AN EXAMINATION OF THE IMPACT OF SUCCESSIVE AND NON-SUCCESSIVE GEOMETRY CLASSES ON HIGH SCHOOL STUDENT ACHIEVEMENT

by

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DISSERTATION ABSTRACT

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This study examines the impact of successive versus non-successive scheduling of mathematics courses on the achievement of ninth-grade students in a suburban Oregon high school. The Oregon Assessment of Knowledge and Skills and student performance on the geometry course final exam were employed to compare the achievement of intact groups of students who had geometry scheduled for two successive trimesters and students who had geometry in two non-successive trimesters. An ANCOVA provides a comparison of students on pre-test and post-test performance. The results show no differences in student mathematics achievement as a result of scheduling differences after the covariate pre-test is examined. The implications are that schools may choose schedules for reasons other than improving student achievement and that scheduling does not impact student achievement.

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For my wife, who encouraged me to finish, and my children, always work towards the next goal.

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CHAPTER I

INTRODUCTION

During the last twenty years, school administrators have been experimenting with longer class periods. These longer class periods have become commonly known as block classes. The research into the effectiveness and impacts of these block schedules has been very sparse (Pliska, Harmston & Hackman, 2001). Most research has focused on benefits to school climate or to individual curricular areas such as math and science.

In my twenty-three-year career as an educator I have worked with many professionals on building master schedules for various schools. In each school we examined our own master schedule and considered making changes. We examined the master schedules of other districts and consulted articles about popular scheduling options. Research usually focused on school climate and the practical benefits of block scheduling. Over the past ten years the emphasis in our schools has moved toward improving student performance, however, research on scheduling and its impact on student performance is thin at best.

This study examines the research base on block scheduling and the impact on student achievement in mathematics. I focus on the impact of one particular type of block schedule, the trimester schedule, and the impact of one aspect of the trimester schedule on the mathematics achievement of ninth-grade geometry students at one suburban Oregon high school.

In the trimester schedule some students receive geometry instruction in successive trimesters and other students receive geometry instruction in non-successive trimesters.

This study examines standardized test results to determine if there is a significant difference in achievement between these two groups. Does non-successive scheduling of the two halves of geometry significantly impact the mathematics achievement of ninth-grade geometry students, as measured by the OAKS mathematics assessment or on the course final exam, when compared with the mathematics achievement of ninth-grade geometry students with successive scheduling of the two halves of geometry?

CHAPTER II

LITERATURE REVIEW

The review of literature provides a context for this study on the use of time. First, the literature review provides a historical perspective for the discussion. Second, the review examines and discusses the common types of block schedules in use today. The review then examines the existing research on block scheduling and the impact on student educational performance. Finally, the review shows that no research on the focus of this study exists.

Schedule as a Structure of Time

The debate about how to organize the school day and how much time should be spent on each subject has been debated since 1894, when the U.S. Commissioner of Education lamented the decision to not keep urban schools open year-round and to reduce the number of school days from 193.5 to 191 (National Commission on Time and Learning, 1994). Over an 84-year period from 1890 to 1974, several indexes measuring education in America rose, including the number of days of school from 135 to 178 and the average days attended by enrolled students from 81 to 160 (Walberg, 1988). The question of how much time a student requires to learn material cannot be absolutely measured; it depends on what is to be learned, the quality of instruction and the aptitude of the student (Walberg, 1988). Walberg found that the amount of time required for the fastest learners and the slowest learners to reach criterion can vary widely (1988).

In 1906 the Carnegie Foundation set out a definition of a high school credit based on the time spent in a classroom studying a specific subject (Zepeda & Mayers, 2006).

Based on this report, the Carnegie unit was deemed an accumulation of 130 hours in one subject, such that a class that meets for 40 to 60 minutes four or five times a week for 36 to 40 weeks each year characterizes one high school credit. Since the establishment of the Carnegie unit, the definition of a credit (as measured by time) has determined the way high schools are organized (Canady & Rettig, 1995). The Carnegie unit affects the way knowledge is organized for instruction in high schools and discourages the use of interdisciplinary teaching practices, because it produces a difficulty in equating learning with seat time. High schools continue to this day to make sure the number of minutes a class meets per day multiplied by number of class meetings is equal to or greater than 130 hours. This formula assumes that each student needs that amount of time to learn the material.

Sixteen years ago, the National Education Commission on Time and Learning (1994) studied the issue of "time" in American schools, and found that from the beginnings of public education in America, we have debated the use of time in schools. The commission divided time into two categories: academic and non-academic time. Academic time is the time spent in class learning a particular curriculum, and non-academic time is time spent on non curriculum activities including, but not limited to, athletics, clubs, assemblies, AIDS education, and student safety. While some of the latter activities take place in specific classes or after school they have either supplanted other academic material or have taken student attention away from studying and doing homework. The National Commission on Time and Learning found that in many states only 41% of school time was spent on core subjects, or what the commission would refer to as academic time, therefore more than half of a student's day is spent on non-core academic content.

The National Commission on Time and Learning found that schools are indeed ruled by the clock. They argued that time governs students, families, administrators, teachers and the way material is organized and presented in schools, leading the commission to title the report, *Prisoners of Time* (National Commission on Time and Learning, 1994). High-ability students are made to sit in a class for longer than they need to learn the material, low-ability students are made to sit in a class for a shorter amount of time than they need to learn the material and average-ability students are made to sit in a class where the teacher is dividing time between students of all ability levels, thus, students of all ability levels are prisoners of time (National Commission on Time and Learning, 1994).

The National Commission on Time and Learning also found that the American high school is flawed in the way time is used. We have organized our schools around time, and over time have placed more demands on the time our schools have. Schools have a host of other initiatives that eat away at the limited amount of time that is available for the focus on academics. The fact that students of varying abilities are expected to learn a subject in the same amount of time is one of the major frustrations for teachers. In addition to these problems, the U.S. is moving towards achievement standards and has a desire to build a world-class education system. This movement may be creating a recipe for disappointment if there is no reform in the way schools organize and use time (National Commission on Time and Learning, 1994).

The National Commission on Time and Learning has attributed the failure of many educational reform efforts on this high school design flaw:

> Decades of school improvement efforts have foundered on a fundamental design flaw, the assumption that learning can be doled out by the clock and defined by the calendar. Research confirms common sense. Some students take three to six times longer than others to learn the same thing. Yet students are caught in a time trap-processed on an assembly line scheduled to the minute. Our usage of time virtually assures the failure of many students (Prisoners of Time section, para 6).

The next section investigates the relationship between time and learning. School leaders are looking for a class schedule that will benefit all students yet fit the rigid structure of high schools.

Semester, Block, and Trimester Scheduling Options

Administrators are trying to find a schedule that will unlock learning and, by allowing teachers to focus on student needs, enable students to reach their full potential (McCreary & Hausman, 2001). That choice of schedule is critical and will have many ramifications. The school schedule can lead to course conflicts that limit student choices by reducing the number of periods in the school day. Schedules with fewer, longer, classes may allow teachers to use more hands-on activities and rely less on lecture. The schedule types I focus on are semester, block, and trimester schedules, the three dominant schedules currently used in U.S. high schools (Canady & Rettig, 1995).

The semester schedule in high school consists of six or seven periods of equal length, usually 42 to 60 minutes, meeting each day for the entire year. For the purposes of this synthesis, I will refer to this as the *traditional* semester schedule, as much of the literature uses the term *traditional* to refer to this type of schedule (Zepeda & Mayers, 2006).

Block schedules are usually one of three types: The 4 X 4 block has four equally long classes that meet for 90 to 120 minutes every day for one semester, and four different classes that meet for the second semester. In the alternating day A/B block, students have seven or eight classes with four classes each day that are usually about 90 minutes long. In the A/B scheduleeach class meets every other day throughout the school year (Zepeda & Mayers, 2006).

In the trimester schedule, there are three terms with five classes, in each term every class meets for about 70 minutes each day (Zepeda & Mayers, 2006). Table 1 summarizes these four types of block schedules and shows the characteristics of each type of schedule.

Table 1. Scheduling Types Summarized

Type	Number of different class periods per day	Length of each class period per day	Number of weeks	Frequency of class meetings
Traditional semester	6 or 7	42 to 60 minutes	36 Weeks	Daily
4 X 4	4	90 to 120 minutes	18 Weeks	Daily
Alternating A/B	7 or 8	90 minutes	36 Weeks	Every other day
Trimester	5	70 minutes	24 Weeks	Daily

Nichols (2000) suggests it is now time to stop holding learning as a prisoner of time, and argues that block scheduling is one of the keys that will set learning free. One recommendation of the commission is to use time in new ways, so as to make better use of the time spent in school (National Commission on Time and Learning, 1994). It is against this backdrop that school administrators began to look for different ways to divide the school day to make time more flexible, although they continue to treat all learners as if they learn at the same rate. The rigidity of the school schedule assumes that each student has the same knowledge currently and learns new knowledge at the same rate.

Although block scheduling, dividing the school day into periods of time that are longer than the traditional 40 to 60 minutes in length, is not the first attempt to change the high school schedule, it is currently the most common form of schedule reform. Before the advent of block scheduling most American high schools ran schedules that included six to nine equal periods of time from 42 minutes to 60 minutes in length with the year broken into two semesters (Canady & Rettig, 1995).

All of these schedules treat each subject the same in terms of the amount of time devoted to teaching the subject (e.g., a physical education class is the same length as a math class). The switch to block scheduling decreases the amount of time lost to management tasks such as student attendance and passing time between classes. This time-saving is accomplished because there are fewer classes so there are fewer times to take roll each day and fewer passing times. The longer class periods allow teachers to use more hands-on activities and to individualize instruction for students (Hausman & McCreary, 2001).

The Consortium on Educational Policy Studies (Hossler, Stage & Gallagher, 1988) policy paper stated that increased instructional time has a moderate positive effect on student achievement. In the article they also cautioned that while the effect on student achievement is positive, it is modest, and therefore school leaders should not expect large gains from increased instructional time. They also stated that research was inconclusive about the best ways to increase instructional time.

Review of Research on Block Scheduling

A review of research on schedule effects found that one benefit of block scheduling is that block schedules allow students to earn more credits over their high school careers than the traditional semester schedule (Canady & Rettig, 2001). In the traditional seven-period semester schedule, students earn seven credits per year or 28 credits in four years, while students on a 5 period trimester schedule can earn seven and one-half credits per year, or 30 credits in four years. Over the past several years, states have been increasing graduation requirements, which tend to “squeeze” electives out of the high school schedule. By allowing students to take more classes, block scheduling has helped to save these elective programs (Canady & Rettig, 2001).

Increased student achievement, increased student attendance, and improved school climate are some of the benefits that have been claimed to result from the use of block schedules (Zepeda & Mayers, 2006). In this age of accountability and high-stakes testing, educators are searching for the best ways to improve student achievement.

In one survey of 231 Virginia high schools, Canady & Rettig (2001) found that a majority of school personnel, parents, and students had positive experiences with block schedules. The researchers also reported that discipline referrals were reduced by 25% to 35% along with small increases in student and staff attendance rates. They also found that failure rates decreased, and the number of students on school honor rolls increased.

Schedule Impact on Student Achievement

How do we know that changing a school schedule will have a positive effect on student achievement? There have been many studies that have examined the effects of block scheduling on school climate, such as the number of discipline referrals and student or teacher morale, however, relatively few empirical studies have attempted to examine the effects of block scheduling on student achievement(Pliska, Harmston & Hackmann, 2001). Student achievement is measured in several ways, such as scores on standardized tests, student grade point averages, and scores on state-mandated and end-of-course tests. In this age of educational accountability, scores on state-mandated tests are very important to administrators and all stakeholders, as these are the scores that the state and federal government use to rate the school on state report cards and adequate yearly progress (AYP). In the next section, I review the research on student achievement in three areas: nationally standardized tests, grade point average, and state-mandated end-of-course tests.

National standardized tests. Pliska et al.'s (2001) longitudinal study examined ACT assessment scores for 38,089 high school seniors in 568 public high schools in the states of Illinois and Iowa. The results of the study showed that the difference in the mean composite scores for the different types of schedules was negligible. The same results were found when the results were broken down by "state, proportion female, school enrollment, number of examinees, and number of years of scheduling model" (Pliska, et al., 2001, p. 5). One limitation of this study was the fact that the data could not be analyzed at the school level.

Bottge, Gugerty, Serlin, and Moon's (2003) study used ACT scores to examine whether the choice of schedule impacted students with disabilities differently than it impacted students with-out disabilities and reported similar findings. The study of 24 upper Midwest schools, 12 block and 12 traditional schools including 160 students with disabilities and 460 students without disabilities found no differences in ACT scores between the two groups using an analysis of variance. Similarly, McCreary and Hausman, (2001) studied Stanford Achievement Test (SAT9) scores for 28,526 students on three types of schedules: semester, trimester, and A/B block. Total math scores were higher for students on semester schedules, with no difference between trimester and A/B block students, while science scores were significantly higher for students on the trimester or A/B block schedule (McCreary & Hausman, 2001). This finding indicates that the effects of block scheduling may vary depending on the subject being taught.

Arnold (2002) and Zepeda and Mayers (2006) found that while standardized test scores increased when a block schedule was first implemented, that improvement was short-lived. In a study examining 51 block-schedule and 104 traditional-schedule schools, Arnold (2002) found that on average students at schools that had been on block scheduling for one or two years outperformed students from schools with traditional schedules, and that the opposite was found for students at schools that had been on a block schedule for three or more years. This could be caused by temporary improvements due to novelty or to the tendency of teachers to return to traditional schedule teaching methods (Arnold, 2002).

Howard's (1997) case study of one teacher showed that schedule changes negatively affected the best students most. Howard's work should be of concern to many educators who teach advanced placement (AP) courses: AP BC calculus, AP physics II, AP pre-calculus, and AP differential equations. Howard studied a teacher who had been teaching for 30 years and judged his effectiveness based on the performance of his students on the AP exams (Howard, 1997). Howard showed that the percentage of students achieving passing scores on the exam originally dropped after the switch to a block schedule, but in most classes recovered within a few years. This may have been due to the reluctance of that teacher to utilize block scheduling teaching methods, as well as the fact that the school did not provide much training to the staff on how to best use the increased length of the period (Howard, 1997).

Summary of block scheduling on standardized achievement measures. The research on the impact of block scheduling on student achievement as measured by national standardized tests is inconsistent or contradictory. Most of these studies did not specify the amount of staff training that each school provided during the implementation of block scheduling, or if the teaching strategies changed to better accommodate the longer class periods of the block schedule. More research needs to be done to see if there are any significant differences in student achievement and how long those differences last. If block scheduling does not have an impact on standardized achievement measures, perhaps it will have an impact on more narrowly defined performance criteria such as the grades a student receives in his/her classes as measured by grade point average.

Block schedule and grade point average (GPA). Student grades have long been used as a measure of student achievement. Schools rank and order students by GPA to determine awards and scholarship winners. Many schools honor students who earn a certain GPA or higher by placing them on the honor roll and printing their names in the local newspapers, or by posting the names in the halls at school. Does moving to a block schedule improve student grades and therefore their GPAs?

McCreary and Hausman (2001) found that students on a traditional semester schedule maintained higher annual grade point averages than students on trimester or block schedules. This study was conducted on one urban school system with an enrollment of 28,000 students. This result both contradicts and supports findings of other studies in this area. Nichols (2000) found the percentage of students with high grade point averages increased as did the percentage of students at the low end of the grade point average when schools switched to block schedules. This study examined the student data generated from six high schools in the Great Lakes Region; the study was able to bring up some important findings by examining different levels of grade point averages and student success. The study examined student data collected from several years before and after the block schedule implementation. An interesting finding by Nichols was that the percentage of students failing two or more classes also increased for students in schools that switched to block scheduling. “Despite the fact that a block scheduling format appears to offer several advantages to its students, the data from this report suggests that educators should remain concerned about the increases in the number of students who remain academically unsuccessful" (p. 145).

Spencer and Lowe (1994) studied the effect of block scheduling on freshman achievement in the following subject areas: Algebra 1, Science, English and Alabama History/World History (Spencer & Lowe, 1994). Participants were from a high school in Alabama that had four classes – one in each subject area was taught on a block schedule and the other was taught in a traditional schedule. When the data was analyzed and the covariates controlled, the differences in the Alabama History/World Geography grades were non-significant; the same was found in Algebra 1 and Science. However, the data showed that students in the block approach earned significantly higher final grades than students taught in the traditional approach for English 1.

Deuel's (1999) study in Florida, utilizing a non-equivalent pre- and post-test design, found that students in schools with block scheduling earned statistically significantly more A grades and significantly fewer C, D, and F (failing grades). Deuel included the records for 48,828 students in Broward County enrolled in 22 schools, ten of which used block scheduling and 12 who used traditional schedules. Block schedules had been used in the district for four years, and there were two types of block scheduling in use, trimester and 4 X 4 semester block.

In summary, the research on grades under the block schedule is contradictory and the effects of block scheduling are unequal in different subject areas. Students in English and science classes may benefit from the longer classes while those in mathematics classes may be disadvantaged due to the increased pace of the class (Deuel, 1999). The results from Deuel, Spencer and Lowe, and Nichols show that findings are split on the advantages and disadvantages of the block schedule based on subject area. They found that in the area of science student achievement was increased, however, no improvement in mathematics achievement was found.

Block scheduling and state-mandated tests. Deuel's (1999) study of students in Florida found no differences in student achievement between students in block schedules and those in traditional schedules as measured by scores on the Florida Writing Assessment and the High School Competency Test, a graduation requirement for the state of Florida.

Deuel's findings did not hold in North Carolina. Lawrence and McPherson (2000) found North Carolina students in traditional schedules had consistently and statistically significantly higher scores than their block counterparts on the North Carolina End of Course tests in Algebra 1, Biology, English 1 and U. S. History. This four-year study examined the data from two North Carolina schools.

Gruber and Onwuegbuzie (2001) studied one Georgia high school that switched from a traditional six-period day to a 4 X 4 block schedule. Study participants were students from two graduating classes. The first class of 146 students graduated after spending four years in the six-period day, and the second class of 115 students graduated after spending three years in the 4 X 4 block schedule, with their first year of high school in the six-period day. This study compared how the students did on the Georgia High School Graduation Tests (GHSGT) in writing, language arts, mathematics, science and social studies. The results showed no significant difference in the scores for the students in writing, however, the study did find that there was a significant difference in language arts, mathematics, science, and social studies in favor of the students that had been on the six-period day for four years (Gruber & Onwuegbuzie, 2001).

Non-successive 4 X 4 scheduling. No published research in the area of non-successive scheduling using a trimester system was found. However, two unpublished dissertations were located. Both Shockey (1997) and Arias (2002) examine varying retention intervals between math classes that are created by 4 x 4 block scheduling where students take a math course in 18 weeks and then take the next math course either immediately, with a short three month interval, a longer eight month interval or even a 12 month interval between math classes. While these studies do not directly address the non-successive scheduling of the two halves of the same math class, I felt that these studies provide valuable information on what to look for in the current study.

Shockey's (1997) study on the effects of the 4 X 4 schedule, and the retention interval that can occur for students in the 4 X 4 block schedule, found that the retention interval had a negative effect when students were given a pre-review assessment. The study also found that the difference in retention was quickly made up and no difference was seen on an end-of-course test. This study was conducted in two suburban high schools using the 4 X 4 block. It specifically looked at the effects of the retention gap on mathematics achievement. In the 4 X 4 block schedule students attend one math class every day for 18 weeks. They can then move directly into the next math class, a retention interval of zero months, or they may have retention intervals of eight or 12 months. This study compared the mean scores of students with various retention intervals on pre-review, post-review and end-of course assessments. The findings showed a significant difference in the pre-review assessment which was given at the beginning of the next class, with students that had a retention interval of zero months doing the best. There was, however, no significant difference on the end-of-course assessment for any of the three retention intervals.

The Shockey (1997) study examined student retention of algebra II concepts and skills when students first entered a pre-calculus course. Shockey included 172 students in the study with students enrolled in one of three sections: regular, honors, or merit pre-calculus. These 172 participants included two ninth-grade students, 38 tenth-grade students, 98 eleventh-grade students, and 34 twelfth-grade students. The sample was mostly white with 18.02% nonwhite students.

In another study of varying retention intervals, Arias (2002) found no difference in the retention rates for students on 4 X 4 block schedules. This study examined 157 students from two suburban high schools with retention intervals of three or eight months between algebra II and pre-calculus. Consistent with other studies on retention intervals, Arias found that the length of retention interval had no detrimental effect on retention of algebra II skills, nor did it have a detrimental effect on student performance in the pre-calculus course.

Arias (2002) also examined the retention of algebra II concepts in pre-calculus students. This study examined the performance of 157 students from two schools. One of the schools in this study offers two levels of algebra II courses and the other school in the study offers a single level of algebra II. In each school, students are broken into two possible retention intervals. The data in the study indicates that most of the participants in the study were in the 11^{th} grade during the study and most of the participants were female, and that the schools were predominantly white although no percentage was supplied.

Both of the studies discussed here differ from the current study in the fact that these studies examined student retention of skills and concepts, while the current study examines the impact on student achievement. The current study focuses on ninth-grade students and the impact of successive and non-successive scheduling of geometry on state achievement tests.

Non-Successive Scheduling in the Trimester Schedule

A typical trimester schedule for a student consists of 15 class sections made up of two sections of English, two sections of math, two sections of science, two sections of social studies, and seven other sections which are usually electives. The two sections of math equate to one full year of math instruction such as geometry, where one section is the first half of geometry and the second section of math is the second half of geometry. A student can be scheduled into the two halves of their geometry course in successive trimesters – either trimester one and trimester two, or trimester two and trimester three. A non-successive schedule is created when a student has their two halves of math class scheduled in non-successive trimesters, where they have the first half of the class during trimester one and the second half of the class during trimester three, leaving a 12 week gap between the two halves of the geometry class.

While my study does not look at varying retention intervals between math classes, the hypothesis of teachers is that students who experience a non-successive schedule will forget some of the geometry learned in trimester one and therefore the schedule will have a detrimental effect on student performance on assessments and student grades. This study examined an area that has not been researched, by examining the trimester schedule and the impact of the trimester schedule on student achievement. This study will also include both a teacher survey as well as a student survey not included in previous research. The research into the various possible master schedules available to current school administrators is very thin.

CHAPTER III

METHODOLOGY

This section provides a framework for how the research was conducted. First, the questions that the study was trying to answer are presented and discussed. Second, the participants of the study and participant grouping are described. Third, the design of the study is explained, including the sampling frame and procedures. Other aspects of the methodology are explained, including non-successive scheduling, pre-test and post-test measures, data collection, fidelity of implementation, training of data collectors, data analysis, and confounding threats to validity.

Research Question

Does non-successive scheduling of the two halves of geometry significantly impact the mathematics achievement for ninth-grade geometry students, as measured by the OAKS mathematics assessment and geometry course final, when compared with the mathematics achievement of ninth-grade geometry students with successive scheduling of the two halves of geometry? According to a student survey, do the different scheduling options result in different perceptions among students? The survey allowed the researcher to examine student perceptions about the trimester schedule and the impact of non-successive scheduling on student learning.

Do the different scheduling options result in different perceptions among teachers? The teacher survey allowed the researcher to examine teacher perceptions about students and perceived differences between students with successive schedules versus students with non-successive schedules.

Study participants. This study focused on 149 ninth-grade students who completed both halves of the geometry class during the 2010-2011 school year at a medium-sized suburban high school in Oregon. Students either took the geometry class during successive trimesters, either first and second or second and third trimesters, or the students had a non-successive schedule and took the class during the first and third trimesters. Students appear in different groups through the traditional schedule-building process using student course requests on a high school master schedule matrix. There was no placement of students, enrollment was simply dependent on student choices; this was a sample of convenience. Some students or parents changed their schedule to avoid the non-successive option as there was a perception that it has a negative impact on student achievement. The demographics of the high school were 84 percent white and 18 percent socio-economically disadvantaged.

For all participants this was their first experience in a trimester schedule where they would not have a math class for the entire year. There was also a possibility that students changed teachers from the first half of the geometry class to the second half of the class, meaning a student could have two different geometry teachers whether in the successive or non-successive schedule groups. Teachers taught students from both the successive and non-successive schedule groups so that during the third trimester in all geometry classes students from both groups were mixed together, thus a teacher did have students from the successive schedule group in the same geometry class as students in the non-successive schedule group.

The high school switched from a traditional semester schedule to the trimester schedule several years before the study, and so all of the teachers had experience in the trimester system for some time. All four of the teachers in the study were licensed to teach mathematics in the state of Oregon. All four of the teachers, one female teacher and three male teachers, had several years of experience teaching math in the trimester schedule, and all four held advanced math licenses. In Oregon a basic math license allows the teacher to teach math through algebra while an advanced math license allows a teacher to teach all levels of mathematics at the high school level. All of the teachers held bachelor's degrees and three of the teachers held a master's degree.

The teachers worked well together, planned the course for the year together and agreed on the content to be covered in geometry A as well as geometry B, as they did with all the courses taught by more than one teacher. This was mandatory as students will sometimes have a different teacher for geometry A than they have for geometry B. The teachers worked to create common assessments as well to help inform each other about how well students are doing across the classes; in this case the same final was given to all geometry B classes. This close cooperation between the teachers reduces the possibilities of confounding variables from the experiences students have in the different classes.

Research Design

My study utilized a Non-Equivalent Comparison Group Pretest-Posttest Design examining extant data from five groups, making it a 5 X 3 study with three groups and three assessments. The students were assigned either successive or non-successive geometry classes. For the purposes of this study students assigned a non-successive schedule were considered to have been assigned the treatment. The study investigated the impact of non-successive scheduling on student mathematics achievement as measured by a state mandated mathematics assessment and the geometry B course final.

This study used extant data gathered from the 2010-2011 school year. All students in this study were given 70 minutes of math instruction per day when they were enrolled in the geometry class. The students in the successive schedule group had 24 consecutive weeks of mathematics instruction of 70 minutes per day, while the students in the non-successive scheduling group experienced 12 weeks of instruction, then 12 weeks of no math instruction followed by 12 weeks of math instruction. Three of the instructors in the study taught students in both groups, one instructor had students only from the successive group and all instructors were of similar qualifications and experience.

This study involved students from one medium-sized suburban high school. There were 149 students total involved in the study. Student schedules were assigned by the school scheduling software which took student course requests and developed individual student schedules by assigning classes from the master schedule.

All 149 of the students in the study were enrolled in the ninth grade during the 2010-2011 school year. The average age of the students in the study was 15.23 years with a standard deviation of .31 years. Of the students in this school 52.3% were male and 47.7% female. Of the 149 students, 84 of the students were in the “successive” group and 65 were in the “non-successive” group. The successive group was comprised of two subgroups, one with 24 students who took geometry during trimesters one and two and the other group of 60 students who took geometry during trimesters two and three. In order to make groups of equal size the 65 students in the non-successive group were randomly placed into two groups of 32 and 33 students each and the 20 students that took geometry in trimesters two and three were randomly placed into two groups of 30 students each. Table 2 summarizes the number of students in each of the five groups.

Table 2. Student Groups Summarized

Group	Trimesters during which geometry was taken	Number of ninth grade students in the group
Group 1	Trimesters one and two	24
Group 2a	Trimesters one and three	30
Group 2b	Trimesters one and three	30
Group 3a	Trimesters two and three	32
Group 3b	Trimesters two and three	33

The five groups were very similar in age, math GPA, Attendance and sex. Group 2b was the oldest with an average age of 15.26 years and group 1 was the youngest with an average age of 15.16 years. Group 3b had the highest average math GPA at 3.25 and Groups 1, 2a and 3a had the lowest average math GPA at 3.14. All five of the groups had an average attendance of over 95 percent. This data is shown in table 3 (next page).

Table 3. Group Characteristics

Characteristic	Group 1 Mean (SD)	Group 2a Mean (SD)	Group 2b Mean (SD)	Group 3a Mean (SD)	Group 3b Mean (SD)
Age (years)	15.16 (.27)	15.21 (.32)	15.25 (.36)	15.26 (.29)	15.24 (.30)
Math GPA	3.14 (.66)	3.14 (.80)	3.19 (.69)	3.14 (.64)	3.25 (.63)
Attendance	95.98% (2.4)	95.30% (4.0)	95.63% (3.7)	95.62% (4.1)	96.24% (3.4)
Percent Male	50% (NA)	47% (NA)	47% (NA)	56% (NA)	39% (NA)

Sampling frame and procedures. The records of students who met the conditions of the study were taken from an extant data source. The conditions included being enrolled in ninth grade during 2010-2011 school year and having completed both halves of a geometry course during ninth grade at the participating high school. There were 149 students in this study, with 84 of the students in the three successive schedule groups, and with the remaining 65 students in the two non-successive schedule groups.

In the spring of 2010 eighth grade students came to the high school and filled out forecasting forms for the classes each student would take during ninth grade. Students were randomly assigned either successive or non-successive math schedules student test scores were not used to assign schedules. The eighth-grade math teachers had placed the students into the proper level of math course. Using this information, along with the information from students in the other grades at this high school, a master schedule was developed. A computer software system assigned students to the course sections in the master schedule and these students were either assigned successive geometry sections or non-successive geometry sections. While not completely random, this system did not predetermine what schedule a student might receive.

Non-Successive Schedule

The treatment in this study was assignment of non-successive geometry classes. The curriculum used in the non-successive classes was the same as the curriculum used in the successive classes. Students from all the successive and non-successive groups were mixed together in approximately two thirds of the geometry classes. Students in the trimester two geometry classes were all from the successive schedule groups 1, 2a or 2b as they were either beginning the geometry course and (a) would finish the geometry course during trimester three, or (b) were finishing a geometry course they started during trimester one.

The math curriculum used was considered a traditional mathematics curriculum as opposed to a reform mathematics curriculum. A traditional math curriculum is similar to the math curriculum used in the United States for the past 30 years and is typically teacher-centered, meaning that the teacher lectures about the mathematical content and then students work individually on the math problems assigned. Students had equal access to technology and teaching practices were uniform, with the teachers delivering most of the instruction in the lecture format. The same curriculum was used with all students in both the successive and non-successive schedules.

Pretest and Posttest Measures

The pretest measure used was the Oregon Assessment of Knowledge and Skills (OAKS) mathematics assessment eighth-grade level. This measure was given to students toward the end of eighth grade in late March or April. The post-test measures used were the tenth-grade level of the OAKS mathematics assessment and the end of course final exam. These measures were given to students near the end of the second half of the geometry class either in February or early May depending on whether the second half of the geometry class was scheduled for the student during trimester two or three.

The Oregon Statewide Mathematics Assessment is a criterion-referenced assessment and was based on the Oregon Content Standards. The results from this assessment are somewhat different than other national norm-referenced tests (Oregon Department of Education, 2009). The test produces a scale score ranging from about 150 to 300, which is similar to other growth scales such as the Scholastic Aptitude Test (SAT). The points are at an equal distance from one another so they can be used to show growth from year to year. The assessment is tied to performance standards, thus allowing educators to target curriculum areas for improvement (Oregon Department of Education, 2009).

The OAKS math assessment is one of the assessments the state of Oregon used to meet federal testing requirements, and produces state report cards in the fall of each school year for each school and school district. The test is thoroughly researched and has content validity. Content validity means that the assessment measures the knowledge that it is supposed to measure. Oregon assesses the content validity of the OAKS mathematics assessment by using rigorous content standards and test specifications that link test content to the content standards, and then to the corresponding performance standards. The assessment is then reviewed by a panel of experts and is considered to be valid (Oregon Department of Education, 2007).

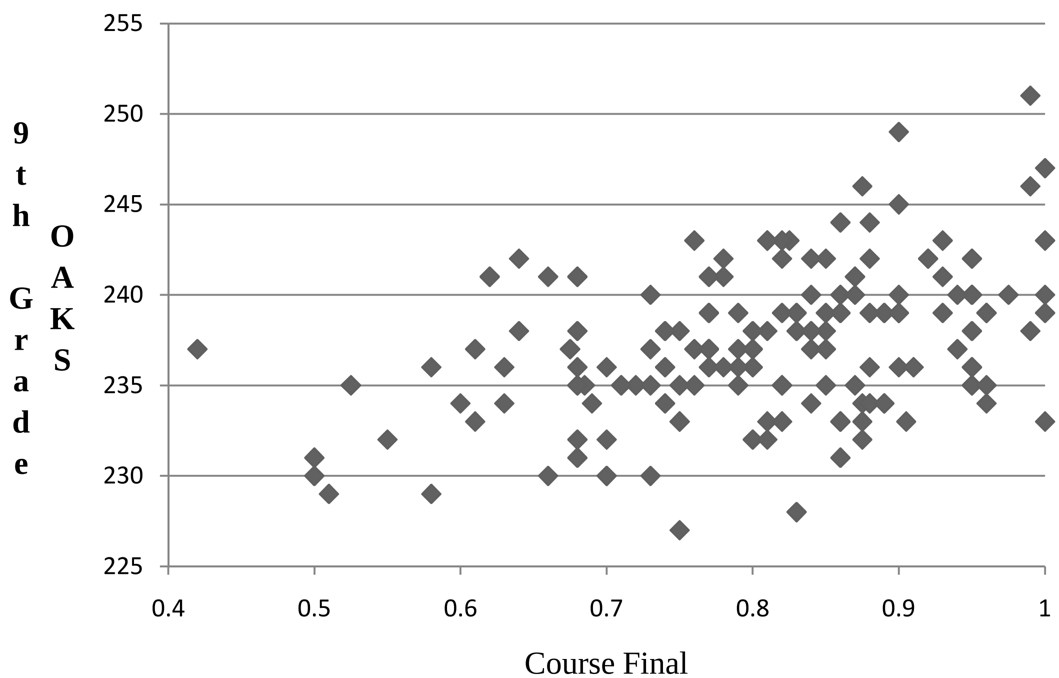
Oregon conducted a study of the reliability of the OAKS assessment and found that the assessment was reliable for scores across the range of ability except at either extreme end of the distribution. Overall reliabilities ranged from 84-99% with most falling above 90% (Oregon Department of Education, 2007).

The state of Oregon assessed the criterion validity of the OAKS assessment by comparing it with nationally-normed tests including the California Achievement Test (CAT) and the Iowa Test of Basic Skills (ITBS). Construct validity will show how well an assessment measures the construct by comparing scores on two assessments that measure the same construct, a high score on one construct should predict a similar score on another assessment of the same construct. The study for the state of Oregon found that the OAKS assessment has a validity score of .77 with the CAT and .82 with the ITBS (Oregon Department of Education, 2007).

In addition to the state test, a final exam was administered to all students at the end of the second half of the geometry class. This exam was created with cooperation from all the geometry teachers using software provided by the textbook company to develop exams for the course. The same exam was used for all geometry B courses during the 2010-11 school year.

Using a state adopted multiple choice assessment and a teacher made assessment gave a board measure for content validity as they both covered the same material and measured the same content. Figure 1 is a scatter plot of the ninth grade OAKS assessment and the teacher made end of course final and indicated a positive correlation that is that a higher score on one measure predicts a high score on the other measure.

Figure 1. Ninth Grade OAKS and Final Scores



Data Collection Procedures

To gather the data for this study an examination was made of the student testing record and high school transcript for each student in the study. This information was recorded in a table and then analyzed for the study. The researcher had access to this data as he was an employee of the school district at the time of the study.

Fidelity of Implementation

Students were in one group or the other in the schedule; they either had a successive or a non-successive schedule unless they failed either first trimester or second trimester. Students that failed either half of the geometry class then completed the class in the third trimester were excluded from the study.

Training of Data Collectors for OAKS

When it was time for the state test, students completed a computer-based multiple-choice test consisting of 45 questions. This test was adaptive, meaning that it selected the next question for the student based on whether or not the last question was answered correctly, choosing a relatively more challenging question if the student answered the last question correctly or a relatively easier question if the student answered the last question incorrectly.

Teachers had instructions that were to be read verbatim to the students while they were taking the test. All teachers were trained in giving the test and all students took the assessment in the same room at various times. Since the test was adaptive in that the next question a student received was determined by the student response to the previous question, no two students were likely to have the same test questions in the same sequence.

The computer labs were attached to the library and the students' classroom teacher served as the test proctor. The test was untimed and students had 90 days to finish the test once started, however the vast majority, more than 95%, of students, finished within the two class periods that were dedicated to the test. To prevent students from accessing the math test any time they wanted, the teacher had to log into the system and create a testing session and then the students logged into that session to work on the test, meaning they only worked on the test at school in a supervised location with a proctor present. Students were allowed scrap paper and calculators to use, as well as one sheet of the state-approved math formulas they used on the test.

Immediately upon finishing the test the score for the student was displayed on the computer screen and the score was reported to the teacher. Some students took the test more than one time and the higher score was kept. Students who retook the test usually did so within a few weeks of the first attempt. At this particular school less than 10% of students retook the test. The data was then retained by the school district and the state of Oregon.

Teachers met during professional development time to align grading procedures for the final exam and to calibrate scoring. The teachers then scored the exams and recorded the scores in the course grade book.

Data Analysis

An analysis of covariance (ANCOVA) was conducted to examine the impact of the non-successive scheduling condition on pre-test and post-test measures of mathematics achievement as measured by the Oregon Assessment of Knowledge and Skills mathematics assessment, and the geometry B course final. The non-successive schedule was the variable and successive schedule was the condition (treatment vs. control).

The use of ANCOVA allowed me to control for the differences in eighth grade OAKS scores for each group. Covariance allowed me to measure how much of the variance in the ninth grade OAKS scores and the end of course final scores was due to the variance of the covariate in this case the eighth grade OAKS scores. In this way I was able to determine if any significant variance in the ninth grade OAKS scores or end of course final scores was explained by the variance in the eighth grade OAKS scores.

CHAPTER IV

RESULTS

As noted, the sample size for this study was 149 with the subjects divided into five different groups ranging in size from 24 to 33. All of the groups were roughly equal in age, gender make-up, attendance and math GPA. As shown in table 4 the groups had some difference in eighth-grade OAKS scores, ninth-grade OAKS scores and the course final.

Table 4. Assessment Results

Measure	1 (24)	2a (30)	2b (30)	3a (32)	3b (33)
8th OAKS	241.33	241.33	242.30	241.16	241.94
SD	5.57	7.02	7.00	7.26	6.62
Min/Max	233/254	231/256	230/256	228/258	233/255
9th OAKS	235.54	237.17	238.37	236.53	237.73
SD	4.90	4.50	4.16	3.72	4.24
Min/Max	227/246	2312/251	230/247	229/243	228/245
Course Final	.80	.80	.82	.81	.80
SD	.17	.11	.11	.11	.12
Min/Max	.5/1	.6/.99	.42/1	.58/1	.58/.99

All groups showed a decrease in scores from the eighth-grade OAKS to the ninth-grade OAKS assessments. These were geometry students and none of them had taken an advanced algebra course. An ANCOVA analysis was run using SPSS software using the ninth-grade OAKS scores as the dependent variable and the eighth-grade OAKS scores as the covariate. The results are shown in table 5.

Table 5. 9th Grade OAKS ANCOVA Results

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	974.74	9	108.31	8.93	.00
Intercept	2352.76	1	2352.76	193.91	.00
Group	122.60	4	30.65	2.53	.04
8thGrade OAKS	735.30	1	735.30	60.60	.00
Group*8thGradeOAKS	120.73	4	30.18	2.49	.05
Error	1686.57	139	12.13		
Total	8381325.00	149			
Corrected Total	2661.32	148			

The analysis showed a significant interaction, $P=.046 < .05$, between the covariate and the dependent variable indicating that the between groups differences on the ninth-grade OAKS assessments could be explained by the interaction between the eighth-grade OAKS assessment results and the ninth-grade OAKS assessment. This result shows no significant difference between the groups on the ninth-grade OAKS assessment after adjusting for differences in the eighth-grade OAKS assessment. No further analysis was done on these results.

This study also examined the impact of successive and non-successive scheduling on the course final. A second ANCOVA analysis was run using SPSS software, using the course final as the dependent variable and the eighth grade OAKS scores as the covariate. The results are shown in table 6.

Table 6. Course Final ANCOVA Results

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.71	9	.08	7.75	.00
Intercept	.32	1	.32	31.55	.00
Group	.11	4	.03	2.68	.03
8thGradeOAKS	.68	1	.68	66.77	.00
Group*8thGradeOAKS	.11	4	.03	2.66	.04
Error	1.41	139	.01		
Total	99.05	149			
Corrected Total	2.12	148			

The analysis showed a significant interaction, $P = .035 < .05$, between the covariate and the dependent variable indicating that the between groups differences on the course final could be explained by the interaction between the eighth-grade OAKS assessment results and the course final. This result showed no significant difference between the groups on the course final after adjusting for differences in the eighth-grade OAKS assessment.

Students were also given a survey as part of this study, and 120 ninth grade students responded with 70 students reporting that they had taken geometry in trimesters 1 and 3, or the non-successive group and 50 reporting that they were in the successive group. Students were asked if they felt the schedule they experienced (successive or non-successive) was beneficial or harmful to their math achievement. Students were also asked if they had a paid math tutor. The results of this survey are reported in table 7.

Table 7. Student Survey

Schedule	Very Harmful	Harmful	Beneficial	Very Beneficial	No Impact	Paid Tutor
Successive	0	1	20	21	7	3
Non-Successive	3	31	16	1	18	3

Table 7 shows that the majority 41 of 49 students in successive scheduling group reported that they thought having the two halves of geometry in successive trimesters was beneficial to mathematics achievement. On the other hand, 34 of 69 students in the non-successive group reported that they thought having the two halves of geometry in non-successive trimesters was harmful to their mathematics achievement. There were three students in each group who reported having a paid tutor.

Student perception of the impact of the trimester schedule was related to how well the students did in class. The average end of course final score for those students who reported the impact to be very harmful was .67 the lowest of any group. The average final score for the students who reported the impact to be harmful was .78 and the average final score for the students who reported the impact as beneficial was .81. The average end of course final score for students that reported no impact was .85. Clearly the student perception of the impact of the non-successive schedule was influenced by the individual students performance.

The three teachers involved in the study were also surveyed, and two of the three teachers reported they thought there would be no impact on student mathematics achievement and the third teacher reported the impact would be harmful to student mathematics achievement.

CHAPTER V

DISCUSSION

This section provides a discussion of the results and implications for future research. First, the results of the study will be discussed. Second, the threats to the validity of the study will be examined. Third, how this study contradicts or confirms the results of other studies in this area will be addressed. Fourth, recommendations for practice and future research will be discussed.

Review Results

The results of this study on successive versus non-successive scheduling of ninth-grade geometry students in a trimester schedule shows no impact on student achievement on the ninth-grade OAKS mathematics assessment or end-of-course final. The differences in student scores on both the ninth-grade OAKS mathematics assessment, and the end of course final, were more aligned with the differences in student scores on the eighth-grade OAKS mathematics assessment than with whether the student was in the successive or non-successive scheduling group. While the differences in the ninth-grade OAKS mathematics assessment and the-end of-course final were significant, both differences were the result of the interaction of these assessments and the eighth-grade OAKS mathematics assessment. Any differences between the successive and non-successive groups on the ninth grade OAKS assessment or the end of course assessment can be attributed to the differences between the scores of the groups on the eighth grade OAKS mathematics assessment.

One unexpected result was the fact that for all groups the mean score on the ninth-grade OAKS assessment was lower than the mean score for the eighth-grade OAKS assessment. This difference may be due to the fact that the ninth-grade OAKS assessment contains some content from Algebra 2, which these students had not been taught.

More than half of the students in the non-successive scheduling group believe that this type of scheduling has a harmful impact on their mathematics achievement. Interestingly, nearly one in four of the non-successive students felt that the schedule was beneficial. This may possibly be a result of having a break from math.

Threats to Validity

Selection was a possible threat to validity due to the fact that the groups were not randomly selected. I examined the scheduling of the two groups to discover if there were patterns which put various groups of students together in one of the groups, such as students on IEPs or advanced students. I found no meaningful differences in the groups as they were all similar in student characteristics.

The history of events threat to validity refers to the difference in experiences that happen between assessments. The threat of history was controlled by a common syllabus and use of the same pacing guide. Teachers identified the standards to be taught in each class and developed common formative and summative assessments. I examined the course schedules for any substantial disruptions such as snow days, school incidents, or natural disasters in the local area. The fact that the students all attended the same school also helped control for history of events. There were no incidents, disasters or interruptions to the school year during the 2010-2011 school year.

Maturation is a process within subjects and occurs with the passage of time. Maturation will be controlled by the fact that all of the students were in the same grade and were approximately the same age. The students in the three groups will also be taking the tenth grade assessment within three months of each other. The oldest average age for one group in this study was 15.26 years and the youngest average age for one group in this study was 15.16 years of age. The age difference between these two groups of .1 years is less than half of the smallest standard deviation of .27 years for the groups.

Regression is caused by the selection of subjects on the basis of scores or characteristics. All ninth-grade geometry students were included in the study, therefore controlling regression. Regression was also controlled through the use of an ANCOVA.

Mortality is the loss of subjects over time during the experiment. I examined the lists of withdrawn ninth grade students and looked for patterns of attrition. In general this high school had a very low mobility rate. Eleven students, four males and seven females, were excluded from the study; three students repeated the first or second half of the geometry class due to failure, five students only attended the high school and their middle school data was unavailable, three students only completed one half of the geometry class and then moved to a different school.

The validity threat of testing is from the effect of taking a test on the outcomes of a second test. All of the students will have taken the assessments in very similar surroundings in previous years as well as in other subjects to control for testing. Some of this student did take the ninth grade OAKS test more than one time during the year and this may have had an impact on the results. All of the students took the end of course assessment one time.

The threat of instrumentation is the change in the instrument, observers or scorers. The measure is a standardized test and all administrations of the assessment are administered by a trained examiner. Two of the assessments were taken on and scored by a computer and this controlled for instrumentation. The course final was scored by the teachers and as discussed previously the teachers had reached common agreement on scoring methods to be used.

Additive or interactive effect validity arises from the possibility that one or more threats may interact, causing interference in the study. Additive and interactive effects are the most serious threat to validity to this study. It was possible for students to have two different teachers for the geometry class. This was controlled through the use of an ANCOVA, and through an examination of the student schedules to discover if substantial number of members of a particular group had experienced a change in teachers it was found that the groups were approximately equal in this area.

Literature Comparison

As has been stated earlier in this dissertation there is minimal research on the impact of scheduling on student mathematics achievement. This study both confirms and contradicts some of the research that does exist in this area.

There is no statistically significant difference in the mathematics achievement of ninth-grade geometry students on the ninth-grade OAKS mathematics assessment or end-of-course final. After adjusting for student scores on the eighth-grade OAKS mathematics assessment the scores were comparable. No effect, positive or negative, was discovered. This finding is similar to the findings of similar studies. Deuel (1999), Shockey (1997) and Arias (2002) found no difference in student achievement on state mandated tests for students in different scheduling configurations and end-of-course assessments.

Deuel (1999) examined the differences in student achievement between students on block schedules and traditional schedules as measured by scores on the Florida Writing Assessment and the Florida High School Competency Test. This study contrasted ten high schools on block scheduling and 13 high schools using a seven period rotator schedule.

The findings of this study are in agreement with Deuel (1999) who found no performance difference between block students and students on traditional schedule on state assessments examining the records of 49, 829 students. Like Deuel this study examined high school students and found that the choice of school schedule had no impact on high school student achievement.

Both Shockey (1997) and Arias (2002) examined varying retention intervals between math classes created by 4 x 4 block scheduling as measured by end of course assessments. Shockey examined the results of 172 high school student, mostly 11th grade students, on the end of course assessment for pre-calculus and found that student schedule differences had no impact on student mathematics achievement.

Arias (2002) measured the performance of 157 high school students, mostly 11th grade students, on an end of course assessment for pre-calculus. Arias found that the school schedule had no impact on student mathematics achievement.

Spencer and Lowe (1994) also found similar results when they studied the effect of block scheduling on freshman achievement in Algebra 1. This study examined the grades that 64 students earned, and when covariates were controlled, differences were non-significant. The Spencer and Lowe study examined result for students in ninth grade algebra 1 the same grade level as this study, however the students in this study were in geometry. The studies both found no impact on student achievement based on the student schedule. Unlike this study student grades were examined instead of student scores on state assessment or end of course assessments.

This study also confirms the results found by Arnold (2002). Arnold found no differences in student achievement when he compared means scores on Tests of Academic Proficiency (TAP) of students on a seven-period A/B block schedule and those on a traditional seven-period day. Arnold examined the records of 155 students in grades nine through twelve. This study and Arnold examined student achievement using assessment scores.

Pliska et al. (2001) found results similar to this study when they examined ACT scores for 38,089 high school students who attended schools using various schedules. They found that the differences in student scores were negligible and although the results could not be examined at the school level the results were important. Similarly Bottge, Gugerty, Serlin, and Moon (2002) found no differences in ACT scores for 620 high school students. This study confirms the results of both of these studies using standardized tests and adding a teacher developed test as well.

In contrast with a 2001 study by McCreary and Huasman which examined the (SAT9) scores for 28,526 students and found that scores for students in a traditional semester schedule were higher than students in a trimester schedule. This study and the study conducted by McCreary and Huasman utilized an ANCOVA to control for variables.

Zepeda and Mayers (2006) found conflicting results when they examined the research in this area. This study is one of the few studies in the area that utilized an analysis of covariance (ANCOVA) to examine the data. This study confirms the results of some studies and contradicts other studies this is the same at Zepeda and Mayers found in their examination of the research.

The results of this study contradicts the findings of Gruber and Onwuegbuzie (2001), who found a significant difference in student achievement for students who had been on a six-period day versus students in 4 x 4 block schedule. Gruber and Onwuegbuzie found that the students on the six-period day significantly out-performed the students in the 4 x 4 block schedule on the Georgia High School Graduation Tests. Gruber and Onwuegbuzie examined the records of 261 students who graduated from Georgia high schools in either the 1997-1998 academic year or the 1999-200 academic year.

The results of this study contradicts Lawrence and McPherson (2000), who found North Carolina students in traditional schedules had consistently and statistically significantly higher scores than their block counterparts on the North Carolina End of Course tests in algebra 1, biology, English 1 and U. S. history. Their four year study examined the data from two North Carolina schools. Lawrence and Mcpherson studied 817 student records and like this study used state assessments to measure student achievement, however no grade level or age data was reported for the study.

Recommendations for Practice and Further Research

This study was conducted to help school administrators determine if switching to a trimester schedule impacts student mathematics achievement. Based on the results of this study it appears that school administrators should not anticipate any impact, positive or negative, on student mathematics achievement by moving to a trimester schedule, and therefore the decision to move to a trimester schedule should be based on different reasoning.

Students in general have a negative perception of the impact that a trimester schedule will have on their mathematics achievement. School administrators wishing to switch to a trimester schedule would be well served to educate themselves and their communities about the research that does exist on the topic. This is the only study focusing specifically at the non-successive student schedules created by the trimester schedule and shows that there is a clear divide between the perception of the impact of the non-successive schedule and the measured impact on student mathematics achievement.

This study adds to the information that building administrators, teachers, and school districts have to inform them of the possible impacts their choice of school schedule may or may not have on student achievement. It is clear that a positive impact on student mathematics achievement can not be expected by moving to a trimester schedule. School administrators should focus their efforts to improve student achievement on other variables that research has shown have a positive impact on student achievement.

This study was conducted on ninth grade geometry students in one suburban high school in Oregon and can generalize to other suburban ninth grade students. When taken into context with the other studies that have been conducted in this area, the results found can be generalized to high school students across the country. This school used a traditional total points based grading system at the time and the results might be different under a proficiency grading model.

Both of the post assessments used in this study relied mostly on recall and computational fluency. An assessment based on reasoning and performance might produce different results and would make an interesting study. The common core state standards (CCSS) call for more performance based assessments to measure student reasoning ability.

The research in this area is sparse and in some cases contradictory. More research should be done on teacher and student perceptions about block scheduling. This study indicates students have an expectation the school schedule will have a significant impact on their mathematics achievement.

APPENDIX A

STUDENT SURVEY

Student Name (please print): ____________________________ Date: ___________

Student Survey

Dear Student:

Thank you for your participation in the study: *An Examination of the Impact of Successive and non-Successive Geometry Classes on High School Student Achievement.*

Would you please answer the following questions? I am collecting data about mathematical experiences you may have had during the 2010-2011 school year. Your identity and the identity of all participants in the study and the name of your school will not be mentioned in any written report. Thank you for your time.

1. When were you enrolled in Geometry A?
   ____ Trimester 1 ____ Trimester 2

2. If you were enrolled in Geometry A during trimester 1, how do you feel that having a gap of three months has impacted your math achievement?

Very Harmful	Harmful	Beneficial	Very Beneficial	No Impact
1	2	3	4	5

   Why?

3. If you were enrolled in Geometry A during trimester 2, how do you feel that having both halves of geometry during back to back trimesters Impacts your math achievement?

Very Harmful	Harmful	Beneficial	Very Beneficial	No Impact
1	2	3	4	5

   Why?

4. Did you have a mathematics tutor (paid or unpaid) during the A portion of the geometry class?
   Yes _____ No _____

5. Did you have a mathematics tutor (paid or unpaid) during the B portion of the geometry class?
   Yes _____ No _____

Thank you for your participation in this study.

Steven Sugg - Researcher

APPENDIX B

TEACHER SURVEY

Teacher Survey

Dear Teacher:

I would like to collect data about your experience teaching geometry in a trimester schedule. This data will be used in my research study *An Examination of the Impact of Successive and non-Successive Geometry Classes on High School Student Achievement.*

Your identity as well as the identity of the participants in the study and the name of your school will not be mentioned in any written report. Your opinions will be kept anonymous. Thank you for your time.

1. How long have you been teaching mathematics at the high school level?

2. How long have you been teaching in the trimester schedule?

3. How long have you been teaching geometry?

4. Do you think that students that do **<u>not</u>** have geometry A and B during successive trimesters are impacted in terms of math achievement?

Very Harmful	Harmful	Beneficial	Very Beneficial	No Impact
1	2	3	4	5

Please share your observations.

APPENDIX C

END OF COURSE EXAM

GEOMETRY B FINAL **version G** **Name**______________
Period:

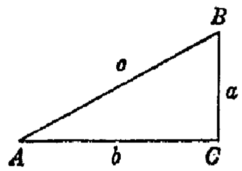
Given the lengths for sides, determine the type of Triangle (Obtuse, Acute, or Right) if it is one.

1. 6,8,11
2. 10, 24, 26
3. 8, 10,12

Solve for the requested variables in simplest radical form. C is a right angle. A, B represent angle measures.

4. a = 7, b = 24, c = ?

5. c =15, a = 10, b = ?



6. a = b = 12, c = ?

7. c =12, b = ?, A = 45 degrees

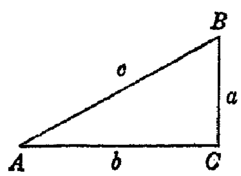
8. A = 30 degrees, a = 8 , b = ?, c =?

9. B = 60 degrees, b =12, a = ?, c = ?

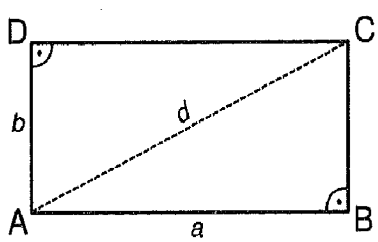
Solve for the requested variables to the nearest tenth. C is a right angle. A, B represent angle measures.

10. A = 40 degrees, a = 16
Find b, c.

11. a = 21, c = 39
Find A, B.



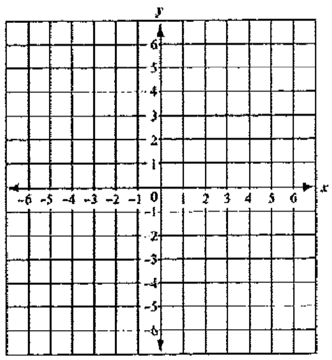
12. a = 24, d = 26, find the perimeter of the rectangle.



GEOMETRY B FINAL

Given the points A (2,3) and B (-4,5). Plot A and B on the graph. Find A' and B' after the given transformation.

13. Plot A and B.



14. A translation of (x,y)→(x +5, y-7)

15. A rotation of 90 degrees clockwise about the origin.

16. A reflection across the y-axis.

17. A dilation from the origin by a factor of 3.

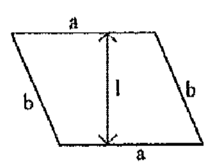
18. A reflection across the x-axis followed by a translation of (x.y)→(x+1, y+3)

19. Give the single transformation that results from reflecting across the x-axis and then across the line y = 4.

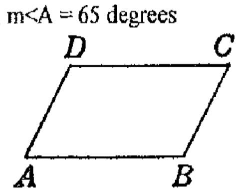
20. Given a reflection of the point C across two lines that intersect at an angle of 70 degrees, find the angle of rotation from C to C'.

Find the Area to the nearest tenth.

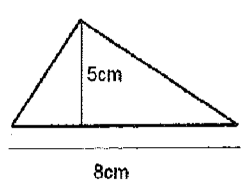
21. Of the parallelogram:
a = 10; b = 9; *l* = 7



22. Of the parallelogram:
AD = 24; AB = 33; m<A = 65 degrees



23. Of the triangle:



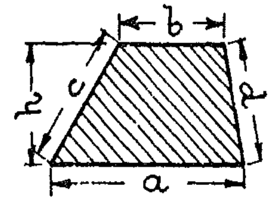
24. Of an equilateral triangle with sides 20cm.

GEOMETRY B FINAL

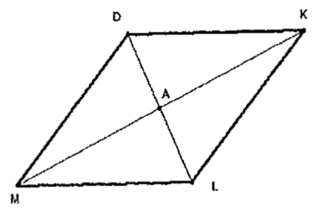
Find the Area to the nearest tenth.

26. Of a regular octagon with sides length 11 cm and apothem 13.3 cm.

27. Of the trapezoid: a=9', b=6',c=8',d=7', h=6'



28. Of the rhombus: AD = 5 m, KD = 13 m



29. Of a rectangle with a side of 8 feet and a diagonal of 10 feet.

30. Two similar polygons have corresponding sides of 12 cm and 26 cm. If the smaller has an area of 36 sq. cm, find the area of the larger polygon.

Find the volume and surface area to the nearest unit (#31-35).

31. Of a rectangular prism 6' x 4' x 8'

32. Of a cylinder with diameter 6 m and height 10m.

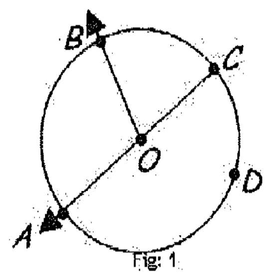
33. Of a square pyramid with base edge 12' and slant height 10'

34. Of a cone with slant height 15m and radius 9m.

35. Of a sphere with diameter 20cm.

36. Two similar cones have radii of 5" and 9". Find the scale factor, area ratio, and volume ratio.

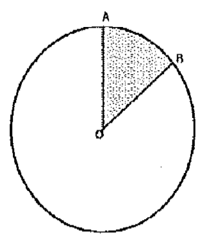
37. Find the circumference of circle O. OB = 15cm



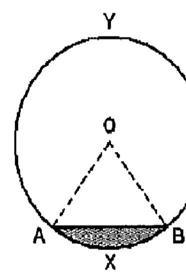
O is the center

38. AC = 24cm. Arc BC has measure 72 degrees. Find the length of arc AB.

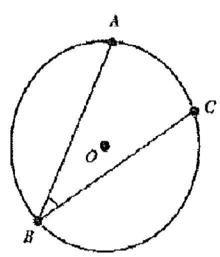
39. AO = 20". Arc AB has measure 80 degrees; Find the area of the shaded region.



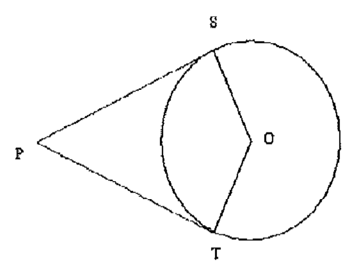
40. Find the area of the segment if angle O is a right angle and OA = 14 cm.



41. If arc AC is 72 degrees, find m<B.



42. PS = 7. Find PT, m<PTO.



43. Find the equation of a circle with radius 9 and center (6,7).

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