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The Effects of Scheduling on Criterion-Referenced Assessments in Arkansas High Schools

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of the requirements for the degree of
Doctor of Education in Educational Leadership

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ABSTRACT

The purpose of this study is to examine the differences in achievement on the end of course assessment in Geometry and the Grade 11 Literacy exam administered to students in Arkansas during the 2005-2006 and 2006-2007 school years. The three main types of scheduling are the traditional schedule with seven or eight periods; the A/B, or the alternating block; and the 4 x 4, or accelerated block. The traditional was utilized by 90% of schools in Arkansas during this time frame. The A/B block and 4 x 4 block were used almost equally, each representing approximately 5% of Arkansas schools.

Demographic data were collected for all public high schools in Arkansas; descriptive statistics were calculated and reported for the 2005-2006 and 2006-2007 school years. Schools utilizing the A/B model had the highest mean student enrollment; schools implementing 4 x 4 blocks had the lowest mean student population. Block schools had higher percentages of minorities but lower percentages of students eligible for free or reduced meals. The highest mean per pupil expenditure was reported to be in A/B block schools.

Block schedule schools and traditional schools with the same or very similar grade configurations were matched as closely as possible by student enrollment, the percentage of students eligible for free or reduced meals, and the percentage of disadvantaged minorities. Analysis of covariance (ANCOVA) was used to analyze differences in student achievement scores on the Geometry end-of-course and the Grade 11 Literacy assessments. Corresponding scores from the eighth grade benchmark were used as baseline data. No significant differences in the variances were found that could be attributable to scheduling type.

This dissertation is approved for recommendation
to the Graduate Council.

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CHAPTER ONE:

INTRODUCTION

Historical Influences

Flexible modular scheduling, a product of the 1960s under the influence of Trump, was based on the philosophy that instruction and learning can be maximized by adjusting class times and structure to meet specific educational goals (Murray, 2008; Zepeda, & Mayers, 2006). In schools that implemented this type of scheduling, the school day was divided into as many as 20 to 21 small blocks of time called modules. These modules were combined into "phases" which were then categorized into four groups: large groups, medium groups, small groups, and unstructured time.

Large groups, which could accommodate up to 200 students, were suitable for guest speakers, lectures, or other types of presentations (Murray, 2008). In medium groups, teachers focused on skills with 20 to 30 students, and developed relationships in small groups of 12 to 15 students. In unstructured time, students participated in independent learning activities such as seeking additional help, catching up in a class, participating in enrichment activities, or studying independently.

Flexible modular scheduling required extensive changes in the conceptual roles of students, teachers, and administrators (Johnson, 1972). This type of scheduling offered several advantages for students, such as the opportunity to take more classes, the development of increased responsibility and time management skills, the building of strong relationships with peers and adults, and the personalization of learning and instruction to meet the unique needs of individual students (Johnson, 1972; Murray, 2008). Data from one school revealed that only

three percent of students felt that they had more individual contact with teachers (Braddock, 1967).

Teachers had the flexibility of designing lessons for a variety of class sizes and for different amounts of time (Johnson, 1972). Administrators had a wide range of alternatives available for organizing the school day and for maximizing time and space in their schools. However, critics have claimed that modular scheduling was too "administratively complex and troublesome" and was being driven by the electronics industry because computers were critical to successful implementation (Braddock, 1967). In one study, modular scheduling tended to be viewed more favorably by parents of college-bound students than parents of students entering the workforce, vocational institutions, or the military (Johnson, 1972).

The component that had the most impact on students was unstructured time, sometimes as much as 30% to 40% of a student's time over a five-day period (Braddock, 1967; Havelock, Areson, Havelock, Miller, Naumann-Etienne, Shakespeare, 1974; Johnson, 1972; Zepeda, & Mayers, 2006). Those students who utilized unscheduled time efficiently reported it to be a valuable experience in preparing them for the demands of college (Havelock et al., 1974). For students unable to manage large amounts of unstructured time, schools created supervised study halls and continuous counseling (Braddock, 1967).

The issue of instructional time came to the forefront of American education with the publication of *A Nation at Risk* (National Commission on Excellence in Education, 1983). This report, commissioned by Secretary of Education T. H. Bell, recommended a more effective use of the existing school day, the extension of the school day, or a lengthened school year.

Also in the 1980s, Goodlad's proposal of school reform involved the formation of smaller schools, the emphasis of a core curriculum, the removal of tracking, as well as the reassessment

of time, “virtually the most important resource” available (cited by Zepeda, & Mayers, 2006). Sizer proclaimed that “The clock is king,” citing the hurried pace students face as they rush from class to class. Boyer emphasized the importance of using time wisely because “time is the student’s treasure.” Although Goodlad and Sizer recommended the restructuring of the delivery of education, they were not advocates of block scheduling. Goodlad stated that merely increasing time could be counterproductive unless improvements were made for its use.

A decade later, the release of *Prisoners of Time* (National Education Commission on Time and Learning [NECTL], 1994) declared that “Time is learning’s warden.” Learning, according to this document, has been constrained by the clock and calendar for the past 150 years. Time is held constant at five hours per day 180 days per year while the amount of learning varies. The commission released a list of eight recommendations; five of which were directly related to instructional time:

1. Reinvent schools around learning, not time.
2. Fix the design flaw; use time to support learning rather than as a boundary.
3. Establish an academic day of at least five and one-half hours.
4. Keep schools open longer to meet the needs of children and communities.
5. Give teachers the time they need to do their jobs.

The concept of time was further addressed by the National Association of Secondary School Principals (NASSP) in partnership with the Carnegie Foundation in *Breaking Ranks: Changing an American Institution* (1996). One recommendation was to abolish or redefine the Carnegie unit which requires 120 hours of seat time in each subject (The Carnegie Foundation for the Advancement of Teaching, 2006). It was also suggested that schools adopt models of flexible scheduling to vary the time needed to meet the requirements of the core curriculum

(NASSP, 1996). Schools would provide extended opportunities for professional development, collegial networking, and instruction by operating year-round.

The Copernican Plan, the model from which most block schedules originated, was developed by Joseph Carroll (Mell, 1996). It proposed more effective use of the instructional day through the use of macro scheduling (Carroll, 1990). The Copernican Plan provided two options to students. The first option allowed students to enroll in one 4-hour class for 30 days; the second alternative allowed students to take two 2-hour classes for 60 days. Seminars were conducted in the afternoons to allow the opportunity for integration across disciplinary boundaries. According to Joseph Carroll, "The Copernican Plan is not about *block scheduling*. It is about the relationship between time and learning" (Cromwell, 1997, p. 2).

Block Scheduling Models

Four basic models of block schedules exist across the United States: the alternate day or A/B schedule, the accelerated or 4 x 4 schedule, the trimester schedule, as well as variations of the 180-day school year (Canady, & Rettig, 1996). In schools that have implemented block scheduling, the two most popular models have been the 4 x 4 and A/B models.

On the accelerated schedule, students are enrolled in four courses that meet for extended periods daily and are completed in a semester (Queen, & Isenhour, 1998). There are several advantages in the 4 x 4 model that are not present in other models (Canady, & Rettig, 1996). Teachers work with only 60 to 90 students per semester and have only three classes to prepare for. This type of schedule allows students to concentrate on only four classes per semester; classes that are failed can be retaken almost immediately. Students have greater opportunities for acceleration and may earn up to eight credits annually. Some perceived weaknesses specific to the 4 x 4 block are: transfer students from schools on traditional schedules, gaps between

sequential courses, less coverage of content, retention of material, absenteeism and make-up work, and preparation for exit exams (Queen, & Isenhour, 1998).

Schools that follow the alternate-day schedule meet for extended blocks of time every other day for an entire school year. Some advantages include: increased instructional time; capability of varying instructional methods; fewer transitions between classes; and fewer quizzes, tests, or homework assignments on any given day. Several issues regarding the A/B model are, as yet, unresolved. Students still carry six to eight subjects per year with limited opportunities for acceleration. If a course is failed, students typically have to wait until the next year to retake it. Teachers continue to be responsible for 100 to 180 students during a year and could have as many as six different preparations.

Very little data are available regarding the prevalence of block scheduling on a national level. In 1996, over 50% of high schools in the United States were estimated to be following some type of block scheduling (Canady, & Rettig, 1996). According to the National Center for Educational Statistics (Parsad, Alexander, Farris, & Hudson, 2004), 42% of all high schools were on block scheduling (2002). Block scheduling was more prevalent in urban schools, in schools with enrollments between 500 and 1,199, and in schools in the Southeast.

Because little formal information is available in Arkansas regarding the types of scheduling in public high schools, each school was contacted to determine the type of schedule utilized. In 2004, 263 schools were on a traditional schedule, 26 schools were on a 4 x 4 block schedule, and 33 schools reported to be on an A/B or some type of modified block (S. M. Trinkle, personal communication, May 5-10, 2004). In 2006, 257 schools reported to be on traditional schedules, 16 reported to be on 4 x 4 block schedules, and 20 reported to be on A/B block schedules (S. M. Trinkle, personal communication, January 3-5, 2006). In 2007, the

number of schools using a 4 x 4 block had dropped to 13; those on an A/B block had fallen to 15 (S. M. Trinkle, personal communication, October 9-11, 2007). The frequency of block scheduling in Arkansas has dropped from 18% in 2004 to 10% in 2007. During this interim, approximately 30 schools were consolidated or annexed with other districts, accounting for the drop in total numbers (ADE, 2010).

Federal and State Mandates

The *No Child Left Behind Act of 2001* (NCLB, 2002) required all states to implement plans to close the achievement gap and ensure that all students, regardless of disability or disadvantage, reach standards of academic proficiency. With the *Arkansas Student Assessment and Educational Accountability Act* (2004), Arkansas outlined an accountability plan designed to meet the requirements established in the *No Child Left Behind Act of 2001* (2002). With the passage of the *Arkansas Student Assessment and Educational Accountability Act* (2004), Arkansas adopted a series of criterion-referenced tests, collectively known as the Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP). Any school that fails to reach specified levels of proficiency is placed on one of five designations of school improvement.

The *Omnibus Quality Education Act* (2003) also outlined Arkansas's strategies for closing the achievement gap for all students. School districts must develop Academic Improvement Plans (AIPs) for all students who fail to score at a proficient level on state mandated exams. Beginning with the 2005-2006 school year, any student who did not reach proficiency on a state mandated test and failed to participate in remediation could not be promoted to the next grade level according to an *Act Pertaining to Public School Assessments and Remediation* (2005). Beginning with the 2009-2010 school year, credit will not be awarded

at the high school level until the student has earned a passing score on the end-of-course exam for Algebra I.

The purpose of the *Omnibus Quality Education Act* (2003, Section 8) was "to provide the statutory framework necessary to ensure that all students in the public schools of this state have an equal opportunity to demonstrate grade-level academic proficiency through the application of knowledge and skills in the core academic subjects consistent with state curriculum frameworks, performance standards, and assessments." The Arkansas Department of Education (ADE) also establishes the schedule for the administration of all state-mandated assessments (2006a), resulting in unequal preparation time for students in schools on 4 x 4 block schedules. Students who take Algebra I, Biology, or Geometry in the fall block finish the class completely before they are evaluated on the end-of-course assessments; students who take the subjects in the spring are assessed at least four weeks prior to completing the courses. Because the literacy exam is an end-of-level assessment, it is only administered in mid-March to students in 11th grade. This results in a lapse of at least two months between instruction in literacy and assessment for students completing the class in the fall; students taking the class in the spring still have approximately 11 weeks of the class remaining which limits their exposure to concepts and preparation time for the exam.

Statement of the Problem

Although many studies regarding the effects of scheduling on student achievement in other states have been conducted, the results may not be generalized to Arkansas schools or to the criterion-referenced assessments taken by students in Arkansas. Several studies regarding block scheduling have been completed in Arkansas, but they have related to students' perceptions of block scheduling (Calvery, Sheets, & Bell, 1998), job satisfaction of teachers

(Holder, 2003), and the increased use of media centers (Huffman, Thurman, & Thomas, 2005). No studies in Arkansas have been located which have studied the effects of block schedules on student achievement, specifically the end-of-course assessment in Geometry and the Grade 11 Literacy examination.

Purposes of the Study

The purpose of this study is twofold. The first section was to provide a detailed description of schools on 4 x 4 and A/B block schedules as they compare to schools on traditional schedules. The second portion of the study was to determine which type of schedule; traditional, alternate day (A/B), or accelerated (4 x 4); was more conducive to higher student achievement on the Geometry end-of-course assessment and the Grade 11 Literacy assessment. While controlling for demographic differences between schools, this causal comparative study compared mean scores on the Geometry end-of-course test and the Grade 11 examination for the 2005-2006 and the 2006-2007 from schools in Arkansas that follow block schedules and those who do not.

Research Questions

Research Question 1: What are the characteristics of schools that utilized traditional, accelerated (4 x 4), or alternate day (A/B) block schedules during the 2005-2006 and 2006-2007 school years?

Research Question 2: Is there a difference in the achievement scores on the end-of-course Geometry assessment of students attending schools implementing an accelerated (4 x 4) block schedule or an alternate day (A/B) block schedule as compared to those attending schools implementing a traditional schedule of seven or eight periods?

Research Question 3: Is there a difference in the achievement scores on the Grade 11 Literacy examination of students attending schools implementing an accelerated (4 x 4) block schedule or an alternate day (A/B) block schedule as compared to those attending schools implementing a traditional schedule of seven or eight periods?

Limitations

The first section, a descriptive analysis, describes what the statistics show; no attempt was made to make judgments or to draw inferences based on the information. The second section of the study follows an *ex post facto* design. Mean scores on criterion-referenced exams in Geometry and Grade 11 Literacy were collected after the mid-year and spring administrations. This study does not account for any achievement measures beyond the scope of these assessments. Because these exams are specifically tailored to the Arkansas curriculum frameworks, their results may not be generalized outside the state of Arkansas or to end-of-course assessments in other states. Data did not reflect achievement of students attending private schools, charter schools, or residential facilities.

Delimitations

The scope of this study was limited to public secondary schools in Arkansas and mean scores on the end-of-course assessment in Geometry and the Grade 11 Literacy examination. Data from end-of-course and end-of-level assessments was collected from the 2005-2006 and 2006-2007 school years. Although Arkansas administers two additional end-of-course assessments in Algebra I and Biology, these assessments will not be included in the study. The Algebra I assessment is primarily given to 9^{th} grade students which are often housed in a junior high or middle school setting rather that a high school setting; the Biology assessment was

piloted in 2007 with no results reported. Only scores from the combined population were used; scores were not disaggregated to reflect scores of any subpopulation; alternate assessments administered to special education students were also not reflected in this study.

In order to control for prerequisite achievement, scores on the 8th grade math and 8th grade literacy Benchmark exams were used as the covariate for the corresponding cohort of students assessed on the Geometry and Grade 11 Literacy examinations. No attempt was made to control for attrition of students between assessments. Comparisons were made between A/B block schools and traditional schools and between 4 x 4 block schools and traditional. No comparisons were made between A/B block schools and 4 x 4 schools.

The amount or quality of professional development provided to teachers in preparation for teaching in a block schedule was beyond the realm of this study. No attempt was made to control for the style and methodology of instruction used by the teacher in the classroom, student attendance, or student discipline. This study did not attempt to address any financial implications resulting from block scheduling.

Significance of the Study

It is crucial that stakeholders make informed decisions regarding the achievement of students within their jurisdiction. Of the 257 public high schools in Arkansas that were on traditional schedules during the 2005-2006 school year, 11 school representatives contacted by telephone indicated that their schools had abandoned block scheduling due to its adverse effect on test scores, even though little research was available to support this decision (S. M. Trinkle, personal communication, January 3-5, 2006). This study will provide school administrators with the research base needed to make choices regarding the scheduling model that is most advantageous for student achievement in the state of Arkansas.

Theoretical Framework

This study will contribute to the knowledge base of learning theories, specifically those regarding time on task. As early as 1963, Carroll indicated that learning is influenced by five factors involving time: student aptitude, ability to understand instruction, quality of instruction, opportunity for learning, and time spent in learning (Massachusetts 2020, n.d.). The amount of time needed to learn a given concept varies widely from child to child. Scheduling of the school day and the school year are the only variables that a school has at its disposal to control time on task. Research documents that more instructional time contributes to higher achievement (Kubitschek, Hallinan, Arnett, & Galipeau, 2005). Time, alone, is not sufficient for learning to occur, rather it can be identified as a minimum requirement for learning because it establishes the boundaries for teachers' opportunities to teach and students' opportunities to learn.

The release of *Prisoners of Time* sparked much debate surrounding the issue of time and learning (Metzker, 2003). The National Education Commission on Time and Learning recommended that the school day be restructured to reduce noninstructional activities and increase instruction in core academic areas in order to meet enhanced state standards. Others contend that electives such as music, drama, sports, and physical education have educational value and should not be reduced.

Time in the school day has been categorized into three types: Allocated Time, Engaged Time, and Academic Learning Time (American Educational Research Association [AERA], 2007; Metzker, 2003). Allocated Time is the total amount of time in a school day or a school year for instruction in a particular content area. Engaged Time, sometimes referred to as "time on task," is the time that students actually spend in learning activities. The period of time that students spend on rigorous activities at an appropriate level in which actual learning takes place

is called Academic Learning Time. Academic Learning Time, only a fraction of Allocated Time, is the most crucial for student achievement. Inefficient use of time during the school day or period can reduce time for teaching and learning. It has been estimated that teachers spend 23% of their day on noninstructional activities (Metzker, 2003). In another study of secondary schools, the time that students were on task was 54.2% of the total instructional time, or 28 minutes of a 55-minute period (Seifert, & Beck, 1984).

Increasing allotted time, in itself, has minimal influence on improving student achievement (Karweit, 1984; Metzker, 2003; Nelson, 1990). "…allocating additional time may simply mean 'more of the same' with very little change in learning" (AERA, 2007, p. 2). Authentic instructional reform requires a focus on many variables simultaneously: quality of instruction, appropriate level of instruction, incentive, and time (Slavin, 2003). Another study listed other factors, such as a well-behaved student body, a respected principal, and qualified teachers, to be contributors to the cause of higher achievement (Karweit, 1984). More time may correlate to more learning only if there was an inadequacy of time in the first place. "Time is the major resource at one's disposal, and educators must address how it is used to improve academic learning and performance" (Wood, 2002).

Definition of Terms

Academic Improvement Plan: a plan that is developed for each student not scoring at the proficient level on every portion of the criterion-referenced tests; it will contain a detailed description of supplemental and/or intervention and remedial instruction used in addressing the student's areas of deficiency (ADE, 2006a)

Accelerated Block Scheduling (4 x 4): students have four classes of approximately 90 minutes which minutes which meet for one semester (Queen, & Isenhour, 1998)

Alternate-block Scheduling (A/B): students meet classes every other day for extended blocks of time for the duration of the school year (Canady, & Rettig, 1996)

Arkansas Comprehensive Testing, Assessment and Accountability Program (ACTAAP): a comprehensive system that focus on high academic standards, professional development, student assessments, and accountability for all schools (ADE, 2006a)

Adequate Yearly Progress (AYP): expected performance gains for student achievement and the secondary indicators (ADE, 2006d)

Benchmark Exams: refers to the six criterion-referenced tests that are administered to students in grades 3-8 (ADE, 2006a)

Block Scheduling: students meet in three or four classes of longer duration daily as opposed to a traditional schedule with six or seven periods daily (Canady, & Rettig, 1996)

Carnegie Unit: the amount of time that a student has studied a subject usually 120 hours, meeting four or five times a week for 40 to 60 minutes for 36 to 40 weeks a year (The Carnegie Foundation for the Foundation of Teaching, 2006)

Core Academic Areas: those subject areas of reading, writing, mathematics, science, history, geography, civics, and other courses identified by the Arkansas State Board of Education as state mandated graduation requirements (ADE, 2005a)

Criterion-referenced Test: an assessment in which an individual's score on a test is interpreted by comparing it to a prespecified standard of performance; in Arkansas CRTs are correlated to the Arkansas curriculum frameworks and are administered in grades three through eight and on end-of-course/level exams in Algebra I, Geometry, Biology, and Grade 11 Literacy (ADE, 2006a; Gall, Gall, & Borg, 2003)

Disadvantaged Minority: Black and Hispanic students (NAEP, 2008)

End-of-Course Assessment: an assessment taken at the completion of a course of study to determine whether a student demonstrates attainment of the knowledge and skills necessary for proficiency in that course (ADE, 2006a)

End-of-Level Assessment: an assessment administered upon the completion of a specified grade level, such as the Grade 11 Literacy Assessment

Frameworks: documents outlining the broad goals and standards of an entire system of education, while giving the local school district the freedom to develop curricular programs to address the frameworks (ADE, 2006a)

High School: public school having some combination of grades 9-12 (ADE, 2006d)

Modular Schedule: division of the school day into 20-21 modules that may be grouped together in phases to accommodate small, medium, and large groups of students (Murray, 2008)

Secondary School: public school having some configuration of grades 7-12

Standards of Accreditation: a series of requirements that specify what a school or school district shall meet in order to be fully accredited by the Arkansas Department of Education (ADE, 2005b)

Student Learning Expectation: a specific learning objective to be introduced, taught, and mastered within a content standard (ADE, 2006a)

CHAPTER TWO:

A REVIEW OF THE LITERATURE

Perceptual Data

Teachers

Advantages of Block Scheduling

Teachers who advocate block scheduling indicated that they have more time to complete lessons or teach expanded lessons with greater continuity due to longer class periods (B. Brown, 2006; Evans, Tokarczyk, Rice, & McCray, 2002; Keller, 1997; Queen, & Isenhour, 1998). Teachers also felt that content could be covered in greater depth on block scheduling (Benton-Kupper, 1999; B. Brown, 2006; Kramer, 1996), and that they had more time to engage students in higher-order thinking skills (Gullatt, 2006). Instructors were able to use varied teaching strategies; such as active learning, hands-on activities, and team teaching; rather than a reliance on the lecture method (Benton-Kupper, 1999; B. Brown, 2006; Deuel, 1999; Evans et al., 2002; Stanley, & Gifford, 1998; Weller, 2002). In a three-year study of block scheduling, Queen (1998) reported that teachers perceived that increased student achievement was due to the implementation of 4 x 4 block scheduling.

Teachers believed that they demonstrated improved job performance because they had time to plan lessons more effectively on block scheduling (Benton-Kupper, 1999; Kramer, 1996; Stanley, & Gifford, 1998). Due to the lighter student load on a 4 x 4 block, teachers indicated that they had time for more individualized instruction. With fewer papers and projects to grade, they stated they could assess students' progress more accurately (Benton-Kupper, 1999; Evans et al., 2002). Teachers perceived that they have better relationships with students and fewer discipline problems on a block schedule (B. Brown, 2006; Evans et al., 2002, O'Neil, 1995).

According to findings of the Georgia Department of Education, the greatest benefit of block scheduling was an improvement in school climate for teachers and students (Gruber, & Onwuegbuzie, 2001; Wilson, & Stokes, 1999). Favorable perceptions were also reported by Buczala (2010). Teachers in the fields of Career and Technical Education, Special Education, Library Science, and Counseling perceived block scheduling to have impacted their effectiveness (Talcott, 2007). In a survey conducted by Smith (2009), teachers in both block and traditional schools indicated that they favored block scheduling. These findings were upheld by a study in Atlanta, Georgia (Todd, 2008). Seventy-five percent of teachers surveyed favored block, but only 50% percent believed that block scheduling positively affected student achievement.

Disadvantages of Block Scheduling

Teachers who taught on block schedules perceived that they taught less content due to a loss of total instructional hours; they reported increased pressure to cover content at a faster pace (Benton-Kupper, 1999; B. Brown, 2006; Keller, 1997). In a 25-year case study of one South Carolina high school, teachers acknowledged the loss of instructional time, approximately 15 hours per year (Wright, 2010). Teachers also reported that sequential courses were often not taught in contiguous blocks resulting in gaps in instruction. This was especially critical in foreign language and mathematics. Teachers in Pennsylvania blame *No Child Left Behind Act of 2001* (NCLB, 2002) mandate regarding Adequate Yearly Progress for the development of negative perceptions of block scheduling (Way, 2006). They cite continuity, retention of information, and loss of curriculum content as negative issues of block scheduling.

A survey of 2,000 teachers in North Carolina found no evidence that instructional practices changed from traditional instruction to the block; an overuse of the lecture method was cited (Jenkins et al, 2001). More experienced teachers tended to change their instructional

methods less than teachers with fewer years of experience when moving to block scheduling (Jones, 2009). Studies by Pryzblick (2009), Reller (2010), and Raines (2010) confirmed that teachers use very similar instructional strategies regardless of schedule type. In an interview with veteran teachers who had taught for 25 years at the same high school on traditional, A/B block, and 4 x 4 block schedules, six of seven stated that they thought the traditional schedule was better suited to the needs of students (Wright, 2010). In another study, teachers with 20 years of experience or more did not feel that block scheduling increased their effectiveness (Talcott, 2007). They believed that daily contact and shorter periods were in students' best interests (Mallory, 2007; Talcott, 2007). "Time for assimilation, time for practice, time for repetition" was needed for some classes (Talcott, 2007, p. 165).

Some teachers questioned the effectiveness of student engagement with a substitute teacher for extended blocks of time (Evans et al., 2002; Jones, 2009). Instructors reported that it was difficult for students to make up work after an absence since the equivalence of two instructional days is missed (Evans et al., 2002; Weller, 2002). Teachers indicated that there were more disruptions in class on a block schedule than on a traditional schedule (Griffin, & Nicholson, 2002). Due to fewer class changes, teachers reported a decrease in socialization as a disadvantage of block scheduling (B. Brown, 2006). Both general and special education teachers related the difficulty experienced by some special education students in staying focused for the duration of a 90-minute class (Pope, 2003). Teachers reported that the attention spans of lower level students could not last for 90 minutes, regardless of instructional strategies (Wright, 2010). One concern of math and science teachers was the lack of inservice training received prior to the implementation of block scheduling (Crosby, 2002; Jones, 2009; Pope, 2003).

Students

Advantages of Block Scheduling

Students indicated more positive attributes on block scheduling than traditional scheduling (Keller, 1997). The greatest student advocates of block scheduling were those who achieved at an average or above average level, who believed in the importance of school, and were satisfied with their achievement (Marchant, & Paulson, 2001). Students reported that they had more opportunities for electives on a block schedule (Evans et al., 2002). More class time was available on a block schedule for collaborative work and for teacher assistance. Students also identified increased study time as an advantage of block scheduling (Allen, 2009; Slate, & Jones, 2000). Although African American students indicated the strongest preference of any ethnic group for traditional schedules, they attributed fewer behavioral problems and increased academic achievement to block scheduling. Slate and Jones (2000) found that 74% of students felt that block scheduling would provide increased study time while 42% believed that block scheduling would increase their chances of passing classes.

Disadvantages of Block Scheduling

Lower achieving students were the greatest opponents of block scheduling; they also had the most difficulty adjusting to a block schedule (Keller, 1997). These students believed that school was important but were displeased with their grades (Marchant, & Paulson, 2001). Lower-achieving students were also found to have the worst relationships with their teachers and the worst perceptions of student behavior. Students reported that some teachers and substitutes had difficulty maintaining student engagement; the class periods were too long for a single activity (Evans et al., 2002). Difficulty attending for the duration of a blocked class was reported by both sexes (Slate, & Jones, 2000). In a survey by Yair (2000), students reported that

instructors used the same teaching strategies on block scheduling as they did in a traditional setting, especially the lecture method.

Administrators

Advantages of Block Scheduling

Administrators, like teachers, reported more in-depth coverage of the curriculum as an advantage of block scheduling (Keller, 1997). They identified an increased number of students who took accelerated classes and made the honor roll (Griffin, & Nicholson, 2002). Administrators also cited decreased failing grades, disciplinary problems, student absences, and dropouts which they credited to block scheduling. Higher grades on block scheduling should be interpreted with caution; however, as they are often the product of grade inflation rather that increased student learning (Kramer, 1996). Principals also indicated that they had increased flexibility in scheduling by having students enroll in eight classes per year as opposed to six or seven classes on a traditional schedule. According to principals, the key for successful implementation of block scheduling is administrative leadership and the provision of professional development (Deuel, 1999). They were confident that clear goals were identified prior to the implementation of block scheduling and that evaluation and adjustments occurred as needed (Smith, 2010). Administrators were generally perceived that block scheduling contributed to student achievement.

Disadvantages of Block Scheduling

Some administrators identified a decrease in the scope of the curriculum covered and a loss of total instructional hours as disadvantages of block scheduling (Keller, 1997). Principals in some schools on block scheduling reported increased numbers of suspensions, both in school and

out-of-school (Griffin, & Nicholson, 2002). Principals identified the major impediment to the implementation of block scheduling as “resistance to change” (Deuel, 1999).

Parents

Advantage of Block Scheduling

Of the studies reviewed, only one utilized input from parents. Parents reported a positive educational experience for their students who attended schools implementing block scheduling (Evans et al., 2002).

Disadvantages of Block Scheduling

Parents believed that block scheduling was not used to its fullest potential; they indicated that students were not challenged enough (Evans et al., 2002). They perceived that longer class periods led to increased frustration and decreased motivation among students as well as a loss of socialization.

Empirical Data

Standardized Tests

ACT

A study in 568 public high schools in Illinois and Iowa found negligible differences in ACT scores between schools on traditional and block schedules (Hackmann, Hecht, Harmston, Pliska, & Ziomek, 2001). Higher scores were found in schools with 4 x 4 schedules, followed by traditional and A/B. Baker (2001) and Stewart (2002) found no differences in ACT scores between schools on traditional or block schedules in studies of public high schools in Missouri. In a study of 28 public high schools in Missouri and Illinois, E. J. Brown (2006) discovered no differences in ACT scores in math and science regardless of schedule type. In Tennessee, Hughes (2009) reported no differences in ACT scores among three scheduling types: traditional, one-semester block, or two-semester block.

Epley (2001) found a significant increase in ACT scores after the implementation of an A/B block schedule in a midwestern urban school district. This was also supported by a study of a high school in Longmont, Colorado (Vladero, 2001). It was found that after four years of implementation of block scheduling, ACT scores had remained the same or improved. Talcott (2007) also reported increased ACT scores for schools on block.

A longitudinal study of 450 public high schools in Illinois and Iowa, conducted over a seven-year period, indicated that schools employing traditional schedules had a slight upward trend over time regardless of the content area (Harmston, Pliska, Ziomek, & Hackmann, 2003). ACT scores in schools with an alternating day scheduled exhibited more variability but little growth. In schools operating under a 4 x 4 model, ACT scores climaxed at or near the year of implementation, continued a slight downward trend for three years, and rebounded somewhat during the fourth year. In Tennessee, a four-year study in the metropolitan areas of Chattanooga, Knoxville, Memphis, and Nashville concluded that students enrolled in 4 x 4 block-scheduled schools had the highest mean scores on the Mathematics subtest of the ACT, followed by students in schools implementing traditional schedules and A/B schedules, respectively (Carter, 2002).

In a study of 797 schools in Texas, students in schools on traditional schedules outperformed those on block schedules on the ACT test (Terrazas, 2001). Dunnan (2001) confirmed this finding in a study of 637 schools in Illinois in which he found that block scheduling had a significant negative impact on ACT scores.

PSAT/NMSQT

Declines in mathematics and science scores were reported after initial implementation of block scheduling on the Preliminary SAT®/National Merit Scholarship Qualifying Test

(PSAT/NMSQT) (Wilson & Stokes, 1999). However, positive changes were noted in scores of students on block schedules when compared to students in traditional classes.

Advanced Placement

In a study of the impact of block scheduling on Advanced Placement (AP) scores, Andrews (2003) found no significant differences between scores on Calculus AB, English Literature and Composition, or U.S. History between traditional and A/B block schools. In a study of 49,830 students, 72 teachers, and 30 counselors, Deuel (1999) discovered no change in standardized test scores or AP scores for students attending schools with block schedules.

The College Board (1998), in an extensive study of AP scores, documented that the mean AP scores in Calculus AB, English Literature and Composition, U.S. History, and Biology were highest for students in year-long classes of 30 to 60 minutes in duration. Evans et al. (2002) found that 25% more students completed AP courses and 30% more earned a score of 3, 4, or 5 than they did prior to the implementation of block scheduling. In their five-year study of a single high school implementing block scheduling, Hansen, Gutman, and Smith (2000) found a 33% increase in the AP pass rate and a 37% increase in students taking AP exams. Because AP examinations are only administered in May, those who took AP courses during the first semester of a 4 x 4 schedule are out of practice; students who take the course during the second semester will not cover enough material by May (Kramer, 1996).

End-of-Course Exams

Mathematics

On the South Carolina High School Assessment Program math scores, Rosenburg (2005) found that means of students on traditional schedules were higher than means of students on 4 x 4 schedules. Gruber and Onwuegbuzie (2001) found that students on traditional schedules scored

significantly higher in math than those on 4 x 4 on the Georgia High School Graduation Test; Brown-Edwards (2006) reported no differences of scores on the same exam. The results of a six-year longitudinal study of 145 high schools found scores to be higher for student on block scheduling (Wilson, 2008).

On the Indiana Statewide Testing for Educational Progress administered to 10th graders, Veal and Schreiber (1999) found higher mean scores for math computation for students on traditional schedules. No significant differences were found between different scheduling types on the math portion of the Texas Assessment of Knowledge and Skills (Schott, 2009) or on the Massachusetts Comprehensive Assessment System-Composite Performance Index (Harvey, 2008).

Both McPherson (1997) and Lawrence (2000) documented higher mean scores on the Algebra I end-of-course exam in North Carolina for students on traditional schedules; however, Ellis (2005), Carter (2002), and Zhang (2003) reported higher scores for students on the 4 x 4 block schedule. Although the differences were not significant, Smith (2004) found higher mean scores and pass rates on the Mississippi Subject Area Exam in Algebra I in nonblocked schools. A five-year longitudinal study by Smith (2010), found that students attending block schools scored significantly higher on this exam that did their counterparts on traditional schedules.

No significant differences in scores were noted between schedule types on the end-of-course exam in Algebra I in Virginia (Farmer, 2005; Killough, 2001; Richardson, 2000). Both Killough and Richardson reported higher scores on traditional schedules while Farmer found higher scores by those on 4 x 4 schedules. Similar results were found on the Mississippi Subject Area Test by Smith (2009). Terrazas (2001) and Mallory (2007) found no significant differences in pass rates on the Algebra I end-of-course assessment in Texas between students on block or

traditional schedules, although pass rates were higher on block according to Terrazas. Students attending block scheduled schools made no significant increases on the Alabama end-of-course test in Algebra I (Harris, 1997). In a comparison between students attending schools implementing traditional schedules and those implementing modified block schedules, it was concluded that students and traditional schedules outperformed their counterparts, although the differences were not significant.

A study by Howard (2010) found that the 4 x 4 block was best for increasing math scores on the Algebra I/Math for the Technologies End of Course Examination Program administered in South Carolina. On the Basic Skills Assessment Program (BSAP) administered to 10^{th} graders in South Carolina prior to 2004, math passing rates were significantly higher on traditional schedules than on 4 x 4 schedules (Wright, 2010). In 2004, the BSAP was replaced by the High School Assessment Program (HSAP) (Norton, 2010). Although not significant, the passage rate for math, as measured by the HSAP, was lowest in schools implementing the 4 x 4 block schedule in 2006, 2007, and 2008.

Significant differences were found on the Algebra II test administered in Virginia. Killough (2001) indicated that scores on traditional schedules were significantly higher than scores on 4 x 4 block schedules; Richardson (2000) also found that traditional schools had the highest mean score, and those on 4 x 4 were significantly lower than traditional or A/B. Farmer (2005) reported significantly higher scores in schools implementing a 4 x 4 schedule. In a study of the end-of-course test scores for second year Algebra students in North Carolina, students on block schedules had lower mean scores in 12 of the 21 schools in the study (Kramer, 1996).

Results on the Geometry end-of-course exam in Virginia were mixed. Killough (2001) indicated schools on traditional schools had the highest mean; significant differences were noted

between traditional and 4 x 4 and between A/B and 4 x 4. Farmer (2005) also found students' mean scores in traditional schools to be higher than those on 4 x 4 or A/B. Richardson (2000) reported the highest mean scores in schools implementing an A/B block; those on a 4 x 4 schedule were significantly lower than traditional or A/B. On the Geometry end-of-course exam in North Carolina, students on block schedules had higher mean scores in 13 of 21 schools studied (Kramer, 1996).

Language Arts

Schools implementing traditional schedules had higher scores on end-of-course English exams than those on 4 x 4 schedules in South Carolina, North Carolina, and Virginia (Farmer, 2005; Gruber, & Onwuegbuzie, 2001; Killough, 2001; Lawrence, & McPherson, 2000; Rosenberg, 2005). Although the results were not significant, students on traditional schedules scored higher than those on a modified 4 x 4 block schedule on the Basic Skills Assessment Program (BSAP) reading and writing subtests, administered as an exit exam to 10^{th} graders in South Carolina prior to 2004 (Wright, 2010). The High School Assessment Program (HSAP) was implemented in 2004 to replace the BSAP. In further research, Norton (2010) found that schools implementing the 4 x 4 block had the lowest mean passage rate in reading and writing in 2006, 2007, and 2008. One year after transitioning from an A/B block schedule to a traditional schedule, students experienced a drop in scores on the reading portion of the Texas Assessment of Knowledge and Skills (Schott, 2009). No significant differences were found between scheduling types on the Massachusetts Comprehensive Assessment System-Composite Performance Index (Harvey, 2008).

In a previous study in North Carolina, McPherson (1997) also found higher mean scores on the English I end-of-course exam in schools implementing traditional schedules. Zhang

(2003) reported that the 4 x 4 schedule most likely had a positive impact on student achievement in English I. In a study of student achievement on the English I End of Course Examination Program administered in South Carolina, Howard (2010) found no superior results among the three types of schedules: traditional, A/B, or 4 x 4.

Terrazas (2001) reported a higher pass rate on English II end-of-course exams in Texas for students in traditional settings. No significant differences in student achievement by schedule type were noted by Veal and Schreiber (1999) on the Indiana Statewide Testing for Educational Progress administered to 10th graders. Smith (2009) and Smith (2010) also found no significant differences on the English II essay portion of the Mississippi Subject Area exam in their studies. Types of scheduling did not appear to impact scores on the English Language Arts portion of the Georgia High School Graduation Test according to Brown-Edwards (2006) but were reported to be higher on block in a subsequent study by Wilson (2008).

Scores on writing end-of-course exams in traditional settings were found to be significantly higher than those on block for students in Virginia (Farmer, 2005; Killough, 2001). No significant differences in scores were noted between traditional and 4 x 4 schedules on the writing portion of the Georgia High School Graduation Test (Gruber, & Onwuegbuzie, 2001). Wilson (2008) reported higher scores for students attending block schools. Floyd (2009) found no differences on end-of-course scores in American Literature between students in block and traditional schools in North Carolina.

Science

On the science portion of the Georgia High School Graduation Test, scores were significantly higher for students on traditional schedules than those on 4 x 4 schedules (Gruber, & Onwuegbuzie, 2001). However, no differences were found on the same assessment by Brown-

Edwards (2006). Scores on end-of-course exams in Earth Science were consistently higher on traditional schedules. Highest scores were reported in schools following traditional schedules; lowest scores were found in schools implementing A/B schedules (Farmer, 2005). Killough (2001) and Richardson (2000) also found that scores on traditional schedules were significantly higher than those on 4 x 4 schedules.

On the Biology end-of-course exam in Virginia, Farmer (2005) and Killough (2001) found the highest mean scores to be those on traditional schedules. Higher mean scores and pass rates were also reported on the Mississippi Subject Area Exam in Biology I in nonblocked schools, although the difference was not significant. Significant differences were noted by Killough between traditional and 4 x 4 and A/B and 4 x 4. Richardson (2000) found the highest mean scores in schools utilizing an A/B block; those on 4 x 4 schedules were significantly lower than A/B or traditional. Biology end-of-course scores in traditional schools in North Carolina were found to be higher than those on block (Lawrence, & McPherson, 2000; McPherson, 1997). In Texas, Keller (1997) found significantly higher mean scores on traditional schedules than on rotating or accelerated block schedules; Terrazas (2001) reported higher pass rates on traditional schedules. Based on a three-year longitudinal study of students' performance on the Biology end-of-course exam administered to students in Texas, Mossman (1999) found that students in school with traditional schedules consistently outperformed students in modified block schools, significantly so in 1996 and 1997.

On the Louisiana Graduate Exit Exam, Buczala (2010) reported higher mean scores from block and modified block schools for four years. With the exception of the first year, students on traditional schedules had the lowest means. This was supported by Smith (2009) and Smith (2010), who found significantly higher scores on the Biology portion of the Mississippi Subject

Area Exam in block schools. No impact of the 4 x 4 block schedule on Biology scores were noted by Zhang (2003). Ellis (2005) reported no significant differences on the North Carolina end-of-course assessment in Biology between students in schools with 4 x 4 block scheduling and traditional schedules.

Virginia was the only state found to administer end-of-course assessments in Chemistry. Three studies over a five-year period found that schools on traditional schedules had the highest mean scores (Farmer, 2005; Killough, 2001; Richardson, 2000).

Dexter, Tai, and Sadler (2006) conducted an extensive comparison of high school scheduling plans and college preparation. The results indicated that block scheduling did not appear to be advantageous in preparing students for college level science courses.

Social Studies

Students on traditional schedules scored higher on the Social Studies portion of the Georgia High School Graduation Test than those on a 4 x 4 block as reported by Gruber and Onwuegbuzie (2001) but no differences were noted five years later by Brown-Edwards (2006). Results were mixed for end-of-course tests in U.S. History. Traditional schedules had the highest mean scores in studies by Farmer (2005), Lawrence and McPherson (1997), and McPherson (2000); A/B models had the highest scores in studies by Killough (2001) and Richardson (2000). Floyd (2009) found that students on 4 x 4 schedules outperformed those on traditional schedules on the North Carolina end-of-course assessment in U.S. History. In Texas, Terrazas (2001) found a higher passing rate in schools with block scheduling. Zhang (2003) found that 4 x 4 block schedules did not positively impact student achievement in U.S. History. In a five-year longitudinal study, Smith (2010) found no significant differences on the U.S. History subtest of

the Mississippi Subject Area Exam; higher scores on block scheduling was reported by Smith (2009).

Richardson (2000) reported higher mean scores of students on A/B block schedules on the World History A and B end-of-course exams in Virginia; means of students on 4 x 4 schedules significantly lower than those on A/B or traditional. Killough (2001) reported significantly higher mean scores by students on traditional schedules on the Virginia World History from 1000/Geography end-of-course test than students on a 4 x 4 schedule. Farmer (2005) found higher mean scores on the World History/Geography I end-of-course exams for those students on traditional schedules; however, on the World History/Geography II exam, students on 4 x 4 schedules obtained the highest mean scores.

On the Economics, Legal, and Political Systems test given in North Carolina, students on a 4 x 4 schedule had scores significantly lower than those on A/B or traditional schedules according to McPherson (1997). Scores of students on a 4 x 4 schedule had higher scores than students in traditional settings as reported by Zhang (2003).

Conclusions

In a meta-analysis of 58 empirical studies regarding block scheduling, Zepeda and Mayers (2006) found the research on block scheduling to be “rather shallow.” Their report described findings across five groupings. Within groups, the data were inconsistent regarding change in teacher practices. Teachers indicated that staff development was a necessity for teaching in a block schedule. Student grade point averages and school climate appeared to rise on block scheduling, but inconsistent reports were found regarding its effect on attendance and standardized testing. Improvement of instruction or test scores is difficult to support based on current literature. The following findings were noted across all studies:

1. Research studies leave out critical information.
2. Teachers and students may view block scheduling in a positive light, but their reasons are not identified.
3. Changes in teachers' practices are inconsistent.

After reviewing literature on block scheduling, this researcher concluded that both teachers and administrators perceived that the curriculum was covered in greater depth on block scheduling, but that the scope of the curriculum was reduced. Teachers reported fewer disciplinary infractions on a block schedule; administrator responses varied regarding disciplinary issues. Student and teachers reported more class time on block scheduling but indicated difficulties in meaningful student engagement with a substitute teacher. Parents' perceptions of block scheduling also varied. Some reported positive experiences while others indicated that their students' frustration levels increased due to the lengthened class periods.

Results regarding ACT scores varied among researchers. Results of research regarding Advanced Placement exams ranged from negligible differences to significantly higher mean scores on traditional schedules.

Achievement scores varied widely in all subjects across all scheduling types. Studies conducted prior to the passage of the *No Child Left Behind Act of 2001* (NCLB, 2002) tended to focus on issues such as school climate and stakeholders' perceptions; studies after NCLB focused more on student achievement and meeting Adequate Yearly Progress. Few studies attempted to control for preexisting knowledge or demographic variables such as socioeconomic status or minorities.

The researcher reviewed 44 dissertations, 40 articles, 4 books, 4 state/federal education acts, 1 presentation, 6 informational websites, as well as the rules and regulations governing

assessment and accountability in Arkansas. Dissertations were included in the literature review only if they pertained to types of scheduling at the high school level; studies of scheduling in middle schools and junior high schools were excluded. Articles were reviewed if they were from reputable journals or organizations. Searches of articles were restricted to those defined as "scholarly articles" by the search engine. Numerous articles were reviewed which included personal opinions with little or no supportive data; these articles were not included in the literature review.

CHAPTER THREE:

METHODOLOGY

The purpose of this study is twofold. The first section provides a detailed description of schools on 4 x 4 and A/B block schedules as they compare to schools on traditional schedules. The second section questions if the type of scheduling model implemented by public schools in Arkansas impacts student achievement on the end-of-course assessment in Geometry or the Grade 11 Literacy examination. Student achievement was compared across scheduling types using the mean standard score of selected schools for the 2005-2006 and 2006-2007 school years using an Analysis of Covariance (ANCOVA). The independent variable is the scheduling type, the dependent variable is the measure of student achievement, and the covariate is the corresponding 8th Grade Benchmark exam.

Research Questions

1. What were the characteristics of schools that utilized traditional, accelerated (4 x 4), or an alternate day (A/B) block schedules during the 2005-2006 and 2006-2007 school years?
2. Was there a difference in the achievement scores on the end-of-course Geometry assessment of students attending schools implementing an accelerated (4 x 4) block schedule or an alternate day (A/B) block schedule as compared to those attending schools implementing a traditional schedule of seven or eight periods?
3. Was there a difference in the achievement scores on the Grade 11 Literacy examination of students attending schools implementing an accelerated (4 x 4) block schedule or an alternate day (A/B) block schedule as compared to those attending schools implementing a traditional schedule of seven or eight periods?

Sample

All schools which fit the definition of public secondary schools in Arkansas were eligible for inclusion in the initial sample. Schools were then categorized based on the type of schedule implemented during the 2005-2006 and 2006-2007 school years. All public high schools were included in the descriptive analysis; schools were selected for inclusion in the analysis of variables based on schedule implementation and similar demographics. Charter schools, private schools, and residential facilities were excluded.

Procedures

Section I-Descriptive Analysis

Demographic statistics for the descriptive analysis were collected for all schools meeting the criteria of public secondary schools in Arkansas. Tables were created to categorize and summarize the data from schools implementing 4 x 4, A/B, and traditional schedules and grade configurations for the 2005-2006 and 2006-2007 school years. Data were collected from the General School Information report compiled through the Arkansas Public School Computer Network (APSCN) and personal contact with schools identified as implementing block schedules (ADE, 2006c; ADE, 2007b). Data collected included: students eligible for free/reduced lunches, grade inflation, percentages of minorities, college remediation rates, student attendance rates, drop-out rates, student enrollments, and per pupil expenditures at the district level.

Section II-Analysis of Variables

According to Ary, Jacobs, and Razavieh (2002), one method commonly used to provide partial control in *ex post facto* research is to match the subjects on as many extraneous variables as possible. It must be noted, however, that an increase in the number of matched variables will likely decrease the number of subjects that can actually be used in the final analysis. McMillan

and Schumacher (2001) describe matching as an acceptable method of creating homogenous groups of factors that affect the dependent variable, which would be student achievement in this study.

Researchers have controlled for a number of contextual factors; however, they rarely agree on the factors that most impact student success. York (2004) contended that a "failure to include these contextual factors (SES, school size, and school locale) results in a very limited study that may be reporting only the results of chance and not that which is statistically significant." In his study regarding the relationship between scheduling type and student achievement, Bertrand (2005) controlled for Limited English Proficient (LEP) students, percentage of white students, percentage of low-income students, and per-pupil expenditures. The percentage of low-income students and per-pupil expenditure were found to most consistently predict student achievement.

Gaudet (1999) identified school-based contextual factors impacting student achievement: average per pupil spending, teacher experience level, average classroom size, and student-teacher research. He also identified factors in the community that affect student achievement but are out of the control of the local school district: mean income, mean educational level, percentage of students attending private schools, family status, incidence of poverty, and employment status. Tajalli and Opheim (2004) identified and categorized process variables into three categories: school characteristics (school size, student/teacher ratio, and campus expenditures), teacher characteristics (salary and experience levels), and per pupil expenditure. Models in the study by Tajalli and Opheim show no direct correlation between school performance and school size, class size, or per pupil expenditures.

One of the most widely used contextual variables for educational research is socioeconomic status (SES) according to Sirin (2005). Coleman and Jencks confirm that one of the most important influences on student achievement is SES (Tajalli, & Opheim, 2004). "Comparing schools and school districts according to unadjusted outcome measures favors schools that serve advantaged students, and unusually adversely affects schools with a population of low socioeconomic demographics. Poverty is the common thread that links most academically troubled schools that are placed on a state-mandated academic watch list" (Sutton, & Soderstrom, 1999, p. 338).

Although individual poverty has been found to impact student achievement, recent research by Banks (cited by Vanderhaar, Muñoz, and Rodosky, 2006) shows that poverty at the school level is a stronger predictor of academic failure because of its effects on students, teachers, and the school. The most common measure of school SES is the proportion of students at each school who are eligible to receive school meals at a free or reduced price (Clotfelter, Ladd, Vigdor, & Wheeler, 2007; Sirin, 2005). The National School Lunch Program (NSLP), a federally assisted meal program, has established guidelines for eligibility for free or reduced-price meals (National Assessment of Educational Progress [NAEP], 2008). Students from families who earn at or below 130% of the poverty level are eligible for free meals; those who earn from 130% to 185% of the poverty level are eligible for reduced-price meals.

This study identified a school's minority status according to the definition issued by NAEP (2008). Low minority schools have fewer than 5% disadvantaged minority students, medium minority schools have from 5% to 50% disadvantaged minority students, and high minority schools have over 50% disadvantaged minority students. NAEP's definition of "disadvantaged minority students" includes Black and Hispanic students.

For the purpose of this study, secondary schools with the same or similar grade configurations were matched on three variables: student enrollment, socioeconomic status, and disadvantaged minorities. Student enrollments for 2005-2006 and 2006-2007 were collected for each secondary school that implemented the same type of schedule for this time frame. These enrollment figures were averaged together to obtain mean enrollment figures which were rank-ordered from highest to lowest.

Since there are no established parameters to define levels of poverty, the researcher followed the procedure outlined by Clotfelter et al. (2007). “High poverty” schools are defined as those with 75% or more of students eligible for free or reduced meals; “low poverty” schools are schools with fewer than 25% of students eligible for free or reduced meals. Percentages of students eligible free or reduced lunches were collected from each school for 2005-2006 and 2006-2007 that implemented the same type of schedule for the same period of time. These percentages were averaged to obtain mean percentages of students eligible for free or reduced lunches (NORMES, 2007).

All schools fitting the criterion of public secondary schools in Arkansas were included in the initial sample. Based on School Information Reports through the APSCN for 2005-2006 and 2006-2007, schools were categorized as block or traditional schools (ADE, 2006c; ADE, 2007b). If the schedule type was reported to be “Block” or listed only four periods in their daily schedule, the schools were contacted personally by the researcher to determine if the specific type of block scheduling that was implemented by the school was a 4 x 4 model or an A/B model. All schools that did not employ the same type of schedule for both years were excluded.

Student achievement was compared across scheduling types using the mean standard score of selected schools for the 2005-2006 and 2006-2007 academic years. Because schools on

a 4 x 4 block schedule administered Geometry exams in both the fall and the spring, a weighted average was calculated by adding the means from the two assessments and then dividing by the total number of students assessed. For schools with multiple high schools in the same district, it was necessary to determine which junior high schools feed into each high school. This was a question asked by the researcher in personal communication with districts of more than one high school. The data obtained were used only to pair test data from students in middle schools or junior highs with test data of the same cohorts of students in high schools. In districts with multiple junior high schools feeding into a single high school, a weighted average of the respective scaled scores was calculated to obtain the covariate variable.

Research Design

Section I-Descriptive Analysis

Tables were created to summarize and categorize schools implementing 4 x 4, A/B, and traditional schedules and grade configurations for the 2005-2006 and 2006-2007 school years. Measures of central tendency including mean, range, standard deviation, and variance were calculated for each secondary school for SES, total student enrollment, race (Asian, Black, Hispanic, Native American, and White), drop-out rate, graduation rate, college remediation rate, and district per pupil expenditure. This section simply describes what the statistics show; no attempt was made to make judgments or draw inferences based on the information.

Section II-Analysis of Variables

This study followed an *ex post facto* quantitative analysis model. According to McMillan and Schumacher (2001, p. 310), *ex post facto* research is used to study cause-and-effect relationships when it is "impossible, unethical, or unfeasible to manipulate variables." The independent variable in this study is the type of schedule employed by the school: traditional,

4 x 4, or A/B; the dependent variable is the schools' mean scores on the Geometry end-of-course exam and the Grade 11 Literacy exam administered in the 2005-2006 and 2006-2007 school years. The covariate for the Geometry exam is the mathematics portion of the 8th grade Benchmark administered in 2003-2004 and 2004-2005; the covariate variable for the Grade 11 Literacy exam will be the literacy portion of the 8th grade Benchmark administered in 2002-2003 and 2003-2004.

Instrumentation

Section I-Descriptive Analysis

Demographic information was obtained from the General School Information report available from APSCN. The breakdown of racial groups was gathered from the Enrollments by School report also compiled by APSCN (ADE, 2006b; ADE, 2007a). Per pupil expenditure figures were obtained from the Arkansas School Performance report generated by the National Office for Research on Measurement and Evaluation Systems (NORMES, 2007) for the 2005-2006 and 2006-2007 school years. The accuracy of this data is completely dependent on the accuracy of the data input into APSCN.

Section II-Analysis of Variables

Gaudet (1999) asserts that quantitative analysis is only as useful as the reliability and accuracy of the data. An ideal assessment is difficult to locate, but a well-developed criterion-referenced test (CRT) is the preferred instrument for measuring student performance. Well-constructed CRTs measure student achievement in absolute terms as opposed to norm-referenced tests (NRTs) which provide little feedback about what students actually know. The assessment instruments used in this study were the Arkansas Comprehensive Testing, Assessment and Accountability Program (ACTAAP) end-of-course assessment in Geometry and the Grade 11

Literacy examination (ADE, 2006e). Both exams, piloted in 2001, are criterion-referenced and consist of both multiple choice and open-response questions.

The Geometry assessment is given to students upon completion on the course; the Literacy exam is given to all students in 11th grade (ADE, 2006e). Students with significant cognitive disabilities, as determined by their Individualized Education Plan (IEP) committees, may participate in the Alternate Portfolio System. Students may the alternately assessed in Algebra and Geometry at the 9th grade level and in Literacy at the 11th grade level. These assessments are scored and become a part of the total assessment for the school.

Validity and Reliability

The Arkansas Department of Education asserts that the state's academic indicators are valid and reliable because the assessments are based on content standards, the exams are constructed by independent contractors, and the process is overseen by an independent technical advisory team (ADE, 2006e). The tests' internal consistency was calculated using Cronbach's Alpha for exams administered in 2005-2006 and 2006-2007. For 2005-2006, the reliability coefficient was 0.903 for the mid-year administration of the Geometry end-of-course assessment and at 0.896 for the spring administration (S. Gray, personal communication, February 25, 2008). The reliability coefficient was calculated to be 0.914 for the mid-year administration of the Geometry examination and 0.919 for the spring administration for the 2006-2007 school year. The Grade 11 Literacy exam is only given in the spring; its reliability coefficient was calculated to be 0.919 for the 2006 administration and 0.929 for the 2007 administration. Nunnaly (as cited in Santos, 1999) indicated that coefficients of 0.7 and above are considered to be acceptable levels of reliability. The reliability coefficients for both Geometry and Grade 11 Literacy examinations exceed this accepted criterion.

Levels of Performance

Each assessment is divided into four levels of performance: Below Basic, Basic, Proficient, and Advanced (ADE, 2006e). Standard scores are categorized as follows:

- Geometry: Below Basic-up to 153, Basic-154 to 199, Proficient-200 to 249, and Advanced-250 and above
- Literacy: Below Basic-up to 168, Basic-169 to 199, Proficient-200 to 249, and Advanced-250 and above

Data Analysis

Section I-Descriptive Analysis

Tables were created to illustrate demographic characteristics for public secondary schools in the state of Arkansas for the 2005-2006 and 2006-2007 school years. These tables included the minimum, maximum, mean, and standard deviation for each category.

Section II-Analysis of Variables

Grade configurations, mean student enrollments, mean minority rates, and mean school poverty rates were calculated and entered into a spreadsheet. Mean minority and school poverty rates were grouped into “low”, “medium”, and “high” categories. Schools on A/B blocks were matched with schools on traditional schedules on these variables. The original design was to match schools from each of the three scheduling types: traditional, A/B, and 4 x 4. Due to the low numbers of schools on block scheduling, this was not possible. A/B schools were matched with traditional schools; 4 x 4 schools were also matched with traditional schools.

Ten matches were found between A/B schools and traditional schools. All variables matched with one exception for grade configuration. One 9-12 school was paired with a 10-12 school. Since the literacy exam is given only to 11th graders, this was of no consequence.

Geometry is given primarily to 10th graders. Since both schools only tested sophomores in 2005-2006, this was not an issue. In 2006-2007, one school tested 25 students as 9th graders; this pair was eliminated for the second year for math only. Eleven matches were made between 4 x 4 and traditional schools. All were matched with the exception of one pair. An 8-12 school was paired with a 9-12 school; this pairing was included in the analysis since neither school administered Geometry tests to 9th graders.

Geometry end-of-course scores and Grade 11 Literacy scores were collected for the 2005-2006 and 2006-2007 school years. Scores were collected for both the mid-year and spring administrations for Geometry. A weighted average was computed for those schools who gave the mid-year assessment, so that all scores were accounted for. Since the Grade 11 Literacy exam is given only in the spring, those scores were collected. Scores on the 8th grade benchmark were collected for the corresponding cohorts of students for literacy and math. This included 2003-2004 and 2004-2005 scores on the 8th grade math benchmark and 2002-2003 and 2003-2004 on the 8th grade literacy benchmark. If high schools had multiple feeder schools, a weighted average was computed for the 8th grade benchmark. A weighted average for the 8th grade benchmark was also figured if two or more schools consolidated or annexed between the time the students were in 8th grade until they were assessed in Geometry or literacy.

Differences in mean scaled scores on 8th grade Benchmark and standard scores on Geometry and Grade 11 Literacy exams between schools implementing traditional, A/B block, or 4 x 4 block scheduling models were calculated using an ACNOVA by the Statistical Package for the Social Sciences (SPSS). A Test for Homogeneity of Slopes was conducted to ensure that the covariate, 8th grade Benchmark scores, do not interact with the independent variable, scheduling type. Since there were no significant interactions, the ANCOVA process was repeated without

the covariate group interaction. If significant differences had been found at an alpha level of 0.05, additional analyses would have been performed.

Ethical Considerations

Although all scores that were used in this study are available to the general public on the Arkansas Department of Education website, precautions were taken to ensure the confidentiality of individual schools and school districts. Only mean standard scores at the school level were analyzed; scores of individual students were not used. Results were reported as an aggregate of schedule type rather than by individual school or district name. Because this research did involve the study of human subjects, permission was granted through the Institutional Review Board of the University of Arkansas.

CHAPTER FOUR:

FINDINGS AND ANALYSIS OF DATA

The purpose of this study was to determine which type of schedule; traditional, A/B, or 4 x 4; was more conducive to higher student achievement on the Geometry end-of-course assessment and the Grade 11 Literacy assessment. In order to control for prerequisite achievement, scores on the 8th grade Benchmark exams for literacy and math were introduced as covariates. The research questions were designed to provide the following information regarding schedules and student achievement in Arkansas:

Research Question 1: What were the characteristics of schools that utilized either traditional, accelerated block (4 x 4), or alternate day block (A/B) schedules during the 2005-2006 and 2006-2007 school years?

Research Question 2: Was there a difference in the achievement scores on the end-of-course Geometry assessment of students attending schools implementing an accelerated (4 x 4) block schedule or an alternate day (A/B) block schedule as compared to those attending schools implementing a traditional schedule of seven or eight periods?

Research Question 3: Was there a difference in the achievement scores on the Grade 11 Literacy examination of students attending schools implementing an accelerated (4 x 4) block schedule or an alternate day (A/B) block schedule as compared to those attending schools implementing a traditional schedule of seven or eight periods?

Findings

Identical demographic variables were identified for all public secondary schools in Arkansas across the three major schedule types for 2005-2006 and 2006-2007. The data were presented in table format; only items that the researcher found noteworthy were discussed in text.

Findings from the ANCOVA calculations were summarized both in table form and in text. An alpha level of .05 was used for all calculations.

Schools from both A/B block and 4 x 4 block were matched to traditional schools on mean student enrollment, mean percentage of students eligible for free or reduced price meals, and mean percentage of minorities. Scores from the Geometry end-of-course exam and the Grade 11 Literacy assessment were compared between scheduling types. The analysis of data was designed to identify any discrepancies in student achievement between schools of different scheduling type. Analysis of covariance (ANCOVA) was employed to determine the significance of any differences in student achievement while controlling for the effect of the 8^{th} grade benchmark.

Research Question 1: What were the characteristics of schools that utilized either traditional, accelerated block (4 x 4), or alternate day block (A/B) schedules during the 2005-2006 and 2006-2007 school years?

In the 2005-2006 school year, data were collected on 297 high schools: 259 on traditional schedules, 20 on A/B block, and 16 on a 4 x 4 block. No information was available for two schools. Schools implementing traditional schedules, representing 87% of the high schools in Arkansas, were scattered throughout the state. The percentage of schools implementing block schedules has dropped considerably from the 2004-2005 school year. The majority, 60%, of schools operating under an A/B block schedule were located in the central part of the state; the remaining were sparsely scattered in the northern, western, and southern portions of Arkansas. Schools utilizing a 4 x 4 block schedule were dispersed throughout the state. By the 2006-2007 school year, the total number of schools had dropped to 285 schools with 257 on traditional schedules, 15 on A/B block schedules, and 13 on 4 x 4 block schedules. During the most recent

conversation with school personnel in 2007, several more indicated that they were moving back to a traditional schedule. The drop in the total number of schools was due to annexation/ consolidation (ADE, 2010).

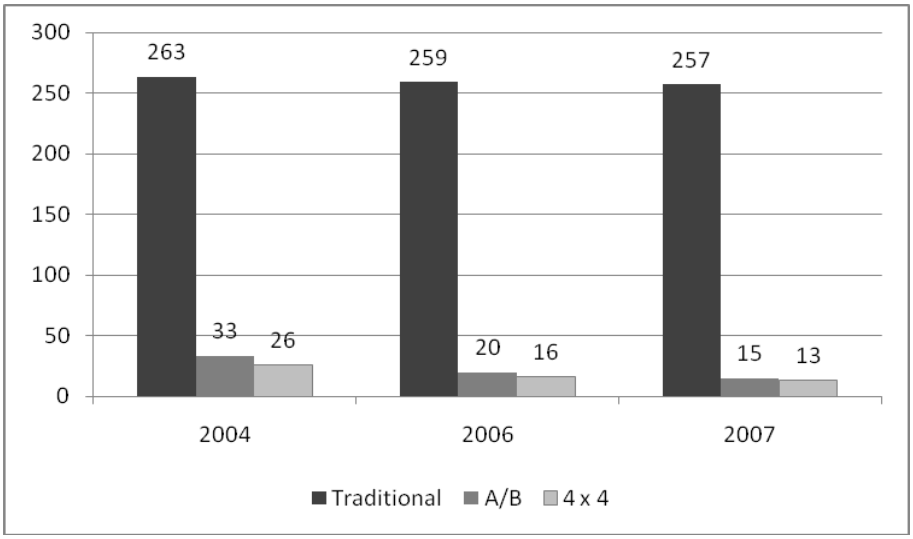

Figure 1. Types of schedules implemented by schools in Arkansas

The most prevalent type of scheduling used by schools in Arkansas is the traditional model, consisting of seven or eight periods taught daily throughout the year. In 2006, student enrollment ranged from 50 students to 2,422, with a mean population of 426 as indicated in Table 1. These schools exhibit a wide range in socio-economic status, from 13% to 100% of students receiving free or reduced meals. Grade inflation rates span the continuum from zero to 100%; the percentages of minorities range from zero to 99.7%. The most common grade configuration of schools on traditional schedules encompasses 7th through 12th grades (53%), followed by 9th through 12th (32%), and 10th through 12th (11%). Of the 259 high schools, 170 met standards while 75 were on Alert or some level of school improvement; no information was available for 14 schools. The numbers displayed on Tables 1 through 6 vary because the data were collected from a variety of sources. Some sources release data from the current year while

others publish data; such as graduation rates, remediation rates, and grade inflation rates; the following year. If schools were annexed or consolidated during the 2006-2007 time frame, data may be incomplete or missing. The total number of schools reflected in Figure 1 was taken from the Arkansas Public School Computer Network (APSCN) for the three school years included.

Table 1

Demographic data for all schools implementing a traditional schedule-2006

Demographic Category	N	Minimum	Maximum	Mean	SD
Student Enrollment	257	50	2,422	426	332.5
Attendance Rate (%)	254	86.4	100	94.0	2.2
Drop-out Rate (%)	245	0.0	21.0	3.3	2.5
Minorities (%)	251	0.0	99.7	20.4	24.9
School Poverty Level (%)	257	13	100	52.0	18.5
Graduation Rate (%)	242	62.3	100	85.6	7.8
Remediation Rate (%)	222	18.2	95.0	52.6	15.9
Grade Inflation Rate (%)	205	0.0	100	32.9	18.0

Few changes in the demographics of traditional schools were noticed from 2006 to 2007. As shown in Table 2, the mean student enrollment increased slightly, from 426 to 438. The number of traditional schools meeting standards dropped to 155; schools on alert or school improvement rose to 99 schools. District expenditures per pupil were reported for the first time. The mean per pupil expenditure for schools on traditional schedules was $7,981.61.

Table 2

Demographic data for all schools implementing a traditional schedule-2007

Demographic Category	N	Minimum	Maximum	Mean	SD
Student Enrollment	255	50	1,942	438	354.2
Attendance Rate (%)	253	82.7	100	93.8	2.5
Drop-out Rate (%)	229	0.2	28.0	4.0	3.0
Minorities (%)	255	0.0	97.0	20.3	23.9
School Poverty Level (%)	254	14.4	100	52.0	18.2
Graduation Rate (%)	245	4.9	100	89.2	8.2
Remediation Rate (%)	231	1.1	94.4	51.8	16.0
Grade Inflation Rate (%)	231	0.0	88.9	33.1	16.6
Per Pupil Expenditure ($) (District Level)	252	6,196.00	11,513.00	7,981.61	951.19

The second most common type of scheduling in Arkansas is the A/B block. In 2006, there were 20 schools implementing this type of schedule as displayed in Table 3. Student enrollment numbers range from 50 to 1,942 with the mean student enrollment being 969. Students receiving free or reduced meals range from 16% to 100%; minorities span from zero to 97%. The most common grade configuration used by schools on A/B block was 9th through 12th (55%), followed by 10th through 12th (20%). Of these 20 schools, 6 met standards; 14 were identified as being on school improvement.

Table 3

Demographic data for all schools implementing an A/B block schedule-2006

Demographic Category	N	Minimum	Maximum	Mean	SD
Student Enrollment	20	206	1,942	969	444.0
Attendance Rate (%)	19	87.5	98.6	93.4	2.5
Drop-out Rate (%)	20	0.0	10.2	4.0	2.9
Minorities (%)	20	3.0	94.2	44.3	26.8
School Poverty Level (%)	20	16.0	100	44.1	18.4
Graduation Rate (%)	19	64.3	98.3	82.1	9.1
Remediation Rate (%)	18	33.8	89.2	58.2	14.7
Grade Inflation Rate (%)	18	11.3	77.4	36.8	17.9

From 2006 to 2007, the number of schools operating on A/B block decreased from 20 to 15 (see Table 4). There was a sizable increase in mean student enrollment, from 969 to 1,210. Little change in other demographics was noted. Five schools continued to meet standards; the remaining 10 were on alert or school improvement status. The mean per pupil expenditure at the district level was $8,888.53.

Table 4

Demographic data for all schools implementing an A/B block schedule-2007

Demographic Category	N	Minimum	Maximum	Mean	SD
Student Enrollment	15	287	2,933	1,210	709.1
Attendance Rate (%)	14	88.0	98.8	94.0	2.9
Drop-out Rate (%)	14	0.4	11.2	4.1	3.2
Minorities (%)	15	3.4	94.7	47.7	30.9
School Poverty Level (%)	15	19.1	100	46.8	19.9
Graduation Rate (%)	14	84.6	98.5	90.5	3.2
Remediation Rate (%)	14	26.0	90.9	54.9	18.8
Grade Inflation Rate (%)	14	5.3	81.8	34.3	22.0
Per Pupil Expenditure ($) (District Level)	15	7,578.00	10,239.00	8,8888.53	1,079.66

In 2006, the type of schedule utilized the least in Arkansas was the 4 x 4 block, used by only 16 schools (refer to Table 5). Student enrollment numbers range from 56 to 1,904; the mean student enrollment was 590. A wide range of socio-economic levels were evident, from 16% to 100%. The most popular grade configuration included grades 9-12 (38%), followed closely by schools with 10-12 configurations (25%). Ten of the 16 schools on 4 x 4 block met standards; the remaining six were on alert or on some level of school improvement.

Table 5

Demographic data for all schools implementing a 4 x 4 block schedule-2006

Demographic Category	N	Minimum	Maximum	Mean	SD
Student Enrollment	17	56	1,904	589.7	444.8
Attendance Rate (%)	19	87.5	98.6	93.4	2.5
Drop-out Rate (%)	20	0.0	10.2	4.0	2.9
Minorities (%)	20	3.0	94.2	44.3	26.8
School Poverty Level (%)	20	16.0	100	44.1	18.4
Graduation Rate (%)	17	80.0	97.3	86.9	5.8
Remediation Rate (%)	18	33.8	89.2	58.2	14.7
Grade Inflation Rate (%)	14	8.8	81.8	33.1	20.0

By 2007, the number of schools operating on 4 x 4 schedules had decreased to 13. A slight increase in the mean student enrollment, from 590 to 667, was noted (refer to Table 6). The mean per pupil expenditure at the district level was $7,741.85. Six out of 13 schools met standards; seven were on alert or on school improvement.

Table 6

Demographic data for all schools implementing a 4 x 4 block schedule-2007

Demographic Category	N	Minimum	Maximum	Mean	SD
Student Enrollment	14	67	1,982	667	489.1
Attendance Rate (%)	14	88.0	98.8	94.0	2.9
Drop-out Rate (%)	13	0.9	6.2	3.3	1.5
Minorities (%)	14	1.3	79.1	35.1	27.1
School Poverty Level (%)	14	17.7	76.1	48.1	17.2
Graduation Rate (%)	14	81.2	96.0	90.1	3.9
Remediation Rate (%)	13	31.7	84.6	53.5	14.0
Grade Inflation Rate (%)	13	18.4	60.0	35.8	13.0
Per Pupil Expenditure ($) (District Level)	13	6,536.00	9,361.00	7,741.85	971.30

Research Question 2: Was there a difference in the achievement scores on the end-of-course Geometry assessment of students attending schools implementing an accelerated (4 x 4) block schedule or an alternate day (A/B) block schedule as compared to those attending schools implementing a traditional schedule of seven or eight periods?

Prior to conducting the analysis of covariance, the homogeneity of regression assumption was tested. Since the outcome suggested that the interaction between the 8^{th} grade benchmark and the A/B block was not significant, $F(1, 16) = .994$, $p = .334$, the ANCOVA was conducted. The end-of-course math scores for the end-of-course Geometry for 2006 are summarized in Table 7. As shown in the table, differences in the mean and the adjusted mean are negligible.

Table 7

Descriptive Statistics for A/B Block and Traditional Geometry End-of-Course Scores-2006

Group	N	Mean	SD	Adjusted Mean
A/B Block	10	203.30	19.89	202.11
Traditional	10	200.20	17.32	201.39

The strength of the relationship between the covariate and the dependent variable was also tested. As illustrated in Table 8, the relationship was significant, $F(1, 17) = 31.426$, $p < .05$. However, the difference between groups was not significant, $F(1, 17) = 2.576$, $p = .889$. The effect size, as calculated by Cohen's d, was very small (.06). Further analysis disclosed a partial eta squared (η_p^2) of .001 for scheduling type and .649 for benchmark. This indicates that scheduling type accounted for .1% of the variance on the Geometry EOC while 8th grade benchmark scores accounted for 65%.

Table 8

Inferential Statistics for A/B Block and Traditional Geometry End-of-Course Scores-2006

Source	Type III Sum of Squares	df	Mean Square	F	Significance Level	Partial η^2
Corrected Model	4110.290[a]	2	2055.145	15.899	.000	.652
Intercept	1683.205	1	1683.205	13.022	.002	.434
SCHED	2.576	1	2.576	.020	.889	.001
MATHBENCH	4062.240	1	4062.240	31.426	.000	.649
Error	2197.460	17	129.262			
Total	820369.000	20				
Corrected Total	6307.750	19				

a. Adjusted R Squared = .611

The homogeneity of regression was tested prior to conducting the ANCOVA. The interaction between the 8th grade benchmark and the A/B block schedule was not significant, $F(1, 14) = .271$, $p = .611$. Table 9 illustrates the mean scores for the Geometry end-of-course

scores for 2007. Mean scores A/B block were somewhat higher than scores on traditional schedules; this gap widens further after adjusting for the effect of the covariate.

Table 9

Descriptive Statistics for A/B Block and Traditional Geometry End-of-Course Scores-2007

Group	N	Mean	SD	Adjusted Mean
A/B Block	9	208.89	28.62	212.05
Traditional	9	192.33	41.57	190.17

A test was conducted to determine the strength of the relationship between the 8th grade benchmark and the Geometry end-of-course exam. As reported in Table 10, the relationship was significant, $F(1, 15) = 11.826$, $p = .004$. The difference between groups was not significant, $F(1, 15) = 2.809$, $p = .114$. Cohen's d, used to determine effect size, was calculated at .61. This was indicative of a moderate effect size. Analysis of the partial eta squared (η_p^2) signified that 16% of the variance on the Geometry EOC could be attributable to scheduling type while 44% could be attributable to the 8th grade benchmark.

Table 10

Inferential Statistics for A/B Block and Traditional Geometry End-of-Course Scores-2007

Source	Type III Sum of Squares	df	Mean Square	F	Significance Level	Partial η^2
Corrected Model	10369.067[a]	2	5184.533	6.826	.008	.476
Intercept	3641.028	1	3641.028	4.794	.045	.242
SCHED	8982.178	1	8982.178	11.826	.004	.441
MATHBENCH	2133.530	1	2133.530	2.809	.114	.158
Error	11392.711	15	759.514			
Total	749784.000	18				
Corrected Total	21761.778	17				

a. Adjusted R Squared = .407

To determine the appropriateness of an ANCOVA, a test of the homogeneity of regression assumption was first tested. There appeared to be no significant interaction between the covariate and the independent variable, $F(1, 18) = 454.079$, $p = .160$. Very little differences were noted between mean or adjusted mean scores on the 4 x 4 block and traditional schedule; the results are depicted in Table 11.

Table 11

Descriptive Statistics for 4 x 4 Block and Traditional Geometry End-of-Course Scores-2006

Group	N	Mean	SD	Adjusted Mean
4 x 4 Block	11	209.00	16.67	211.06
Traditional	11	213.00	17.30	210.94

In order to determine if the 8th grade benchmark was a good predictor of performance on the Geometry EOC, the strength of this relationship was tested. A significant relationship was found, $F(1, 19) = 6.765$, .018, as illustrated in Table 12. The difference between schedule types was not found to be significant, $F(1, 15) = .000$, $p = .985$. The effect size was found to be very small, .007, as determined by Cohen's d. According to the partial eta squared (η_p^2), none of the variance in Geometry scores can be attributed to scheduling type and 26% can be attributed to performance on the 8th grade benchmark.

Table 12

Inferential Statistics for 4 x 4 Block and Traditional Geometry End-of-Course Scores-2006

Source	Type III Sum of Squares	df	Mean Square	F	Significance Level	Partial η^2
Corrected Model	1602.547[a]	2	801.273	3.579	.048	.274
Intercept	5442.305	1	5442.305	24.311	.000	.561
SCHED	.081	1	.081	.000	.985	.000
MATHBENCH	1514.547	1	1514.547	6.765	.018	.263
Error	4253.453	19	223.866			
Total	985318.000	22				
Corrected Total	5856.000	21				

a. Adjusted R Squared = .197

No significant interaction between the covariate and independent variable was found when testing for the homogeneity of regression assumption, $F(1, 18) = .012$, $p = .914$); the ANCOVA was conducted. No significant differences were noted between means or adjusted means as indicated in Table 13.

Table 13

Descriptive Statistics for 4 x 4 Block and Traditional Geometry End-of-Course Scores-2007

Group	N	Mean	SD	Adjusted Mean
4 x 4 Block	11	213.27	21.11	216.37
Traditional	11	208.64	19.79	205.54

As displayed in Table 14, the covariate was determined to be a good predictor of achievement on the Geometry EOC, $F(1, 19) = 28.286$, $p = .000$. The relationship between groups was found to be not significant, $F(1, 19) = 3.496$, $p = .077$. The effect size was determined to be moderate, .55, as calculated by Cohen's d. The partial eta squared indicated that 16% of the variance of the Geometry scores was due to scheduling type; 60% was due to the 8th grade benchmark.

Table 14

Inferential Statistics for 4 x 4 Block and Traditional Geometry End-of-Course Scores-2007

Source	Type III Sum of Squares	df	Mean Square	F	Significance Level	Partial η^2
Corrected Model	5124.307[a]	2	2562.154	14.477	.000	.604
Intercept	1483.371	1	1483.371	8.382	.009	.306
SCHED	618.770	1	618.770	3.496	.077	.155
MATHBENCH	5006.080	1	5006.080	28.286	.000	.598
Error	3362.647	19	176.981			
Total	987527.000	22				
Corrected Total	8486.955	21				

a. Adjusted R Squared = .562

Research Question 3: Was there a difference in the achievement scores on the Grade 11 Literacy examination of students attending schools implementing an accelerated (4 x 4) block schedule or an alternate day (A/B) block schedule as compared to those attending schools implementing a traditional schedule of seven or eight periods?

A test of the assumption of the homogeneity of regression was first tested to determine the appropriateness of ANCOVA . There appeared to be no significant interaction between the 8th grade benchmark and the scheduling type, $F(1, 16) = .000$, $p = .996$. As displayed in Table 15, very little differences were noted between mean or adjusted mean scores on the A/B block and traditional schedule for literacy.

Table 15

Descriptive Statistics for A/B Block and Traditional Grade 11 Literacy Scores-2006

Group	N	Mean	SD	Adjusted Mean
A/B Block	10	195.40	8.07	194.40
Traditional	10	192.10	6.47	193.09

The relationship between the 8th grade benchmark and the Grade 11 Literacy exam was found to be significant, $F(1, 17) = 30.239$, $p = .000$, as displayed in Table 16. The difference between schedule types was found to be not significant, $F(1, 15) = .403$, $p = .534$. According to Cohen's d, the effect size was found to be small, .14. According to the partial eta squared (η_p^2), 2.3% of the variance in Literacy scores can be attributed to scheduling type; 64% can be attributed to performance on the 8th grade benchmark.

Table 16

Inferential Statistics for A/B Block and Traditional Grade 11 Literacy Scores-2006

Source	Type III Sum of Squares	df	Mean Square	F	Significance Level	Partial η^2
Corrected Model	671.082[a]	2	335.541	16.454	.000	.659
Intercept	1484.956	1	1484.956	72.820	.000	.811
SCHED	8.220	1	8.220	.403	.534	.023
LITBENCH	616.632	1	616.632	30.239	.000	.640
Error	346.668	17	20.392			
Total	751799.000	20				
Corrected Total	1017.750	19				

a. Adjusted R Squared = .619

In order to determine that it was appropriate to proceed with the ANCOVA, it was necessary to test the assumption for homogeneity of regression. No significant interaction was found, $F(1, 16) = 1.951$, $p = .182$. As reported in Table 17, there is very little difference between the means or adjusted means for A/B and traditional schedules.

Table 17

Descriptive Statistics for A/B Block and Traditional Grade 11 Literacy Scores-2007

Group	N	Mean	SD	Adjusted Mean
A/B Block	10	200.30	11.136	198.313
Traditional	10	194.60	7.351	196.587

A significant relationship was found to exist between the covariate and the dependent variable, $F(1, 17) = 24.040$, $p = .000$, as reported in Table 18. The differences between schedule types was found to be not significant, $F(1, 17) = .351$, $p = .561$. According to Cohen's d, the effect size was found to be very small, .10. Using the partial eta squared (η_p^2), 2% of the variance in Literacy scores can be attributed to scheduling type while 59% can be attributed to the 8th grade benchmark.

Table 18

Inferential Statistics for A/B Block and Traditional Grade 11 Literacy Scores-2007

Source	Type III Sum of Squares	df	Mean Square	F	Significance Level	Partial η^2
Corrected Model	1101.154[a]	2	550.577	14.100	.000	.624
Intercept	561.564	1	561.564	14.382	.001	.458
SCHED	13.723	1	13.723	.351	.561	.020
LITBENCH	938.704	1	938.704	24.040	.000	.586
Error	663.796	17	39.047			
Total	781495.000	20				
Corrected Total	1764.950	19				

a. Adjusted R Squared = .580

The test for homogeneity of regression assumption, conducted prior to the ANCOVA, found that the interaction between the covariate and the independent variable to be not significant, $F(1, 18) = .473$, $p = .501$. An inspection of the means and adjusted means displayed in Table 19 revealed negligible differences.

Table 19

Descriptive Statistics for 4 x 4 Block and Traditional Grade 11 Literacy Scores-2006

Group	N	Mean	SD	Adjusted Mean
4 x 4 Block	11	194.73	8.52	196.07
Traditional	11	196.45	8.08	195.11

A significant relationship between the 8th grade benchmark and the Grade 11 Literacy exam was found, $F(1, 19) = 10.090$, $p = .005$, as displayed in Table 20. The difference between schedule types was found to be not significant, $F(1, 15) = .098$, $p = .757$. According to Cohen's d, the effect size was determined to be small, .13, as Using the partial eta squared (η_p^2), .5% of the variance in Literacy scores can be attributed to scheduling type while 35% can be attributed to performance on the 8th grade benchmark.

Table 20

Inferential Statistics for 4 x 4 Block and Traditional Grade 11 Literacy Scores-2006

Source	Type III Sum of Squares	df	Mean Square	F	Significance Level	Partial η^2
Corrected Model	494.675	2	247.337	5.218	.016	.355
Intercept	1233.899	1	1233.899	26.030	.000	.578
SCHED	4.658	1	4.658	.098	.757	.005
LITBENCH	478.266	1	478.266	10.090	.005	.347
Error	900.643	19	47.402			
Total	843023.000	22				
Corrected Total	1395.318	21				

a. Adjusted R Squared = .287

The test of the homogeneity of regression assumption indicated that the relationship between the 8th grade benchmark and the scheduling types was not significant, $F(, 17) = .171$, $p = .685$. The results indicate that the ANCOVA procedure can be conducted. A visual inspection of the data in Table 21 indicates very few differences between the mean or adjusted means.

Table 21

Descriptive Statistics for 4 x 4 Block and Traditional Grade 11 Literacy Scores-2007

Group	N	Mean	SD	Adjusted Mean
4 x 4 Block	11	197.18	8.352	199.56
Traditional	11	199.40	11.266	196.78

A test was also conducted to determine the strength of the relationship between the 8th grade benchmark and the Grade 11 Literacy exam. As reported in Table 22, the relationship was significant, $F(1, 18) = 34.628$, $p = .000$. The difference between groups was not significant, $F(1, 18) = 1.047$, $p = .320$. Cohen's d, used to determine effect size, was calculated at .31. This was indicative of a small effect size. Analysis of the partial eta squared (η_p^2) indicated that 5.5% of the variance on the Grade 11 Literacy exam could be attributable to scheduling type while 66% could be attributable to the 8th grade benchmark.

Table 22

Tests of Between-Subjects Effects for 4 x 4 Block and Traditional Grade 11 Literacy Scores-2007

Source	Type III Sum of Squares	df	Mean Square	F	Significance Level	Partial η^2
Corrected Model	1236.472[a]	2	618.236	17.682	.000	
Intercept	46.857	1	46.857	1.340	.262	
SCHED	36.617	1	36.617	1.047	.320	
MATHBENCH	1210.699	1	1210.699	34.628	.000	
Error	629.338	18	34.963			
Total	827131.000	21				
Corrected Total	1865.810	20				

a. Adjusted R Squared = .625

Summary of Findings

The traditional schedule, with 7 to 8 periods per day, is used by 90% of the public schools in Arkansas. A/B block and 4 x 4 block schools combined account for the remaining 10%. Schools utilizing an A/B block had higher mean student enrollment; those on a 4 x 4 had the lowest mean enrollment. Schools operating under either type of block schedule had higher mean rates of minorities but somewhat lower mean rates of students receiving free or reduced meals. The highest per pupil expenditure at the district level was by schools on A/B block. Data from all other demographic statistics reported were similar across the three schedule types.

Separate ANCOVA calculations were conducted on eight data sets which compared mean scores from the Geometry end-of-course assessment and the Grade 11 Literacy exam between schools on A/B block with traditional and schools of 4 x 4 with traditional. Eighth grade benchmark scores were used as baseline data. Tests of homogeneity of slopes were conducted prior to each ANCOVA calculation; no significant interactions were found. Each calculation indicated a strong relationship between the covariate and the dependent variable but no significant relationships were found between the type of schedule and student achievement. Small effect sizes were found in six of the calculations; moderate effect sizes were found in two. To answer research questions 1 and 2, there were no differences in student achievement in Geometry or Literacy based on the types of schedules implemented at the school level.

CHAPTER V:

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to answer the following questions:

Research Question 1: What were the characteristics of schools that utilized either traditional, accelerated block (4 x 4), or alternate day block (A/B) schedules during the 2005-2006 and 2006-2007 school years?

Research Question 2: Was there a difference in the achievement scores on the end-of-course Geometry assessment of students attending schools implementing an accelerated (4 x 4) block schedule or an alternate day (A/B) block schedule as compared to those attending schools implementing a traditional schedule of seven or eight periods?

Research Question 3: Was there a difference in the achievement scores on the Grade 11 Literacy examination of students attending schools implementing an accelerated (4 x 4) block schedule or an alternate day (A/B) block schedule as compared to those attending schools implementing a traditional schedule of seven or eight periods?

The study was limited to public secondary schools in Arkansas. Analysis included examination of descriptive statistics and analysis of covariance (ANCOVA). Demographic data from all public secondary schools were included in the descriptive portion of the study. Schools on A/B block and 4 x 4 block schedules were paired with schools operating on traditional schedules using percentages of students on free or reduced lunch, percentages of minorities, student enrollments, and grade configurations. An alpha level of .05 was used for all calculations.

Summary

A review of the literature yielded generally positive perceptions from teachers, administrators, students, and parents regarding issues of school climate. However, the body of empirical data varies widely, even within the same state, on the same assessments, and in the same time frame.

Teachers felt that they had more time to teach the curriculum in greater depth and to use more varied instructional strategies. They felt that their job performance improved; they perceived that students also performed better. Others felt they taught less content due to a loss of instructional time. Some subjects, such as music and foreign language, require daily contact with students. Some teachers indicated that it was difficult to maintain student engagement for extended class periods.

Top performing students were the greatest proponents of block scheduling. They cited more opportunities for electives, more time for collaborative interaction, and more availability of teacher assistance. Lower performing students, the greatest opponents of block scheduling, indicated that they had difficulty staying on task for the duration of the class period.

Administrators cited more flexibility in scheduling as an advantage of block scheduling; they were able to enroll more students in advanced courses. Like teachers, they perceived that the curriculum was covered in greater depth. They found decreased failing grades, less disciplinary issues, reduced absences, and fewer drop-outs. Other administrators' views were contradictory. They cited decrease in the scope of content, primarily due to a loss in the total number of instructional hours. Increased suspensions, often the outcome of unstructured time, were also listed as disadvantages.

Some parents believed that block scheduling provided positive educational experiences for their children; others felt that it was not used to its fullest potential. Frustration, decreased motivation, and lost time for socialization were listed as perceived disadvantages.

The body of research is inconclusive regarding the impact of scheduling type on student achievement. Student achievement results on the ACT, PSAT/NMSQT, Advanced Placement, and end-of-course assessments in mathematics, language arts, science and social studies were inconsistent. According to a meta-analysis by Zepeda and Mayers (2006), improvement of instruction or test scores is difficult to support based on current literature.

1. Research studies leave out critical information.
2. Teachers and students may view block scheduling in a positive light, but their reasons are not identified.
3. Changes in teachers' practices are inconsistent.

Demographic characteristics from all public secondary high schools were analyzed for the 2005-2006 and 2006-2007 school years. An analysis of covariance was used to analyze the relationships between block and traditional school that were matched on grade configuration, student enrollment, percentage of students on free or reduced meals, and percentage of minorities.

Conclusions

Research Question 1: What were the characteristics of schools that utilized either traditional, accelerated block (4 x 4), or alternate day block (A/B) schedules during the 2005-2006 and 2006-2007 school years?

Through personal communication and research, it was determined that the number of block schools in Arkansas is declining annually. Over 90% of public high schools in the state

operate on a traditional schedule with seven or eight periods daily; 10% utilize either the A/B model or the 4 x 4 model. An examination of demographic data indicated that schools implementing A/B schedules have higher mean student enrollments; schools utilizing the 4 x 4 model have the lowest. Block schools tend to have higher rates of minorities but lower numbers of students eligible free or reduced meals. A/B block schools have the highest mean per pupil expenditure at the district level.

Research Question 2: Was there a difference in the achievement scores on the end-of-course Geometry assessment of students attending schools implementing an accelerated (4 x 4) block schedule or an alternate day (A/B) block schedule as compared to those attending schools implementing a traditional schedule of seven or eight periods?

Although it was the expectation of the researcher that traditional schedules were more conducive to higher test scores, this study confirmed that there were no significant differences in Geometry achievement scores between either type of block schedule and traditional schedules. Prior to the conduction of the ANCOVA, the homogeneity of slopes assumption was tested; the outcomes were determined to be not significant. In all calculations, the strength between the 8^{th} grade mathematics benchmark and the Geometry end-of-course assessment was significant, but the difference between schedule types was not significant. Minimal differences were found between mean and adjusted mean scores for each schedule type. Effect sizes were determined to be very small in 2006 but moderate in 2007. Only a small portion of the variance of Geometry scores could be attributed to scheduling.

Research Question 3: Was there a difference in the achievement scores on the Grade 11 Literacy examination of students attending schools implementing an accelerated (4 x 4) block

schedule or an alternate day (A/B) block schedule as compared to those attending schools implementing a traditional schedule of seven or eight periods?

No significant differences in Grade 11 Literacy achievement scores between either type of block schedule and traditional schedules; the researcher expected higher achievement scores by students on traditional scheduls.. The homogeneity of slopes assumption was tested prior to conducting an ANCOVA; no significant interaction was found. In all calculations, there was a significant relationship between the literacy portion of the 8th grade Benchmark and the Grade 11 Literacy assessment; no significant differences were found between schedule types. Mean scores and adjusted mean scores were very similar for each schedule type. Effect sizes were determined to be small; only a small portion of the variance of Grade 11 Literacy scores could be attributed to scheduling.

Discussion

Personal research from 2004 through 2007 indicates that block schedules in Arkansas is all but extinct. The researcher personally contacted school personnel of 322 high schools in Arkansas in January of 2004; 263 reported to be on traditional, 33 on A/B block, and 26 on 4 x 4 block. Of those schools that were on traditional schedules, 42 had tried block but returned to traditional. Seventeen of the 59 schools that reported to be on block schools, 17 indicated that they planned to return to a traditional schedule.

During this time, Arkansas legislature determined that schools whose enrollment fell beneath 350 students would be annexed or consolidated with other districts. As a result, 46 schools annexed or consolidated in 2004, two in 2005, and 7 in 2006. This resulted in fewer total schools in Arkansas.

In January, 2006, all public high schools were once again contacted by phone. Personnel in the majority of the 4 x 4 schools expressed no concerns. One school principal stated that the 4 x 4 model worked well for introducing new concepts, but it was difficult to make up work after an absence. Remarks were more varied for those on A/B block. Some indicated that they had no concerns and planned to remain on an A/B block; others cited a return to traditional schedule due to financial crises and problems with retaking portions of failed classes.

The emotions of school personnel tend to be very high, especially in those schools that have tried block scheduling and returned to traditional. One principal stated that he "usually slaps anyone who suggests block." Since most of the state operates under a traditional model, transfer students are a huge problem for block schools. Others felt that teachers did not implement block properly. The use of lengthy lectures and inefficient use of class time and prep time were cited as problems. The loss of instructional time and gaps in instruction were reasons for several to move back to traditional schedules. One administrator summed it up by saying, "(Block is) not the way to go unless you have excellent teachers."

Several schools indicated that they were moving back to traditional scheduling models due to financial and staffing issues. Others referred to increased accountability standards as reasons to leave block scheduling. Some administrators stated that they returned to traditional scheduling to improve test scores. An inequitable time to prepare for state tests was cited as one of the main reasons. Some subjects; such as science, music, and career and technical courses; lend themselves to lengthened class periods while others are needed on a daily basis for the entire year. Athletics, if a part of the school day, took up 25% of the instructional time.

Recommendations for Schools

The main issue should not be about scheduling but doing what is best for students. If a move to block scheduling is a potential, consider the other schools in the area. Transferring students between traditional and block schedules, especially those on 4 x 4 block, is a major problem. Not only do mobile students have tremendous gaps in instruction, they often lose credits in the process. This may necessitate participation in a credit recovery program, summer school, or delayed graduation.

A common thread throughout the research on block scheduling deals is the perceived inefficient use of class time by teachers. Some blame this on a lack of pre-service training; others cite an unwillingness to change. Regardless of the reason, there must be more variety of classroom activities than lecture and time for homework. Teachers must learn how to engage students effectively for extended periods of time. This can only be accomplished through extensive training and accountability for its implementation.

Finances are another matter that must be considered in moving to a block schedule. Several schools in Arkansas cite financial/staffing issues as reasons for the return to traditional schedules. The number of faculty members must be considered. Funds must be available if additional personnel must be hired.

Since some courses lend themselves well to extended periods and others are more suited to daily interaction with students, administrators should consider the possibility of a hybrid schedule. Although it could prove to be a scheduling nightmare, it could resolve many conflicts of each scheduling model. Longer periods would be conducive to classes accompanied by labs, classes that are performance-based, and multidisciplinary courses. Classes in which daily contact with students is needed for practice, for internalization, or for reinforcement, could be taught

throughout the year. According to experts (Daggett, Gendron, & Heller, 2010), the implementation of Common Core State Standards will require the integration of instruction, curriculum, and assessments. Administrators may be forced to reexamine their master schedules to allow for more flexibility of time, especially in those areas which will be assessed.

There are considerations when moving from a block schedule to a traditional schedule. If a school moves from a block to a traditional 7-period day, then students will go from earning potentially eight credits per year to only seven. Schools may have to lower the number of credits required for graduation if more credits than the state-mandated 22 are required. Students will typically not be able to retake classes as quickly on a traditional schedule as on a 4 x 4.

Any change in scheduling models will require extensive modification to the curriculum. Since there will be less total instruction time on a block schedule, teachers must prioritize the goals and objectives of their courses to ensure that students are adequately prepared for state assessments. Although it may seem like there is an endless amount of time on a traditional schedule, courses must be paced so that essential content is covered.

Recommendations for Further Research

Many school administrators cite financial concerns as reasons for moving away from block scheduling. There is little research on a national level, none in Arkansas to the researcher's knowledge, which confirms or denies this. It would be beneficial to be able to quantify the costs surrounding different scheduling models.

More studies need to be done which controls for students' prior knowledge. Much of the research available used a simple analysis of variance between mean scores on state assessments to compare different scheduling types. Studies may claim significant differences in performance

between scheduling types when the some of the variance could be attributable to students' prerequisite skills.

It would also contribute to the educational knowledge base to examine the psychological capabilities of adolescents, especially regarding time on task, attention span, as well as processing and retention of concepts. There is some evidence that supports the claim that lower level students have difficulty attending for extended class periods; however, there has been little research for average and above average students.

In order to have a more accurate representation of the significance of scheduling models on student achievement, a national study would be useful. Currently, all states have different standards, different assessments, and different models for meeting adequate yearly progress. The advent of Common Core State Standards followed by common assessments will provide a consistent form of measurement for all participants.

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