s Rule)</td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 13 – Periodic Functions &amp; Trigonometry</strong> (including exploring periodic data, angles and the unit circle, radian measure, sine function, cosine function, tangent function, translating sine and cosine functions, reciprocal trigonometric functions)</td>
<td>Covers similar topics with the exception of periodic data, tangent function, translating sine and cosine functions</td>
<td>X</td>
<td>Covers similar topics with the exception of exploring periodic data</td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 14 – Trigonometric Identities &amp; Equations</strong> (including trigonometric identities, solving trigonometric equations using inverses, right triangles and trigonometric ratios, area and the law of sines, law of cosines, angle identities, double-angle and half-angle identities)</td>
<td>X (also includes using sum and difference formulas)</td>
<td>X (Also includes trigonometric graphs)</td>
<td>X (Also includes translation of graphs)</td>
<td></td>
</tr>
</tbody>
</table>
Appendix E:

Use of Prentice Hall High School Math Resources
Table E1. Percent of Usage of Key Prentice Hall High School Math Program Components

<table>
<thead>
<tr>
<th>Component</th>
<th>YEAR 1</th>
<th>YEAR 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of Time Used Regularly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used &quot;Essential Understanding&quot;</td>
<td>88.21%</td>
<td>79.8%</td>
</tr>
<tr>
<td>Used &quot;Essential Questions&quot;</td>
<td>85.09%</td>
<td>72.3%</td>
</tr>
<tr>
<td>Had students get ready using &quot;Solve It&quot;</td>
<td>87.39%</td>
<td>71.7%</td>
</tr>
<tr>
<td>Used the &quot;Got Its&quot;</td>
<td>93.36%</td>
<td>93.1%</td>
</tr>
<tr>
<td>Went through the sample problems</td>
<td>93.41%</td>
<td>93.7%</td>
</tr>
<tr>
<td>Used the &quot;Think/Plan/Write&quot; boxes</td>
<td>70.03%</td>
<td>60.3%</td>
</tr>
<tr>
<td>Assigned &quot;Practice and Problem Solving Exercises&quot; (independent practice)</td>
<td>87.59%</td>
<td>95.0%</td>
</tr>
<tr>
<td>Used the &quot;Get Ready!&quot; at the start of the chapter</td>
<td>67.47%</td>
<td>67.9%</td>
</tr>
<tr>
<td>Showed &quot;My Math Video&quot;</td>
<td>49.33%</td>
<td>35.8%</td>
</tr>
</tbody>
</table>

*% reflects average percent of logs where teachers reported using the listed program components as noted during a given month from teacher log.

Table E2. Percent of Usage of Additional Prentice Hall High School Math Program Components

<table>
<thead>
<tr>
<th>Component</th>
<th>YEAR 1</th>
<th>YEAR 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of Time Used Regularly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online problems</td>
<td>89.2%</td>
<td>77.1%</td>
</tr>
<tr>
<td>Lesson Check</td>
<td>86.7%</td>
<td>71.1%</td>
</tr>
<tr>
<td>Teaching resources with editable worksheets</td>
<td>68.8%</td>
<td>64.2%</td>
</tr>
<tr>
<td>Vocabulary support</td>
<td>53.8%</td>
<td>55.4%</td>
</tr>
<tr>
<td>Tutorial videos</td>
<td>43.0%</td>
<td>49.4%</td>
</tr>
<tr>
<td>Concept Bytes</td>
<td>41.6%</td>
<td>41.0%</td>
</tr>
<tr>
<td>Online homework and workbook pages</td>
<td>36.6%</td>
<td>34.9%</td>
</tr>
<tr>
<td>Lesson Quiz</td>
<td>32.9%</td>
<td>28.9%</td>
</tr>
<tr>
<td>MathXL for extra practice and review</td>
<td>27.2%</td>
<td>19.3%</td>
</tr>
<tr>
<td>Dynamic Activity</td>
<td>22.0%</td>
<td>17.6%</td>
</tr>
<tr>
<td>Successtracker online assessments and remediation</td>
<td>14.0%</td>
<td>16.4%</td>
</tr>
<tr>
<td>Multilingual support</td>
<td>11.8%</td>
<td>12.0%</td>
</tr>
<tr>
<td>Portable study center</td>
<td>3.2%</td>
<td>0%</td>
</tr>
</tbody>
</table>

*% reflects average percent of logs where teachers reported using the listed program components as noted during a given month from teacher log.
Table E3. Percent of Usage of Prentice Hall High School Math Program Materials on a Given Month

<table>
<thead>
<tr>
<th>Component</th>
<th>YEAR 1 % of Time Used</th>
<th>YEAR 2 % of Time Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Edition</td>
<td>94.5</td>
<td>94.3</td>
</tr>
<tr>
<td>Teacher’s Edition</td>
<td>93.9</td>
<td>96.2</td>
</tr>
<tr>
<td>Practice Worksheets</td>
<td>73.5</td>
<td>95.0</td>
</tr>
<tr>
<td>ExamView/Test Generator CD-ROM</td>
<td>68.5</td>
<td>69.8</td>
</tr>
<tr>
<td>Practice and Problem Solving Workbook</td>
<td>59.9</td>
<td>72.3</td>
</tr>
<tr>
<td>PowerGeometry.com</td>
<td>58.7</td>
<td>28.3</td>
</tr>
<tr>
<td>PowerAlgebra.com</td>
<td>57.2</td>
<td>--</td>
</tr>
<tr>
<td>Practice and Problem Solving Workbook, Teacher’s Guide</td>
<td>57.2</td>
<td>79.9</td>
</tr>
<tr>
<td>Reteaching</td>
<td>55.2</td>
<td>53.5</td>
</tr>
<tr>
<td>Student Companion Worktext</td>
<td>53.0</td>
<td>34.6</td>
</tr>
<tr>
<td>Student Companion Worktext, Teacher’s Guide</td>
<td>52.9</td>
<td>33.3</td>
</tr>
<tr>
<td>Quizzes and tests</td>
<td>50.8</td>
<td>57.9</td>
</tr>
<tr>
<td>Solve It/Lesson Quiz Transparencies</td>
<td>46.6</td>
<td>24.6</td>
</tr>
<tr>
<td>Standardized test prep</td>
<td>43.9</td>
<td>38.4</td>
</tr>
<tr>
<td>Performance tasks</td>
<td>40.8</td>
<td>5.7</td>
</tr>
<tr>
<td>Enrichment</td>
<td>39.4</td>
<td>6.3</td>
</tr>
<tr>
<td>Teaching with TI Technology</td>
<td>38.9</td>
<td>3.8</td>
</tr>
<tr>
<td>Spanish Student Edition</td>
<td>37.7</td>
<td>0</td>
</tr>
<tr>
<td>English Language Learners</td>
<td>34.1</td>
<td>12.6</td>
</tr>
<tr>
<td>Guided Problem Solving</td>
<td>32.8</td>
<td>22.0</td>
</tr>
<tr>
<td>TI-Nspire Lesson Support CD-ROM</td>
<td>26.2</td>
<td>0</td>
</tr>
<tr>
<td>Teaching Resources CD-ROM</td>
<td>25.6</td>
<td>1.9</td>
</tr>
<tr>
<td>Cumulative review</td>
<td>23.2</td>
<td>11.9</td>
</tr>
<tr>
<td>Answers and solutions CD-ROM</td>
<td>21.6</td>
<td>11.3</td>
</tr>
<tr>
<td>Chapter project</td>
<td>21.1</td>
<td>1.9</td>
</tr>
<tr>
<td>Student Edition on CD-ROM</td>
<td>18.9</td>
<td>0</td>
</tr>
<tr>
<td>Progress Monitoring Assessment</td>
<td>17.8</td>
<td>5.7</td>
</tr>
<tr>
<td>Professional development at <a href="http://www.mypearsontraining.com">www.mypearsontraining.com</a></td>
<td>17.6</td>
<td>6.3</td>
</tr>
</tbody>
</table>

*% reflects average percent of logs where teachers reported using the listed program components as noted during a given month from teacher log.