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DOES SCHEDULING MATTER? AN ANALYSIS OF A NEW HIGH SCHOOL ACADEMIC SCHEDULE POLICY AND ITS IMPACT ON ATTENDANCE, DISCIPLINE AND ACADEMIC ACHIEVEMENT

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by

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ABSTRACT

The purpose of this exploratory study was to analyze a Missouri school district's newly adopted academic schedule type policy. The school's new traditional academic schedule type replaced its previous block academic schedule type, effective for the 2005–2006 school year. This study reviewed the effectiveness of the policy change by analyzing the impact of each of the high school's academic schedule types, block and traditional, on the high school's targeted areas of student concern: attendance, academic achievement, and discipline incidents over a period of ten academic terms, 2000–2001, 2001–2002, 2002–2003, 2003–2004, 2004–2005, 2005–2006, 2006–2007, 2007–2008, 2008–2009, and 2009–2010.

Attendance data was defined as average daily attendance. Academic achievement was defined as tenth grade Missouri Assessment Program (MAP) mathematics subtest results, eleventh grade MAP communication arts subtest results, and the American College Test composite scores. Discipline was defined as the number of incidents per one hundred students enrolled during each academic year. Quantitative methods were utilized in this study. Descriptive statistics allowed for a review of each data set to calculate the means and variances requiring further analysis, and to determine whether the data met the assumptions of such analysis tools. One way Analysis of Variance was performed using each data set to determine if there were significant differences between and within each of the group/category means.

This study yielded mixed support of the school's new academic schedule policy. Therefore, as suggested in the literature review, a hybrid academic schedule policy may prove to ultimately provide for the best academic schedule type in meeting the needs of students, course content, and school goals. The hybrid allows a school freedom to utilize a combination of both the traditional and block academic schedule at its discretion.

DEDICATION

I dedicate my dissertation to the many family and friends who have supported me along this journey. I am grateful for your support. What began as a childhood dream—has finally come true! I truly appreciate each of you!

As a dear sorority sister of mine says, "To God Be The Glory"! I am very grateful to God for giving me the dream of obtaining a Doctorate Degree as a child! I am also grateful for his continuous guidance during this process. He has introduced me to various individuals who have encouraged me along the way. He has also made me a much stronger and wiser individual throughout this dissertation journey. Although this part of my life's journey is over, I know that there is more that God has in store for me.

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CHAPTER 1

INTRODUCTION

The policy implementation of block and/or traditional academic schedule type and manipulating instructional time for the purpose of improving student academic achievement have been topics of education reform for decades. Educational reports such as "A Nation at Risk" (National Commission on Excellence, 1983) and "Prisoners of Time" (National Education Commission on Time and Learning [NECTL], 1994), along with the policy revision of the 1965 Elementary and Secondary Education Act known as the No Child Left Behind Act of 2002 (NCLB; US. Dept. of Education, n.d.) have contributed to both education research and school level decision making regarding the manipulation of time for the improvement of student academic achievement within high schools across the United States.

The National Center for Education Evaluation (NCEE, 1983) addressed all stakeholders: parents, students, communities, and schools. Essentially, this report called for students to be more prepared to compete in a global market for the purpose of helping American society sustain itself. Time was one of the committee's five areas of study. The NCEE (1983) recommended that American schools restructure the use and extension of time in school hours, days, and year, in order to improve instruction, increase average yearly attendance, and decrease discipline incidents.

Similarly, NECTL, established under Public Law 102-62 of The Education Council Act of 1991, conducted a study of time, learning and the relationship between the two. Their 18-month study reiterated many of the findings and recommendations cited by the NCEE (1983). It, too, suggested that American schools needed to restructure their time so that American children would be better equipped to succeed in a globally competitive society. Unlike its predecessor,

NCEE (1983), this latter report focused solely on the matter of time and how teachers utilized it during their instruction; it delved deeper into the issues that schools faced when trying to meet the many needs of those they served. Five of NECTL's (1991) eight recommendations emphasized the need to improve how time was used in order to increase student achievement. The recommendations also addressed how schools adjusted their time to best meet the educational needs of their students, above average, average, below average, and special education learners.

At the time of this study, the most recent effort to improve education was NCLB (U.S. Dept. of Education, n.d.). One of its emphasis areas is accountability. Beginning in 2002, schools were required to show continuous improvement of student achievement so that by 2014, all students will be performing at grade level. To ensure consistent progress, schools were asked to utilize scientific research based methods, another emphasis area of NCLB. States were required to set annual benchmarks. Through these benchmarks, which are also known as annual proficiency targets, schools should be able to demonstrate gains in improvement, thus receiving percentage points toward their adequate yearly progress (AYP) goals. Any school and/or district not meeting AYP on a consistent basis could face restructuring to the extent of a state takeover or dissolution.

Like many schools throughout history, one of the three high schools within a Missouri school district found difficulty in demonstrating continual progress, and considered restructuring its allotted instructional time for the purpose of improving student attendance, decreasing the need to discipline students, and increasing academic achievement. According to the Missouri Department of Elementary and Secondary Education's (Missouri DESE, 2006) website, approximately 71.3% of the high school's population received free and/or reduced lunch prior to

the adoption of the new academic schedule policy; the percentage of at-risk students continued to remain above 70% for each academic term within this particular study. Toward the end of the 2004–2005 school year, this Missouri high school initiated a policy to change from an AB block schedule to a traditional six-period schedule effective for the 2005–2006 school year.

With Board approval, the school implemented a new academic schedule policy; this policy was counter to the prevailing trends, when most high schools were changing from traditional to block academic schedule policy. Instead of students attending six classes on an AB block schedule (three classes every other day), the new academic schedule required students to attend seven, 55-minute classes on a daily basis. The new policy was implemented during the 2005–2006 school year. Since the policy's adoption, a traditional schedule has remained in effect at the high school. This setting provided the opportunity to explore the impact of the two academic schedule policies on measurable student outcomes, with an emphasis on the following academic years: 2000–2001, 2001–2002, 2002–2003, 2003–2004, 2004–2005, 2005–2006, 2006–2007, 2007–2008, 2008–2009, and 2009–2010. It also allowed for an analysis of the impact of the new academic schedule policy over time as well as cohort data analysis.

The impact of the academic schedule policy on the high school's three areas of student concern: attendance, discipline incident rate, and academic achievement were the focal points of this research study. With regard to attendance, there was one question that this study attempted to answer. Although students must meet school registration requirements to be considered enrolled in school, they must also be accounted for through daily class attendance. The teachers were to provide individual student attendance data to designated office personnel each day on an hourly basis and maintain an accurate, updated-written record of each student's attendance within their courses throughout the quarter, semester, and academic year. Also, it is important to

note that the school moved to a new building in a different location within the district's attendance area; Board-approved redistricting efforts gradually increased the student enrollment over a 5- to 6-year period.

With regard to discipline incident rate, there was one question that this study attempted to answer. All schools are to provide a safe environment for both students and staff in an effort to maintain and promote continued student achievement. In addition, it is important for students to remain in their regular academic learning environment in order to maximize their learning. When students are suspended, their absence results in their missing valuable learning experiences. This often leads to increased discipline incidents due to the fact that some students misbehave in order to mask their learning deficiencies.

Regarding academic achievement, there were four questions that this study attempted to answer. Student achievement is the ultimate goal of academic institutions, and how it is measured is paramount in determining student success. Therefore, academic achievement was measured through data from two standardized state administered subtests and one nationally administered standardized test. The results of these tests were considered a standard measure of both instruction and student learning in that student learning was evaluated on grade level curriculum standards that were expected to have been taught over time, prior to test administration. In addition, Missouri considers these tests as commonly accepted standard measures of academic achievement. Furthermore, unlike course grades and grade point average (GPA), these standardized tests do not have the potential to be subjective or inflated by nature; they are based on standardized norms and/or criterion references and are administered under the same standard conditions for all schools. Therefore, the Missouri Assessment Program (MAP) mathematics and communications arts subtests and American College Test (ACT) composite

scores were selected for this study in an effort to provide solid, reliable results with regard to the research questions.

Fowler's (2000) modified policy model serves as the contextual framework for this study. Although there are six stages of the model: (a) issue definition, (b) agenda setting, (c) policy formulation, (d) policy adoption, (e) implementation, and (f) evaluation, the final stage was of most interest to this study because this area had potentially the greatest impact at the classroom level in terms of teacher instruction and student learning. Even though data influenced the faculty and staff in the processes of issue definition, agenda setting, policy formulation, and implementation, the evaluation process would need to be consistent and ongoing in order to determine the overall impact of the new academic schedule policy. This is supported in the review of research literature and is later discussed in detail within the final chapter of this research study.

Research Questions

What impact did implementing a new academic schedule policy have on (a) student attendance, (b) discipline incident rate, and (c) academic achievement over time? Specifically, the research questions are:

1. Did implementing a new high school academic schedule policy coincide with a change in the students' average daily attendance (ADA)?
2. Did implementing a new high school academic schedule policy coincide with a change in the students' rate of disciplinary incidents per 100 students enrolled?
3. Did implementing a new high school academic schedule policy coincide with a change in the students' state mathematics subtest scores?

4. Did implementing a new high school academic schedule policy coincide with a change in the students' state communication arts subtest scores?
5. Did implementing a new high school academic schedule policy coincide with a change in the students' performance on the ACT?
6. What impact did implementing a new high school academic schedule policy have on the students' cohort test results across all instruments and all years?

Delimitations of the Study

The data of only one high school is analyzed in this research study. Data regarding the student outcomes attendance and discipline could only be accessed as "whole school" data for each academic year. Also, cohort data for each graduation cohort was only available for the academic achievement student outcome when discussed as the percentage of students scoring as proficient and advanced on the MAP subtests and those taking the ACT and scoring above the national average. In addition, data for this study was retrieved from the Missouri DESE website archives, as the school reported it through its Missouri Core Data system.

In order to conduct a more manageable study, the following factors are not included: school climate issues including, but not limited to, parental involvement, student motivation, teacher-student relationship, teacher expectations, teacher experience and training in working on block and traditional schedules, after school jobs of students, change in administration, student and teacher socioeconomic status, teacher instructional style, and a change in discipline policy. These factors were assumed to be constant throughout the academic years of this study.

Limitations of the Study

The chief limitation in this study was that, even though there was a comparison of the same students under both types of academic schedules for some of the dependent variables, the

students are different ages ranging from thirteen to nineteen when they are all on one schedule in a given academic term. In addition, maturation of students may mask some of the impact of the academic schedule policies. Data relative to each individual student and/or individual graduation cohort by all student outcomes within each academic year for a more comprehensive school level policy study would have allowed for greater analysis of the impact of the new academic schedule policy that was implemented at the high school. There are also limitations with regard to causality, impact, assumptions, and power analysis that are discussed within the data analysis section of this research study.

Definition of Terms

When referring to block scheduling throughout this study, the term block scheduling was used loosely to include all forms of block scheduling (i.e., AB block, 4 x 4 semester block, trimester, quarter plan, hybrid). However, when referring specifically to the academic block schedule type policy and its impact on the data analyzed within this study, it should be noted that only the AB block schedule was implemented in the high school. Although students attending the high school were enrolled in six classes, they attended three classes on A Days and a different set of three classes on B Days, with an academic schedule following the A-B-A-B sequence. Most courses were year-long; a few were offered on a semester basis.

For the purpose of this study, a traditional academic schedule refers to the practice of students attending the same classes on a daily basis for equal, but shorter time periods for the duration of the course, whether for the entire academic year or semester. For the students within this study, their traditional academic schedule experience consisted of seven classes, each for 55 minutes, meeting on a daily basis. The students attended the same classes for an entire school year, except for a few classes that were offered on a semester basis (e.g., practical arts).

Attendance was discussed in this study as the ADA for each academic year from school data that Missouri DESE published on its website. The ADA was based on monthly enrollment figures and attendance calculations and averaged for the entire school year. This helped to determine the overall ADA for the school on an annual basis.

Discipline incident rate was discussed in this study as the rate of incidents per one hundred students as the school reported it to Missouri DESE through the Missouri Core Data system. The incident rate does not distinguish multiple and/or repeated incidents per student, but rather includes all incidents for all students within its data set. As a result, the rate of incidents per 100 students is based on each year's annual student enrollment.

Academic achievement in this study was discussed as the percentage of students who took the MAP mathematics and communication arts subtests and exceeded the minimum performance standards, scoring as proficient and advanced. The percentage of students who took the ACT and scored above the national average was also included within this study as an indicator of academic achievement. These academic outcome indicators were selected because these tests are approved standardized measures of academic achievement; the MAP is state administered and the ACT is a nationally administered test that is used in Missouri as its most commonly accepted standardized college entrance exam.

Significance of Study

The significance of this study is the contribution it aims to add to the current literature and body of knowledge concerning the impact of high school academic schedule policies, in particular the effects that such a change has on student attendance, discipline incident rate, and academic achievement. Much of the existing research literature concerning high school schedule type focuses on the block schedule and its practice of courses being taught for specific blocks of

time during the school year (i.e., quarter plan block, AB block, 4 x 4 semester block, trimester block, hybrid), and does not fully address the benefits and concerns of both block and traditional academic schedule types. Also, there are few longitudinal studies in the literature and little mention of school schedule environments such as those experienced by the students in the graduating classes of 2006, 2007, and 2008 at the high school in this study; the students within these graduation cohorts experienced a block academic schedule type in the early part of their high school career and a traditional academic schedule type during the latter part of their high school career. Such data can also be compared across academic school years for each graduation cohort to determine the impact of high school academic schedule type on student attendance, discipline incident rate, and academic achievement. It would allow us to further illustrate any advantages or disadvantages of the two academic schedule policies being examined, with regard to schools either maintaining their current academic schedule policy or exploring the possibility of adopting a new academic schedule policy.

In addition, this study may possibly affirm this Missouri high school's advocacy for a new academic scheduling policy, allowing a traditional academic schedule to replace the high school's previous AB block academic schedule. A review of the school's data results can serve to inform its decision makers about whether the newly implemented policy was an appropriate means for addressing its intended educational outcomes. Furthermore, this study can add to the current body of knowledge by helping to address concerns regarding long term and multiyear evaluation of academic schedule policies and their impact on measurable student outcomes.

CHAPTER 2

A REVIEW OF RELATED LITERATURE

In its earliest stages, block scheduling (i.e., quarter plan, AB block, 4 x 4 semester block, trimester, hybrid) was perceived as an *educational fad* (Bowman, 1998). This was due to the fact that there was very little quantifiable data, and the data that existed presented opposing views (Bowman, 1998; Veal, 1999). Within this review is a brief synopsis of the research literature on high school academic schedule policy from a variety of perspectives and research methodologies that have helped to establish block scheduling as a viable and often preferred academic schedule policy option. First, is a summation of stakeholder (i.e., administrators, teachers, students, parents) perceptions regarding academic schedule type policy (Evans, Tokarczyk, Rice, & McCray, 2002; Hamdy & Urich, 1998; Marchant & Paulson, 2001; Slate & Jones, 2000; Wilson & Stokes, 1999a, 1999b, 2000). The second section presents a contrast of beginning and veteran teachers' experiences regarding teaching within a given academic schedule policy (Benton-Kuppper, 1999; Howard, 1997; Zepeda & Mayers, 2001). The third section focuses on traditional and block academic schedule policy comparative analysis studies (Evans et al., 2002; Gruber & Onwuegbuzie, 2001; Jenkins, Queen, & Algozzine, 2002; Knight, De Leon, & Smith, 1999; Lawrence & McPherson, 2000; Nichols, 2005; Stoyko Deuel, 1999; Trenta & Newman, 2002; Veal, 1999; Veal & Flinders, 2001). This is followed with a review of literature that examines the impact of curricular and instructional adaptations pertaining to academic schedule policy (Kienholz, Segall, & Yellin, 2003; Kramer, 1996; Rikard & Banville, 2005). The final overview of the related literature discusses the impact of academic schedule policy on special needs students (Bottge, Gugerty, Serlin, & Moon, 2003).

The researchers behind these studies were male and female high school teachers, school administrators, school districts, and university professors in collaboration with schools and independent researchers. Their research on academic schedule policies was conducted throughout the United States (Alabama, California, Colorado, Florida, Georgia, Illinois, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, North Carolina, Ohio, Oregon, Pennsylvania, Texas, Virginia, Wisconsin) in small and large rural, urban, and suburban school districts. Student populations were comprised of mostly Caucasians and African Americans of socioeconomic status ranging from below poverty to upper income. These researchers and their studies have helped to provide an array of qualitative and quantitative studies to assist high schools in assessing academic schedule types, regardless of the school's location, student population, course offerings, and teacher experience. It is important to note that the literature for this study was intentionally selected from within the 10-year span of 1996 to 2005 because it would have been most relevant to the potential academic schedule policy research that the high school explored in making its decision to advocate for a new academic schedule policy.

Stakeholder Perceptions

Besides the lack of quantifiable data and consistency in favorable attitudes and results regarding block scheduling, another factor influencing whether or not block scheduling is viewed as a fad or a viable scheduling option is the perception of stakeholders—administrators, teachers, students, and parents—which is the largest contributing data source for the literature regarding academic schedule policy. Stakeholder perceptions not only tended to drive qualitative data, but also quantitative data. When trying to determine the appropriate school schedule, the input of all stakeholders is of utmost importance (Kienholz et al., 2003).

Administrators' Perceptions

Administrators are central figures in coordinating the academic schedule policy process from start to finish: issue definition, agenda setting, policy formulation, policy adoption, implementation, and evaluation (Fowler, 2000), which is why Hamdy and Urich (1998) conducted a nationwide study of administrators' perceptions toward various aspects of block scheduling. The participating administrators were employed at schools selected from ten state departments of education school lists, representing the following states: California, Colorado, Florida, Illinois, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, Oregon, Pennsylvania, Texas, Virginia, and Wisconsin. The schools sampled were from urban, suburban, and rural areas, representing 23%, 38%, and 39% of each respective location.

The survey instrument was a 26-item Likert-type questionnaire that was pretested for reliability based on initial responses from ten local principals to help determine potential design errors. Even though only 89 of the original 125 selected school principals responded, the list was narrowed even further because it was determined that only 69 of the administrator survey responses were useful for this study (60 were male and 9 were female). Based on the survey results, Hamdy and Urich (1998) concluded that administrators fully supported block scheduling because they perceived extended class time as an opportunity for teachers to increase individualized instruction to better accommodate individual student learning styles, ultimately yielding improved academics and better student–teacher relationships. In addition, administrators perceived block scheduling to be more costly than traditional scheduling. They noted more requests for additional materials and supplies, computers for class instruction, professional development, and a greater need for substitute teachers during block schedule in-service training for individual teachers.

Other important findings in Hamdy and Urich's study (1998) were that administrators perceived a lack of student maturity and problems with course sequence offerings concerning block scheduling. In order to improve student success, 71% of the principals suggested a student orientation program, consisting of basic study skills and classroom behaviors necessary for academic success under block scheduling. Also, 51% of them advocated a block schedule for 11th- and 12th-grade students and a modified or traditional schedule for their 9th- and 10th-grade students. Regarding course content, administrators perceived science teachers as being the most satisfied with block scheduling because they had extended time to complete labs. In contrast, foreign language teachers were perceived as being the least satisfied with block scheduling because of the time gap in foreign language course offerings on the 4 x 4 semester block, which did not allow for the next advanced course offering (e.g., Spanish II) until the following school year. As a result, students taking foreign language courses experienced a semester without reinforcement of previously learned skills.

Teacher, Student, Parents' Perceptions

Equally important are the perceptions of teachers, students, and parents. Evans et al. (2002) compiled data from an urban, suburban, and rural New Jersey school district. A 4 x 4 semester block schedule had been implemented at each of the New Jersey schools since the start of the 1997–1998 school year. Evans et at. (2002) partnered with the staff at Temple University to conduct interviews and focus groups with teachers, students, and parents during and after school hours. Their research yielded both positive and negative reactions to block academic schedule type in overall group responses.

The *teacher interviews and focus groups* revealed the following perceptions:

- Varying classroom activities allowed for more than just lecture;

- Decrease in behavior problems;
- Inclusion of more activities to expand the lessons (i.e., movie, review time);
- More individual student attention and better teacher–student relationships;
- More in-depth coverage of concepts to help make lessons more interesting and challenging;
- Decrease in grading due to fewer students being taught (Evans et al., 2002, pp. 320–321).

Additionally, the teachers perceived time for adequate preparation for substitute teachers during their absence and students making up missed assignments as the most challenging aspects of block scheduling.

The *student interviews and focus groups* were as positive as the teachers. Students enjoyed:

- Being able to take a variety of courses, electives, and advanced-placement (AP) classes;
- More time to work with peers in class, more independent projects, and high teacher expectations;
- Fewer classes and more concentrated assignments and homework;
- More time for comprehensive coverage of difficult topics/subject matter (Evans et al., 2002, p. 321).

Like their teachers, the student groups' perceived insufficient preparation during teacher absences as a challenge for block scheduling. The students also felt that some of their teachers were unable to effectively teach within a block schedule.

The *parent interviews and focus groups'* perception of block scheduling was mixed.

- Parents tended to agree with teachers that students were learning more, more engaged in class activities and had a positive relationship with their teachers.
- Parents also tended to agree with their children that they were more productive and being held to a higher standard of learning (Evans et al., 2002, p. 321).

However, the perceived challenges of block scheduling according to parents included:

- Frustration for struggling students due to extended class time,
- Decreased opportunities for students to interact with one another throughout the school day; and
- Students not being challenged enough in their classes due to the fact that their children reported receiving more help with homework during class.

Year 1 and Year 2 Block Teachers' Perceptions

Wilson and Stokes conducted a two-phase study (1999a, 1999b) of first-year and second-year block experienced teachers and their perceptions toward the schedule and student outcomes. The questions for Phase 1 were:

1. What are teachers' perceptions of the overall effectiveness of block scheduling?
2. Do teachers experiencing the first year of block scheduling and teachers experiencing the second year of block scheduling differ in their opinions of the effectiveness of block scheduling?
3. Is there a relationship between teachers' opinions of the effectiveness of block scheduling and their subject areas?
4. Is there a relationship between teachers' opinions of the effectiveness of block scheduling and their years of teaching experience?

5. What are the most important factors to consider when implementing block scheduling?
6. What are the most critical elements in maintaining block scheduling as an effective curriculum alternative? (Wilson & Stokes, 1999a, pp. 37–38).

Wilson and Stokes (1999a, 1999b) sampled 137 participants, primarily middle class Caucasian teachers and administrators. Sixty-seven of the participants were from a city and a county high school from two different districts in their first year on a block academic schedule. Seventy of the participants were from two city high schools from two different districts in their second year on a block academic schedule. The deciding factor for these four schools to qualify for this study was the fact that the schools had neither participated in any previous studies, nor had they been affected by previous data collection efforts. Although minorities were represented within the schools studied, Wilson and Stokes (1999a, 1999b) did not consider race, ethnic background, or gender as relevant to the intent of their study.

After reviewing literature and examining local school district block schedule implementation evaluation instruments, Wilson and Stokes (1999a, 199b) developed a 30-question Likert scale, consisting of the following sections: (a) descriptive data relevant to the research questions, (b) the effectiveness of block scheduling as compared to traditional scheduling, (c) the most important factors to be considered prior to initiating block scheduling, and (d) critical factors in maintaining block scheduling as an effective curriculum tool. The final evaluation tool was a 25-question Likert Scale that had undergone three field tests and revisions.

The procedure for data collection included a “multiple group comparative design” (Wilson & Stokes, 1999a, 1999b, p. 39). The evaluation tool was administered in January 1997, after one semester of block scheduling for the year-one schools and 1½ years of block for the

year-two schools. The return rate for the first-year block schedule schools was 65% and 89% for the year-two block schedule schools. Means on the data from the four schools were calculated. With a significance level set at .01, an ANOVA was run to determine differences between the year-one and year-two groups.

There was no statistical significance among the two groups found in terms of teachers' perceptions of block scheduling compared to traditional scheduling, subject areas taught and teachers' opinions of block scheduling and critical factors for sustaining block scheduling. However, between the two groups, there was a statistical significance regarding professional development and perceived needs pertaining to block scheduling. Although both groups agreed that more professional development regarding hands-on activities and authentic assessment techniques was needed, first-year block schedule teachers expressed a greater need for training than did their year-two block schedule counterparts.

Wilson and Stokes (1999a) were able to draw the following conclusions based on their research findings:

- Teachers favor block scheduling, regardless of their years of involvement.
- Regardless of years of experience, teachers tend to feel block scheduling is effective.
- Favorable teacher opinion of block scheduling "does not decrease significantly after the initial favorable impact of a change in curricular structure" (Wilson & Stokes, 1999a, p. 42).
- Differences in first-year and second-year block schedule teachers could be attributed to variance in their self reflection.
- Years of experience and subjects taught appear unrelated to teachers' opinions of block scheduling.

- Organizing a block class and training on the overall concept are the most important areas for teacher development and as critical factors for "maintaining block scheduling as an effective curricular structure" (Wilson & Stokes, 1999a, p. 43).

The research questions for Phase 2 of their study (Wilson & Stokes, 1999b) were:

1. What do teachers perceive to be the major advantages of block scheduling?
2. What do teachers perceive to be the greatest measureable outcomes of block scheduling? (Wilson & Stokes, 1999b, p. 48)

Wilson and Stokes (1999b) found no statistical difference between the year-one block and year-two block teachers. Although first-year block teachers ranked a great decrease in discipline problems as number one and increases in daily attendance as second, their second-year block schedule counterparts rated these items in reverse order. However, both groups were consistent in ranking the last three items. Another key finding in this study is that the teachers' rankings revealed that they did not perceive any measureable outcomes resulting from block scheduling; this was the only section that received a rating of less than 4.0.

Wilson and Stokes (1999b) were able to draw the following conclusions as a result of Phase 2 of their study:

- Based on the two groups of teachers, it can be concluded that favorable attitudes towards block scheduling among teachers does persist from year-to-year.
- The highest advantages of block scheduling were those for teachers, not instruction, which included increased planning time.
- The greatest advantage of block scheduling for students was increased opportunities for gaining graduation credits.

- Teachers in this study did not report a significant increase in measurable learning outcomes resulting from block scheduling; however, decreased discipline and increased daily attendance were perceived as measurable outcomes most positively influenced by block scheduling (Wilson & Stokes, 1999b, p. 53).

With regard to future research, Wilson and Stokes (1999b) recommended that researchers continue to: (a) follow teacher attitudes towards block scheduling over a five or ten year period, (b) study a variety of teachers involved with block scheduling for an extended period to more fully confirm and identify the major advantages of block scheduling, and (c) conduct additional research to "more clearly determine whether or not there are significant increases in measurable outcomes of block scheduling" (Wilson & Stokes, 1999b, p. 53).

Students' Perceptions

Student perceptions are also important to academic schedule policy decisions because they are on the receiving end of the policy implementation and its implications for their educational future. Another Wilson and Stokes' study (2000) examined students' perceptions regarding block and traditional scheduling with regard to effectiveness, advantages, and disadvantages. The population sample consisted of a random selection of students from two rural and two city Northwest Alabama high schools; two of the schools with four years of 4 x 4 semester block schedule implementation, one school with two years, and the other with only one year of block implementation. The sample student population was comprised of mostly middle class Caucasian students, with some Mexican American and African American students enrolled in all of the schools. However, as in their previous block schedule studies (1999a and 1999b), Wilson and Stokes (2000) did not consider ethnic background and gender to be relevant variables for their study.

Wilson and Stokes (2000) developed a 30 item instrument consisting of four sections: Section I focused on descriptive data pertaining to the variables such as the number of block schedule policy exposure and Sections II through IV focused on the results from a Likert Scale evaluating the students' perception of block versus traditional schedule effectiveness, advantages, and disadvantages. The survey instrument was standardized in that it was given to the students by the same researcher, under the same conditions in late March and early April 1999. A *t*-test, Chi Square, and ANOVA were used to analyze the data.

Although students' perceptions regarding the advantages of block academic scheduling were favorable, Wilson and Stokes' (2000) most significant findings in this particular study were: (a) students' perceptions of block academic scheduling remained consistent over time, (b) years of exposure to block academic schedule policy had no bearing on students' perceptions, and (c) "students seeking a general diploma perceived the block to be more effective than students seeking the advanced or honors diploma" (p. 4).

The students' perceived disadvantages of block scheduling included:

- Completing missed assignments
- Longer classes, and
- "Too much busy work" (Wilson & Stokes, 2000, p. 4).

Wilson and Stokes (2000) recommended that future research of their results and in the area of determining the disadvantages of block scheduling. Additional research would allow for continuous improvement of the school restructuring process.

Slate and Jones (2000) also studied student attitudes towards block scheduling. Unlike Wilson and Stokes' studies (1999a, 1999b, 2000), Slate and Jones' study (2000) isolated factors such as grade level, gender and ethnicity. In Slate and Jones' study (2000), the administrators

implemented a 4 x 4 block schedule on a 1-week trial basis to determine whether or not the faculty and students were ready to change from a traditional schedule to a block schedule. Slate and Jones (2000) felt this trial would lend itself to an assessment of social validity due to the fact that the students' perceptions were based on their own personal experiences and their perceptions were solicited in an effort to determine the most appropriate academic schedule policy prior to any permanent schedule change.

Slate and Jones (2000) developed the following research questions with the students' attitudes in mind:

1. What difficulties and advantages do students believe are associated with block scheduling?
2. What instructional behaviors do students perceive in teachers during block scheduling?
3. To what extent do students believe block scheduling is an acceptable alternative to traditional scheduling, and to what extent do they prefer block scheduling to traditional scheduling?
4. To what extent do the findings vary as a function of students' grade level, gender, and ethnic background? (Slate & Jones, 2000, p. 56)

The students within this study were from a southern Georgia high school. Only 33% of the students received free or reduced lunch and the student performance on the Georgia High School Graduation Test (GHSGT) for the 1998–1999 school year was 84% to 94%. Although the entire school participated in the academic schedule policy trial period, the students completed the research questionnaires on a voluntary and anonymous basis during regular class sessions.

As a result, only 57% of the entire student body responded (586 boys and 609 girls). Following is a synopsis of the students' responses.

Overall results. A majority of the students favored block scheduling. They believed that it allowed more time for them to study, which they felt would improve their academic performance. Slightly more than half of the students noticed changes in instruction to include cooperative learning and additional labs. However, an analysis of the students' overall perceptions indicated a slight preference for traditional scheduling over block scheduling.

Differences by grade level. Ninth and 10th-grade students favored block scheduling more than their upper level counterparts, and perceived greater academic benefit to this schedule type with regard to higher achievement on assignments and standardized tests. Seniors were the only subgroup to view block scheduling as an unacceptable schedule alternative. Slate and Jones (2000) asserted that this may be due to the fact that seniors are least likely to view education reforms as having a major influence on their education. In addition, because seniors are so close to graduating, they have the least amount of time to experience any significant impact of the implemented change. Furthermore, by the time students become seniors in high school, they have developed coping mechanisms for dealing with potential changes that do not require them to make any significant changes to their overall high school experience.

Differences by gender. Boys demonstrated a greater preference for block scheduling than their female counterparts. However, there was no difference between attitudes towards block scheduling with regard to gender. Although the increased instructional time of a block academic schedule can be a problem for both males and females, Slate and Jones (2000) found block scheduling to be more of a challenge for girls. Girls, who had less difficulty than their male counterparts maintaining their attention span, had the potential to experience more trouble

adapting to the extended time of the block schedule. Slate and Jones also found that preference for block scheduling differed for boys and girls; boys preferred block scheduling because of their ability to select the courses and electives of their choice, whereas girls preferred block scheduling due to a potential increase in the opportunity to form meaningful relationships.

Differences by ethnic background. Even though ethnic background was a variable for this particular study, the results of those who indicated "other" on their surveys were excluded from the data analysis. As a result, Slate and Jones (2000) found that African American students were more likely than their Caucasian counterparts to associate block scheduling with few discipline incidents during passing time and an increased potential for academic success in class as well as on standardized tests. In contrast, although there was no significant difference in either group's perception of the extent to which its members perceived block scheduling as an acceptable alternative to traditional academic scheduling, African American students tended to favor traditional academic scheduling. Yet, despite varying results amongst African American students, Slate and Jones found that the results of this particular ethnic group were, in fact, very much aligned to that of their Caucasian counterparts. However, Slate and Jones cautioned that individual students may need behavior and/or academic support, even though a reform may appear to have an overall positive effect on an educational program.

Slate and Jones (2000) made note of the limitations of their study. First, data was from one school and based on voluntary participation. Limiting the study to one school did not account for the experiences of students at other schools. Also, because the survey completion was voluntary, data from all of the students was not able to be included in their study. Second, student reactions were in direct response to the 1-week trial implementation of a block schedule at their high school. Data pertaining to procedures for the schedule implementation, professional

development, and availability of instructional materials were beyond their control. Finally, student responses were subjective, which meant that the results were not necessarily realistic in that the students' perceptions were not quantified. All of the aforementioned limitations could have adversely affected the outcome of their study's results. Slate and Jones (2000) concluded by stating:

- "Educational reforms designed to increase academic achievement are unlikely to have social validity with high school students because . . . increasing academic achievement may not be a highly valued goal for high school students" (Slate & Jones, 2000, p. 64).
- "Administrators may need to make special efforts to obtain the support of seniors or implement programs in a way that will have minimal impact on the current senior class" (Slate & Jones, 2000, p. 64).
- "Educators need to look beyond group trends that show overall positive change and provide necessary support to students who are experiencing difficulty adjusting to the changes that have been implemented" (Slate & Jones, 2000, p. 64).

Marchant and Paulson (2001) examined how student academic profiles influenced their perceptions of school within a modified block-8 schedule (seven classes and one extended study hall period over 2 days; class meetings every other day). The Midwestern high school in their study was in its third year of block scheduling. It had conducted its own longitudinal study based on the previous two years, and was now wanting to engage in a more comprehensive evaluation. The additional evaluation was to serve as a catalyst for the school's recommendation of teacher professional development and student support. There were 2,191 high school student participants in Marchant and Paulson's study (2001).

Marchant and Paulson's (2001) primary data source was a modification of the school's previous teacher survey instrument, consisting of a 27-statement questionnaire with a 5-point Likert-type scale. "A factor analysis with varimax rotation revealed five more, stable, interpretable constructs from the 27 items. Four of the factors involved students' perceptions regarding their functioning in school: (a) support for block schedule, (b) difficulty managing school, (c) positive teacher relations, and (d) good student behavior. The fifth factor contained five items more specific to students' perceptions of their achievement. These five items were used to identify the academic profiles of the students" (Marchant & Paulson, 2001, p. 14); the academic profiles by which Marchant and Paulson later clustered the students were: (a) schedule-dependent/ability-oriented achievers, (b) schedule-independent/effort-oriented achievers, (c) displeased, lower achievers, (d) schedule-dependent/effort-oriented students, and (e) apathetic, lower achievers. The questionnaire was distributed and collected during study hall. A few weeks later, approximately 40 students were divided into student focus groups based on their grade level and survey responses to their support for block scheduling.

In general, the results of Marchant and Paulson' study (2001) reported that most students perceived a benefit to block scheduling and were in support of it. The student focus group interviews provided additional insight in that the students felt as if the days were shorter, material was covered in greater breadth and depth and there was extra time for discussion, labs, and homework. In addition, Marchant and Paulson found that the low-achieving students who were dissatisfied with block scheduling were least likely to be in favor of block scheduling due to a lack of organization and an inability to maintain their attention span. Thus, Marchant and Paulson concluded that based on their findings, it is important for schools to analyze the academic profiles of students in order to increase academic success within a block academic

policy. In fact, the group of most interest was the low-achieving students who were concerned about education and their academic achievement. In addition, Marchant and Paulson's study cautioned that block scheduling may be causing problems for students due to various aspects of this particular schedule type.

Beginning and Veteran Teachers Contentions with Academic Scheduling

One characteristic of the literature was the overall revelation that the stakeholder comfort level and success with a particular schedule determined his/her level of support and the degree of impact that the schedule had on the overall school. Included in this section is literature pertaining to the study of new teachers struggling to transition into both a new job and a new academic schedule type, block academic scheduling, at their new place of employment. Also included, are two studies of veteran teachers who had prior experience with a traditional academic schedule policy, and were required to transition to a new academic schedule policy, block scheduling. One veteran teacher struggled over a 3-year period to help students regain success on the AP mathematics exam, due to the teacher's own initial resistance. Fortunately for a group of veteran English teachers, they quickly discovered success in their transition due to their immediate determination to improve their students' success during the implementation of the block academic schedule policy.

Beginning Teachers

Zepeda and Mayers (2001), found no research literature regarding the experiences of new teachers who had graduated 3 months prior to accepting their first job. This population of teachers was of interest because their level of success was impacted by them being new to the profession and being required to work within an academic schedule policy of which they had no prior experience. These researchers conducted their year-long study of 31 first-year teachers

from seven different high schools in three Midwestern urban school districts. The teachers taught on a 4 x 4 semester block, in a school with a racially mixed student enrollment between 1,200 and 2,000. In order to ensure an adequate number of participants, each school had a large number of first-year teachers who only held a Bachelor's degree.

Qualitative methods were utilized to help determine the teachers' shared experiences. Four open-ended interviews were conducted at the beginning of the school year and later repeated at the middle and end of the school year in order to continually document the issues of these teachers with regard to block scheduling. In addition to coding the information, member checking, and a random sampling of participants across the three districts to read the analysis helped to ensure validity of Zepeda and Mayers' (2001) findings and data analysis.

Three problematic areas for first-year teachers resulting from this study included: (a) adjusting instruction to extended class period formats, (b) transitioning learning activities, and (c) assessing student progress. Other issues within these areas emerged: classroom discipline, planning time, and not enough materials for the duration of class. The results of this study offered insight for K–12 school systems and higher education institutions as to how they can work together to assist teachers with student learning. Results also demonstrated the need for building level support from administrators, department chairs, and mentors; staff development as a long term transition plan for properly implementing block scheduling; and focus on varying instructional activities to supplement classroom lectures with regard to subject specialization.

Zepeda and Mayers (2001) emphasized the need for planned, purposeful, ongoing peer coaching as a means of supporting new teachers on the block academic schedule. They also discussed the importance of frequently utilizing data to determine the professional needs of staff. Zepeda and Mayers questioned whether teachers new to the profession experienced the same

problems and types of support, regardless of their school's academic schedule policy. They concluded that pursuing this area of research would be worthwhile for future research because the results could help to resolve teacher shortages and the number of teachers who exit the field within their first 3 years of service.

Veteran Teachers

The 30-year veteran teacher in Howard's study (1997) had previously taught AP mathematics courses (e.g., AP BC Calculus, AP Physics II, AP Precalculus, AP Differential Equations) on a traditional academic schedule until the start of the 1994–1995 school year at a central Texas magnet high school for mathematics, science, and technology. Prior to the implementation of the new academic schedule policy, the teacher had been known for having a large number of students perform well on the AP exam. One technique for motivating the students to do well each year was posting a list of the students who demonstrated successful performance on the AP exam from previous school years, dating back to the 1988–1989 school year.

Difficulty for this particular veteran teacher was mostly due to a top down approach to the implementation of the school's block academic schedule policy and several modifications to the policy during the first 3 years of implementation. The teachers at this central Texas magnet high school didn't learn of the new academic policy until they returned from summer break for the 1994–1995 school year. During Year 2, the newly implemented academic schedule policy underwent changes at the beginning and middle of the school year. By Year 3, the final version of the block schedule was implemented; it was more consistent with a different set of four 90-minute class meetings on alternating days. All of these changes caused a negative perception of

block scheduling amongst the school's faculty, especially the veteran teacher who had experienced a great deal of success under the previous academic schedule policy.

Based on the results of Howard's study (1997), teacher attitude and appropriate teacher training played a major role in the degree of success attached to the new block academic schedule policy. Neither the veteran teacher's negative attitude, nor the school's lack of professional development provided for continuous student learning during the transition of the new academic policy. Howard's study also revealed that a change in academic schedule policy could lead to decreased achievement until curricular and instructional adaptations are implemented. For instance, it took some time for the veteran teacher to realize the need to adapt the curriculum and instruction to the new academic schedule by reviewing more before the AP exam, administering more quizzes, and teaching on Saturdays and early mornings in order to increase students' success on the AP examinations. Howard's study also suggests further research in determining the benefit of block scheduling across all content areas.

Benton-Kupper's study (1999) is a "collective case study" (p. 2) that examined three high school English teachers' experiences in their second year of teaching under their school's new block academic schedule policy. Each of the three teachers worked within traditional and block schedule policies. They had different professional backgrounds and taught a different type of English course: composition, literature, and grammar. This study is unique because the teachers were aware of the school's plan to implement block scheduling at the time they sought employment at the newly built high school in 1994.

Data were collected from audio tapes of an open-ended interview with each of the participants focusing on questions pertaining to instructional strategies, process/ approaches for planning and preparation, and scope and depth of curriculum, and content taught. Data were also

collected from two observations of each teacher. Additional data were collected from the following participant documents: "syllabi, lesson plans, assignment handouts, and informational handouts, which were used to validate interview data" (Benton-Kupper, 1999, p. 2). Individual and cohort data were grouped according to emerging themes.

The participants in Benton-Kupper's study (1999) preferred block scheduling over traditional scheduling due to its freedom and flexibility. The additional class time allowed for a variety of activities and assessments, resulting in increased depth of material. The teachers also reported greater academic benefit for their students in that more students passed their courses than in previous years and students were doing rather well on the AP examinations. One of the participants in Benton-Kupper's study expressed enthusiasm for having the opportunity to get to know students and how they learn. Increased instruction and learning were very important findings in Benton-Kupper's study.

Academic Schedule Policy Comparative Analysis

Studies revealed that school and district efforts to select the appropriate academic schedule policy have ranged from the very simple to the very complex. The following studies: Stoyko Deuel (1999) and Jenkins et al. (2002) concentrated their efforts on comparing several schools that were on a block academic schedule to several schools that were on a traditional academic schedule. Gruber and Onwuegbuzie (2001), Trenta and Newman (2002), Evans et. al (2002), and Nichols (2005) conducted a comparative analysis of pre- and post-block schedules within individual schools. Knight et al. (1999), Lawrence and McPherson (2000), and Veal and Flinders (2001) studied schools that took a more complex approach to academic scheduling; each school setting within their studies simultaneously implemented three different schedules for the purpose of determining the best academic schedule policy for their students. These trischedule

plans consisted of a traditional schedule, a 4 x 4 semester block and a hybrid block (a combination of block and traditional schedules).

Single Academic Schedule Policy per School, Block vs. Traditional Schools

Stoyko Deuel's study (1999) compared data from 22 of Broward County Public Schools' (BCPS) 23 high schools. Ten of the schools operated under a block academic schedule policy and the rest were under a traditional academic schedule policy. Located in an urban section of Southeast Florida, BCPS's population consisted of an ethnically diverse group of at-risk students (48.8% Caucasians, 32.0% African Americans, 15.4% Hispanics, and 3.8% Asian/Indian/Multiracial). Under the direction of the School Board's priorities and Superintendent's charge, the district explored block academic schedule policy as a viable scheduling option for increasing student achievement.

The BCPS introduced its new traditional seven-period rotating academic schedule policy to its high schools in the early 1990s. At the start of the 1994–1995 school year, one of its high schools became the first to pilot a block schedule; its schedule choice was the trimester. The following year, nine additional BCPS high schools followed in adopting a block academic schedule policy, with the 4 x 4 semester block as their schedule preference.

The BCPS evaluated their academic schedule policies during the 1996–1997 school year. Despite limited statistically significant gains and/or losses, there was some evidence that the block academic schedule policy positively impacted students' grades and behavior as well as teaching methodologies. However, the schools were unable to show any evidence of the traditional schedule schools outperforming their block schedule counterparts.

Stoyko Deuel's study (1999) served as a follow-up to one of the BCPS high school's initial study and efforts to continue to evaluate the newly implemented academic schedule policy

after its second year of implementation. The questions for Stoyko Deuel's study (1999) included:

1. Would the initial benefits associated with the switch to block scheduling remain stable?
2. Would new benefits or detriments associated with the scheduling change emerge after 2 years on the new schedule?
3. Finally, what are staff perceptions regarding the block schedule as it becomes more institutionalized at each school? (Stoyko Deuel, 1999, p. 3).

Data were collected from 30 counselor and 100 teacher surveys and administrator phone interviews; the surveys and interviews focused on block scheduling. Data were also retrieved from the district's student information system. A nonequivalent pre- and posttest design was used to measure relative impact of the implementation of block scheduling. Regarding the analysis of the data, the data were categorized and analyzed by group, with ten schools in the block group and 12 schools in the nonblock group. In addition, a one-shot case study approach helped to determine the faculty and staff's perceptions of the impact of the newly implemented block academic schedule policy.

In the final analysis, there was no evidence of the schools with the traditional academic schedule policy outperforming their block academic schedule policy counterparts. However, there was evidence that showed a significant increase in A's and significant decrease in C's, D's and F's at the schools that operated under the block academic schedule policy. Students under this same schedule also earned higher advanced mathematics grades than did their nonblock counterparts. As a result, 80% of the teachers preferred to remain on block scheduling if given the option, and 75% of the counselors felt block scheduling had the potential to positively

influence the entire school. Administrators believed that the success of the block academic schedule policy was dependent on adaptations that the teachers made to the curriculum and their instructional methodology. However, the most frequently reported challenges to block scheduling were related to leadership, staff development, AP exam preparation and course scheduling.

Perhaps, one of the most rewarding aspects of Stoyko Deuel's study (1999) is that BCPS demonstrated serious, meaningful, and continuous evaluation and support with regard to block academic scheduling. Because of these efforts, the school community anticipated a "long-term impact on student achievement and discipline" (p. 8). Their commitment can serve as a model to other districts that contemplate and/or implement a change in academic schedule policy.

Jenkins et al. (2002) studied over 2,000 teachers from North Carolina high schools: 1,036 taught in a traditional academic setting and 1,131 taught in a block academic setting. Their study was conducted with assistance from the North Carolina Department of Public Instruction. This study focused on high schools that had implemented a 4 x 4 semester block schedule for at least 3 full years. In their comparison of traditional and block schools, Jenkins et al. made sure both types of schools were similar in size, ethnicity, community characteristics, and socioeconomic status according to the students' free and reduced lunch status. Data were collected from certified teachers who responded to survey questions that were recorded on a Likert-type scale.

Although the teachers in Jenkins et al.'s study (2002) had not received extensive training in the area of cooperative learning, the teachers on the block and traditional schedules felt that there was some merit for the use and relevancy of this particular instructional strategy. However, the results of Jenkins et al.'s study illustrated conflicting opinions regarding the benefits of block scheduling relative to the reduction of lecture. In fact, the degree to which the

two groups of teachers welcomed the promise of an increased opportunity to learn how to use instructional methods beyond lecture was minimal.

Pre- and Postblock Academic Schedule Policy within One School

Gruber and Onwuegbuzie (2001) examined the 4 x 4 semester block model at one of Georgia's high schools. Two of its graduating classes were participants in this study: the class of 1997 consisting of 115 students who had experienced a traditional six-period day schedule and the class of 2000 consisting of 146 students who had experienced a 4 x 4 semester block schedule for 3 consecutive years after its implementation at the start of the 1997–1998 school year. The following variables remained constant and were very similar for both groups during this study: curriculum, student retention, teacher turnover, race, and gender. For data analysis, Gruber and Onwuegbuzie used an independent sample *t*-test for comparison of the students' GPA; a nonparametric I-test (i.e., Mann-Whitney) to compare the GHSGT standardized scores due to kurtosis coefficients relative to the scores on each portion of the test; and Benferroni's adjustment in order to maintain an overall error rate of 5%. As a result of their study, Gruber and Onwuegbuzie found no statistical significance in the difference for the two graduating classes regarding GPA and the written portion of the GHSGT. However, they did find that students who had experienced the traditional schedule had higher GHSGT scores on the language arts, mathematics, social studies, and science subtests.

Although Gruber and Onwuegbuzie (2001) concluded that block scheduling may not be the best scheduling option for meeting the needs of individual learners, they interjected that potential threats to internal and external validity made it difficult to generalize their study's results. For instance, the school's attendance policy changed after the implementation of the block academic schedule policy in order to allow students to receive course credit despite their

number of absences, which was reported to have influenced a decline in the school's ADA rate. Ultimately, students were not as academically successful. In addition to the change in attendance policy, Gruber and Onwuegbuzie noted other potential threats that lend themselves to expanded research in the future. These areas included professional development on proper block schedule implementation, extensive longitudinal data (more than 3 years) for determining the accuracy and consistency of results over time, multiple school settings and geographic locations, inclusion of educational outcomes beyond academic achievement (e.g., attitudes, motivation) and sharing and comparing the findings among educators and stakeholders.

The pre- and postblock study that Trenta and Newman (2002) conducted was a longitudinal quantitative study based on the grades, Ohio Proficiency Test scores (OPT), ACT scores, and attendance of 500 students randomly selected from a small Ohio high school. These participants were 9th-, 10th-, 11th- and 12th-grade students (125 students from each grade level) from the graduating classes of 1997, 2000, 2001, and 2002; those who had not been enrolled at the high school since their freshman year were not included in the sample. Trenta and Newman's analysis of the data was critical in helping to determine the future of a new block academic schedule policy at the high school. The high school implemented a 4 x 4 semester block schedule in the 1997–1998 school year; however, criticism of the new schedule policy arose with the intent to persuade the School Board to reinstate the previous traditional academic schedule policy. In response to the request of the critics, the School Board requested quantifiable data regarding achievement, during the 2000–2001 school year.

Regarding the relationship between block academic schedule policy and student grades, Trenta and Newman (2002) found a significant positive relationship and a positive trend in mathematics, English, science, and social studies grades. However, they could not conclude that

the block academic schedule policy was the cause of the relationship because correlations show relationship, not cause. An additional finding was that no significant relationship existed between block academic schedule policy and cumulative GPA. Therefore, Trenta and Newman decided to investigate for differences through comparison of student data prior to and after the implementation of block scheduling.

With regard to standardized testing, the timing of the OPT and student exposure to block scheduling left the results up to "chance" (Trenta & Newman, 2002, p. 60). However, Trenta and Newman (2002) were confident that GPA supported the implication of the role that block scheduling might have in impacting a student's ability to pass the OPT, especially for those who did not pass the test prior to starting high school. In contrast, there was no significant relationship between the block academic schedule policy and ACT scores. So, they examined this relationship in terms of whether or not block academic schedule policy influenced the decline in ACT scores. Holding IQ constant in order to covary for ability, they found no significant relationship in this relationship as well.

The final analysis pertained to attendance. Regarding the relationship between block academic schedule policy and attendance, Trenta and Newman (2002) did not notice any significance. In addition, the variation in attendance patterns for each grade level made the determination of any relationship unclear.

The limitations of Trenta and Newman's study (2002) included the following: (a) an inability to establish a direct cause and effect relationship between the block schedule and the four outcome indicators due to a lack of evaluation protocol prior to the implementation of the new schedule, (b) only 3 years of longitudinal data available, and (c) extremely small sample size of only 12 students for the ACT scores due to the test date and number of block schedule

experience for each group of students. In spite of these challenges, Trenta and Newman were able to present their findings and answer questions at the School Board meeting. As a result of the block academic schedule policy evaluation, the "Board voted to continue the block scheduling program for at least one more year" (2002, p. 65).

Evans et al. (2002) gave particular attention to academic achievement in the areas of grades, honor roll, failure rates, the number of students successfully completing AP courses and student performance on standardized tests in their pre- and postblock study. In addition, they focused their study on student discipline and attendance. The data for their study came from three schools that used slightly modified versions of the 4 x 4 block schedule. The schools were from an urban, suburban, and rural school district within New Jersey.

Grades, honor roll and failure rates. There was a 9% increase in the number of students on honor roll at the three sites. There was a 7% decrease in the percentage of students receiving a *D* or an *F,* as a final grade. In addition, the number of students experiencing multiple failures decreased from 8% to 5%, even though students under the block academic schedule policy completed eight classes, instead of seven as they had in previous years under a traditional academic schedule policy.

Number of students successfully completing AP courses. AP course offerings increased at the three schools. There was an increase of 25% in the number of students completing AP courses and successfully passing the tests. In addition, no students received a score of one and the number of students obtaining a score of three, four, or five on the placement examinations increasing to 30% from the baseline measures.

Achievement test scores from 1996–97 school year and 1998–99 school year. Additional achievement measures for students at these schools included the Scholastic Aptitude

Test (SAT) and High School Proficiency Test (HSPT). The average combined SAT score increased 14 points and the percentage of juniors passing all three sections of the HSPT increased from 67% to 73%.

Student decorum and attendance. Although the number of suspensions remained virtually unchanged, the number of detentions decreased 50%. Also, student attendance increased from 92.4% to 94.1%. Opinion surveys at each of the three schools resulted in 80% of the teachers, 70% of the students, and 62% of the parents favoring block academic schedule policy.

With regard to future studies, Evans et al. (2002) recommend that schools collect preblock baseline data, collect for all possible variables, collect comparable postblock data, and attempt to control all possible variables for their study. Due to the fact that there was no baseline data on the amount of time students spent completing homework, the degree of relationship between homework and the block academic schedule policy could not be determined. Also, one of the three schools changed its discipline policy, which did not provide for consistent discipline-related data during preblock and block implementation years. Although the population sample consisted of only three schools, the researchers concluded that the many similarities consistently found across the three schools were nonspecific in nature and, therefore, were able to be applied to other schools.

Nichols (2005) conducted a pre- and postblock study that was designed to examine the long-term effect that block-scheduling might potentially have on students' academic achievement. The researcher collected data before and after block schedule implementation at five high schools from a large urban area. Each of the district's high schools chose their own form of block scheduling. In the fall of 1994, the Block 8 schedule was implemented at Elm

High School, a small inner-city school serving a culturally diverse population that was below the poverty line and North High School, a large school in the suburbs that served a culturally diverse population in the middle to upper income status. South High School, a large school in the suburbs of the inner city with a 50% minority population of blue collar economic status, implemented the Block 8 schedule in the fall of 1995. The 4 x 4 semester block schedule was implemented in the fall of 1996, at River High School, an inner-city school that served students in the lower income bracket from diverse backgrounds and Oak High School, a large suburban high school with a diverse population in the middle to upper income bracket.

Nichols (2005) developed a formula for calculating the GPAs for English and language arts courses. In addition, "the number of English and language arts grades given for each year at each school [helped] to explore fluctuations in student enrollment in these required courses when block scheduling was implemented" (p. 301). Nichols' study (2005) posed the following questions:

1. Did student GPAs in English and language arts courses increase significantly when schools adopted block format scheduling?
2. Were GPAs for high- and low-income students affected differently after block-scheduling structures were implemented?
3. Were GPAs of minority and majority students affected differently after block-scheduling structures were implemented? (Nichols, 2005, p. 301)

An ANOVA was used to: (a) explore initial differences among GPAs from the 1992–1993 and 1993–1994 school years (the last year of the traditional academic schedule policy for the high schools) prior to each school's block implementations, (b) calculate GPA mean differences among the five high schools for the 1998–1999 school year (several years after all

schools converted to block formats), and (c) calculate the mean differences regarding GPA and socioeconomic status as defined by free and reduced lunch status among the five high schools. This same procedure for data analysis was also used to calculate mean differences in GPA and ethnicity among the five high schools.

Block scheduling can allow for a more personal teacher-student relationship to support qualitative data. However, because the type of instructional methods and assessments used within classrooms was at each teacher's discretion, qualitative data was not considered in this study due to possible inconsistencies in instruction, procedures, assessment, and standards being taught. Therefore, Nichols limited the study (2005) to only quantitative data, compiled from student GPAs in required language arts courses and the number of grades the teachers distributed over the past 7 years. Even though Nichols used GPA as an outcome indicator, two assumptions were made: (a) letter grades during the pre- and postblock implementation were equivalent, regardless of the teacher and (b) the grades accurately assessed the students' learning.

Nichols (2005) concluded that the schools in the study could expect to see incremental improvement with continued implementation of the block academic schedule. However, the gains for low income and minority students were consistently lower than those of higher income ethnic minorities. Therefore, Nichols recommended additional support programs be implemented for low income and ethnic minority populations. Nichols' most significant finding was that the block schedule allowed students to complete more language arts courses. As a result, individual students were able to meet or surpass their previous academic success under the new academic schedule policy over time. Also, the number of language arts grades distributed to students increased over 100% in three of the four block high schools over a 7-year period. In addition, Nichols found that English and language arts courses were only slightly impacted by

the new block academic schedule policy. Lastly, Nichols found few differences in academic achievement in a study of the variations in the block academic schedule types (e.g., Block 4 x 4 and Block 8).

Trischedule Academic Schedule Type Policy

Knight et al. (1999) conducted a study that included 10 teachers (eight female and two male) with a roster of approximately 400 students in 30 secondary classes. The following subject areas were included in the study: algebra, art, biology, calculus, economics/government, English III and IV, Spanish, and U.S. and world history. The block schedule classes were taught during first and second hour for 90 minutes and completed within one semester, with a total of 20 block classes offered for the entire school year; there were 158 students in these block classes. The same 10 teachers also taught courses on a traditional schedule with approximately 250 students. The traditional classes were taught for 50 minutes on a daily basis; this group served as the comparison group. From the students that school counselors identified as eligible to take part in the block schedule, a small group was randomly invited to participate in the study, resulting in 25 parents enrolling their children in the block schedule classes and agreeing that their child would enroll in one block schedule course per semester. Teachers who volunteered for the study were required to teach a class in the same content and ability level on both the traditional and block schedule.

Academic performance indicators for both groups included information from school records pertaining to scores from course grades, examinations (i.e., AP, final examinations), and GPA. Student survey data, using a 5-point scale, was included in the study results and taped as well as results from structured 50-minute focus group interviews of students randomly selected by administrators from groups based on a tracking system and the student's success level:

Advanced/Successful, Advanced/Less Successful, On-Level/Successful, and On-Level/Less Successful. The selection of parents for the parent focus interview groups was similar to the selection process for students; however, the parents were only placed into two groups and their interviews lasted approximately 90 minutes.

Knight et al. (1999) compared observation data pertaining to the classroom activities, teacher–student interaction, and instruction of four teachers in both their block and traditional classes using the Stallings Observation System (SOS) in both the fall and spring. Data analysis consisted of descriptive data calculated for each of the variables and an ANCOVA to determine the difference in GPA as a covariate for the control and experimental groups. MANOVA was useful in examining the differences in students' perceptions of the two types of schedules. As a post hoc test, ANOVA was used as needed in order to determine which scales contributed to overall differences. Finally, Knight et al. identified categories and patterns in the qualitative data obtained in the focus group interviews.

Knight et al. (1999) found significantly higher achievement for students on the block schedule than their peers on the traditional schedule. However, students enrolled in AP classes tended to take the exam less frequently than their traditional schedule AP counterparts; this was especially true for students enrolled in first semester AP classes because the AP exam was not given until second semester. Students in block classes felt less prepared for the exam because they equated less time in class with less content coverage. Parent responses were positive overall, but the parents tended to perceive their children as being more stressed because of the acceleration of the block courses. Knight et al.'s study revealed few statistically significant differences. However, in all cases except one, the means of the exam and grades were higher for the block schedule or were equal across groups after adjustment was made for prior achievement.

Of the four teachers in this study, only one exhibited differences in student performance between classes that were statistically different.

Lawrence and McPherson (2000) conducted a study comparing student performance on end-of-course examinations (EOCs) administered in Algebra I, Biology, English I, and U.S. History on a traditional class schedule to the performance of those on a block schedule to assist administrators with their decision regarding academic schedule options. The student demographics in the southeastern region of North Carolina consisted of: African Americans at 51.4%, Caucasians at 41.6%, Native Americans at 6.8% and Hispanics at 0.2%. In addition, the average household income and graduation rate were below the state average. The two selected highs schools in Lawrence and McPherson study's were chosen because they were the first of the three high schools in the county to implement block scheduling.

In order to determine the effects of block academic and traditional academic schedule policy on test scores, Lawrence and McPherson (2000) used a causal/ comparative design, comparing test scores in four subject areas taught on both academic schedule types. They used Statistical Package for Social Sciences (SPSS) version 6.1 to analyze the EOC data from 1992–1993, 1993–1994, the fall semester of 1994–1995 and the spring semester of 1994–1995. In addition, descriptive statistics, inferential statistics, and an independent *t*-test were used to analyze data and test their hypotheses.

Lawrence and McPherson (2000) found academic performance to be higher on the traditional schedule than on the block schedule. Therefore, they concluded that block academic scheduling may not be the most effective solution for addressing low student performance over time. Furthermore, schools should engage in a continuous study of block academic scheduling

research and frequently evaluate their own block academic schedule policy to make sure they are meeting both teacher and student needs.

Veal's study (1999) of Springfield High School's trischedule was conducted during its 2-year trial period. Veal gathered qualitative data from surveys, interviews, observations, and documents such as journals from teachers and administrators. In addition, quantitative data from a 5-point Likert scale was used to track survey results, semester examinations, and GPA. The Midwestern high school in the study implemented a trischedule in which some courses were offered on a traditional schedule, some were offered on a 4 x 4 semester block schedule, and others were offered on a combination of the two through what is known as a hybrid schedule. Implementation of the three schedules running concurrently was for the purpose of determining if the 4 x 4 semester block would best suit the students' needs. Prior to the school's experiment, school personnel had engaged in 5 years of research and dialogue. Veal's research yielded support of both the 4 x 4 semester block and hybrid block schedule in improving student GPA, attendance, and attitude about school.

Veal and Flinders (2001) conducted a study of how block academic schedule policy impacted teachers and their classroom practices by focusing on block academic schedule policy effects on a large Midwestern high school comprised of a predominantly white population with students from the city and rural areas of the county. In the fall of 1997, the high school implemented three academic schedule types simultaneously: an 87-minute 4 x 4 semester block schedule type, a 55-minute traditional six-period schedule type, and a hybrid schedule type consisting of both the block and traditional schedules on a 3-year trial basis.

In some instances, students were randomly assigned a block or traditional schedule, whereas parent requests, scheduling, and class size determined student assignment to courses

taught on a hybrid schedule. Teachers either volunteered or were asked to accept a particular schedule type based on students' choices of course offerings. Veal and Flinders (2001) reported that they used triangulation of qualitative and quantitative methods to compensate for any internal validity limitations surrounding the issue of self-selection of academic schedule type. Their data sources consisted of a 5-point Likert scale on surveys from stakeholders (i.e., students, parents, teachers) as well as additional surveys, interviews, classroom observations, and a collection of written documents. Survey participation amongst stakeholders varied because participation was voluntary. SPSS was used to analyze the data along with Pearson Chi-Square and an ANOVA was run in order to distinguish significance among the groups.

Veal and Flinders' study (2001) yielded significant differences in four areas that can be applied to the manipulation of time for the purpose of improving student achievement. These results are described below:

Changes in teaching methods. Both students and teachers on the block and hybrid schedule types noted increased variety and change in teaching methods across all subject areas. Unfortunately, parents, students, and teachers on these schedule types also indicated that with a longer class period and only a semester in which to teach the course, more material and/or activities were packed into a class session. Surprisingly, some teachers admitted that the accelerated pace of the block and hybrid schedules caused them to rely on the traditional method of lecture in order to cover all of the course content.

Opportunities for reflection. Although teacher perceptions regarding opportunities for reflection tended to vary—even within the same content area and schedule, each of the three teacher groups expressed similar reason for little reflection that included grading for large numbers of students. Of the three groups of teachers, those on the block and hybrid schedules

were much more likely to realize the perceived demands (i.e., variety of teaching methods and pace of instruction) on their time associated with their school's new academic schedule policy.

Relationship with students. The greatest difference was between teachers on the traditional schedule and those on the hybrid schedule. Teachers on the hybrid schedule presented both negative and positive views on their relationships with students, unlike their traditional and block counterparts who reported more positive relationships with their students based on small class size. Although students under the block academic schedule policy felt they had a more positive relationship with their teachers because they spent more time with them in class, their counterparts on the hybrid schedule agreed only when the class size was small.

Levels of anxiety. Reported anxiety levels differed amongst the stakeholders. Teachers under the hybrid academic schedule policy indicated the most increase in anxiety level due to the number of students per class, additional preparations and increased content presentation. Students who experienced the hybrid and traditional academic schedule policies expressed the greatest increase in anxiety level with regard to schedule type than did their block academic schedule policy counterparts. Overall, the results of Veal and Flinders' study (2001) show that the teachers and students who experienced the most change and variance in experience were those under the block and hybrid academic schedule policies.

Academic Schedule Policy Curriculum and Instructional Practices Adaptations

The studies in this section focused on instructional practices of educators for the purpose of improving student achievement as measured by grades, GPA, honor roll, failure rates, semester examinations, state tests, high school proficiency tests, and the ACT test. These studies revealed the need for teachers to adapt their curriculum and instructional practices in response to the demands of the block academic schedule policy implemented at their schools. Adaptations

were related to areas concerning student learning, breadth and depth of content coverage, curriculum, use of instructional time, and engagement rate. Also included in this section is how academic schedule type and instructional practices impact special needs students and their learning.

Mathematics

Kramer (1996) had experience as both an elementary and junior high teacher and was pursuing a doctoral degree in mathematics education at the time of the study. In an exploration of the effects of block academic schedule policy on mathematics instruction, Kramer studied the following issues: reduced effectiveness of learning, decreased breadth and increased depth of coverage, adjusting the mathematics curriculum, AP classes, effects on the use of classroom time, instructional versus administrative time, engagement rate, home study time, impact on student absences, and retention of learning after a gap in sequential instruction.

Reduced effectiveness of learning. Kramer's study (1996) was driven by the fact that the literature regarding the reduced effectiveness of learning on a block schedule was limited to survey results from administrators, teachers, and students, rather than student performance data. Also, at the basis of the research was that even though the results of previous studies had not found lecturing during block scheduling to be less effective for all subjects, the data did not specifically pertain to mathematics. As a result of Kramer's study, most mathematics teachers interviewed expressed a need to reduce the amount of lecturing during a block schedule. Kramer also found that many teachers felt like first-year teachers during their transition from traditional to block academic schedule policy; therefore, Kramer concluded that traditional instructional methods were not beneficial for block academic schedule classrooms. In the final analysis,

Kramer suggested additional support regarding planning time and other areas of staff development for helping teachers as they make the adjustment from one schedule to another.

Decreased breadth and increased depth of coverage. Kramer (1996) found mathematics teachers were concerned with the breadth and depth of content they were able to cover on a block schedule. Based on semistructured teacher interviews, it appeared that even though mathematics teachers taught less material on a block academic schedule, they were able to cover their subject matter in greater depth. Kramer cautioned, however, that this information was based largely on survey data, with only the Ontario study in the late 1970s that was based on observation.

Adjusting the mathematics curriculum. Kramer (1996) recommended curricular modifications as a solution for eliminating the amount of review needed between courses offered on a block schedule. Eight of the teachers from the schools experiencing the success of the block academic schedule policy at their schools revealed the following mathematics curriculum changes during their interviews:

- Creation of a two-part algebra class for lower-level mathematics students;
- Replacement of the normal first-year—second-year-algebra sequence with that of three shorter algebra courses;
- Modification of geometry and first-year-algebra courses to eliminate topics taught in second-year algebra;
- Creation of two separate classes to replace a combined second-year-algebra and trigonometry class; and
- Addition of new courses, such as statistics, for students who complete the regular sequence (Kramer, 1996, p. 760).

Advanced-placement classes. Kramer (1996) also discussed the difficulty associated with Advanced Placement (AP) classes taught on a block academic schedule. Kramer conducted informal telephone interviews and found that some of the schools saw a need for block schedule adjustments in order to better prepare students for the AP examination, which is only offered each May. As a result, some schools offered AP seminar courses in the spring and others offered block AP classes all year or for 75% of the year.

Effects on the use of classroom time. Instructional versus administrative time and engagement rate were the two key areas of this study. Kramer (1996) discovered from previous literature that teachers would reduce their time on administrative tasks (i.e., taking attendance) due to few class changes. In effect, teachers would gain more instructional time. With the additional instructional time, Kramer hypothesized that student engagement would increase, but did not find any studies on engagement rate and the AB block academic schedule, in particular. Additionally, Kramer (1996) found that prior research did not appear to support the theory.

Impact of student absences. The teachers in Kramer's study (1996) expressed concerns about student absences in relation to their block schedule classes. They felt that the students missed an average of two days of class instruction. As a result, they viewed student absences during the block academic schedule as more detrimental to a student's academic success than absences during the traditional academic schedule.

Retention of learning after a gap in sequential instruction. One of the questions important to Kramer's study (1996) was

> In [semester block] and other intense schedules, do students forget more after a gap of a summer vacation plus one or more semesters between courses than they do in traditional schools after a gap of only a summer vacation? (p. 752)

Based on research, Kramer concluded that the interruption of instruction only decreased recall of newly learned material. In addition, the gap in instruction was not likely to have any ongoing negative effects on students' learning.

Mathematics achievement under a block schedule. Kramer (1996) was very interested in how block scheduling impacted mathematics, and felt that mathematics test scores could be well suited for providing an accurate and, therefore, valid measure for the study. Although Kramer did not find any studies that investigated mathematics test scores under the AB block academic schedule policy, the author did find a rare amount of studies that compared mathematics results to the 4 x 4 semester or quarter-plan block schedule. Based on the findings, Kramer noted that block academic scheduling could result in students learning less mathematics, and teachers needing to adapt their teaching methodology to include more student participation, rather than relying on lecture as a primary means for delivering course content.

English and Language Arts

Kienholz et al. (2003) explored teacher effectiveness in using instructional time and enhanced student learning. The basis for their study was the absence of the impact of block scheduling on language arts skills pertaining to literature study and creative writing. Included in their study was an examination of how longer classes influenced students' attitudes towards literacy and the ability to achieve more by teaching less. Two of the authors reflected on their experiences with high school academic schedule policy in order to address the topics of teacher effectiveness in use of time and enhanced student learning.

Teacher effectiveness and use of time. As a former high school English teacher, Kienholz (Kienholz et al., 2003) described experiences under a traditional academic schedule policy as fast-paced and rushed, which made for "an impersonal, chaotic environment" (p. 64).

Kienholz also felt that the "traditional schedule worked against goals as an English teacher" (Kienholz et al., 2003, p. 64). However, after teaching on a block academic schedule, Kienholz felt he had gained additional time to teach the same stories previously taught on the traditional schedule in more depth. Kienholz was also able to complete all of the activities related to the lessons within one class setting under the block schedule. As an Assistant Professor of English, Kienholz found preservice teachers to be supportive of block academic scheduling because they had a clear understanding of how time under a block schedule effected their instruction and their students' learning. For Kienholz, "our school schedule isn't simply a way to organize our school day; it's a way to organize our learning" (Kienholz et al., 2003, p. 64).

Enhanced student learning. As a career English teacher who worked at the same high school as Kienholz, Segall had over 20 years' teaching experience within a variety of academic schedule policies at the secondary level. The rural high school where Segall taught adopted a 4 x 4 semester block academic schedule policy in 1995 after 2 years of research. The reasons and/or benefits included: (a) wanting to give students more responsibility for their education and lowering the number of failures; (b) to provide students with more individual instruction while expanding curriculum electives; (c) the block schedule promised to help students focus on skills, concepts, and process over rote memorization; and (d) a potential reduction in out-of-classroom paperwork also offered more time for student–teacher interaction while improving morale (Kienholz, Segall & Yellin, 2003, p. 65). Segall (Kienholz et al., 2003) believed that the flexibility of the block schedule policy allowed for a better learning environment.

Physical Education

Rikard and Banville's study (2005) included 8 of the 24 high schools in one southeastern school district. These schools were selected for this study due to their students' ethnic and

demographic diversity (56.2% Caucasian, 30.3% Asian/Pacific Islander and Hispanic populations, 12% African Americans and 1.5% Multiracial, American Indian/Alaskan, and Undesignated populations), AB block schedule policy, and teacher willingness to participate in the study. The school district decided to implement a block schedule format during the 1995–1996 school year, and schools were offered the option of using either an AB block or 4 x 4 semester block for 90 days.

Fifteen high school physical education teachers (6 male and 9 female) with an average of 14.7 years of teaching physical education and 4.3 years of teaching physical education on an AB block schedule volunteered for this study. Each of the teachers had 5 or more years of teaching high school physical education classes, 2 or more years teaching under their school's newly adopted block academic schedule policy and were recommended by their department head or activity director based on their instructional leadership. These criteria had been set in order to achieve data from veteran teachers experienced in both academic schedule types.

The teachers participated in a semistructured, audiotaped, one-on-one interview with a lead researcher at their school. The data collected from the interviews were transcribed verbatim and coded by researchers independently. Emerging themes were compared for trustworthiness, discrepancies were resolved through the use of the transcripts, and reanalysis of data was implemented as necessary. Interview topics helped to organize emerging themes into four broad categories relevant to the study:

- Planning (themes: multiple transitions and curriculum variety)
- Instruction (themes: teaching styles, fitness component, skill development, length of units, and lesson review)

- Learning environment (themes: attendance, discipline management, reduced stress level, and teacher–student relationships)
- Student learning

Rikard and Banville's study (2005) reported decreased stress among teachers and students; decreased discipline, absenteeism, and tardiness; flexibility in adding additional activities to their curriculum; and increased instructional time due to less time spent on routine administrative tasks (i.e., attendance). Rikard and Banville's study also revealed findings specific to physical education teachers. First, because many of the physical education teachers were coaches, they were able to adopt a "coaching model" approach that enhanced their class transitions that included: "(a) a brief warm-up session, (b) a 20–30 minute fitness component, (c) instruction focusing on skills, and (d) a culminating activity" (Rikard & Banville, 2005, p. 32). In fact, this transition pattern was adopted by department members as a whole, even though there was no schoolwide or departmental policy in place. The second finding included the development of a 20–30 minute fitness focus emphasized by each of the physical education teachers due to the extended class period. The third finding unique to physical education teachers was their perception of limited teaching strategies. Although most of the teachers believed that student learning had increased, there was no empirical data to support their perceptions. Despite the fact that this experience was based on a 90-day trial block academic schedule policy, this group of physical education teachers were able to quickly find success that resonated throughout their entire department.

Special Needs Students

Implementing a new academic schedule policy is often viewed as a positive reform for the entire school. Unfortunately, this may not necessarily hold true when it comes to evaluating

the impact of an academic schedule policy on subgroup populations such as students with disabilities. Sometimes, the needs of disabled or special needs students are unintentionally overlooked or even minimized when a school is intending to implement policy changes for the school as a whole. Bottge et al. (2003) found that changing academic schedules "did not necessarily lead to instructional modifications or academic benefits, especially for students with disabilities" (p. 9).

Bottge et al. (2003) compared the academic achievement of special needs students who were identified as learning disabled (LD) and those diagnosed with a cognitive disability on the block schedule and the traditional schedule to their general education peers who were also on a block and traditional schedule. Over a 2-year period, 12 block schedule and 12 traditional schedule schools participated in the study. The population sample consisted of 160 seniors with disabilities and 460 seniors without disabilities. The schools shared similar characteristics: attendance rate (93.3% for block and 93.1% for traditional), graduation rate (94.4% for block and 93% for traditional), instructional time (361 minutes for block and 364 minutes for traditional), student–teacher ratio (12:1), and at least 4 years of block or traditional schedule type policy implementation. Both special education and regular education students' achievement measures included GPA, Wisconsin Knowledge and Concepts Exam (WKCE) results, and ACT scores. The data were analyzed for group comparisons through an ANOVA and a series of two-tailed *t*-tests. Although there were a few limitations, the researchers felt confident in their conclusion and their belief that the single most important factor in restructuring time may be "what is accomplished in classrooms between student and teacher" (Bottge et al., 2003, p. 11).

Conclusion

It is important to note that there were a few contradictions in the literature pertaining to stakeholder perceptions and a comparative analysis of academic schedule policies due to increased and expanded research efforts. In the Hamdy and Urich's study (1998) concerning administrator perceptions of academic schedule type, administrators across the United States felt that block scheduling was best suited for 11th- and 12th-grade students, and that their 9th- and 10th-grade students would do better on a modified or traditional academic schedule type. Slate and Jones' research (2000) contradicted this earlier viewpoint. The 9th- and 10th-grade students participating in their study appeared to be more receptive of the block academic schedule policy, along with their 11th-grade peers, whereas seniors seemed unaffected by the change in academic schedule policy (However, this was based on only a 1-week trial schedule.). The comparative analysis section revealed that although students under the traditional academic schedule policy did not outperform those on the block academic schedule policy in Stoyko Deuel's study (1999), a later study by Gruber and Onwuegbuzie (2001) revealed that students under the traditional academic schedule policy did perform better than their peers under the block academic schedule policy on the Georgia High School Graduation Test.

Stoyko Deuel's study (1999) presented the least favorable results towards traditional academic schedule policy. In this study, the results revealed that students under the traditional academic schedule policy did not outperform their peers who were under a block academic schedule policy in both the school's initial 1-year evaluation of the academic schedule policy and in Stoyko Deuel's follow-up study after Year 2 of the new schedule's implementation. In contrast, Knight et al. (1999) showed that the traditional academic schedule policy was best for AP students, first semester AP students in particular. A later study by Lawrence and McPherson

(2000) demonstrated that the traditional academic schedule policy was better for academic outcomes overall.

Despite the fact that much of the literature focus was on block scheduling, it was found that both block scheduling and traditional scheduling can be successful academic schedule policy options for restructuring high schools. It was also found through this review of the related literature that many of the studies pertaining to block academic scheduling referenced the 4 x 4 semester block and year-long AB block as the most commonly implemented and researched forms of the block academic schedule. Although each form of the block schedule was successful in many instances, it can be inferred from the review of literature that another form of block scheduling is, perhaps, the best academic schedule policy option, the hybrid block academic schedule. This academic schedule type may be emerging as another option for schools due to the fact that it is able to accommodate courses that may be better suited for block schedule and others that appear more suited for a traditional schedule. As indicated in the literature, a hybrid academic schedule policy could best suit the needs of both course content and student needs, resulting in an overall positive impact on student achievement and school climate.

Although it may be somewhat difficult to generalize individual study results to a host of high school settings and situations, collectively, the results of these studies can become germane to all schools in that they echo many of the same common themes, which supported improvement in:

- Student–teacher relationships
- Professional development in instructional methodology and understanding how to teach within a block schedule
- Collaborative stakeholder planning

- Continuous program evaluation
- Longitudinal data
- Multiple data sources and
- Empirical data analysis.

Based on this review of literature, block scheduling is here to stay (Veal, 1999). As supported by the literature, it is imperative that individual schools and districts continue to evaluate their academic schedule policy with regard to content area and stakeholder input, using a variety of measurement instruments to ascertain longitudinal qualitative and quantitative data to help ensure maximum benefit of its academic schedule policy.

CHAPTER 3

METHODS

This research study is an analysis of school-level data to evaluate a Missouri high school's academic schedule policy shift. The school implemented the new policy for the purpose of (a) increasing student attendance, (b) decreasing the need to discipline students, and (c) improving student achievement. The high school's newly adopted traditional academic schedule policy replaced its previous AB block academic schedule policy at the start of the 2005–2006 school year. Data regarding student attendance and discipline were analyzed and discussed as whole-school data for each academic year, using year-by-year and cohort data for each graduating class for the academic achievement student outcomes. These outcomes are (a) state-administered mathematics subtest scores, (b) state-administered communication arts subtest scores, and (c) nationally administered ACT scores. Data came from the Missouri DESE website archives as the school reported it through the Missouri Core Data system for the academic years ending in the spring of 2001 through the spring of 2010.

"Attendance" is discussed as ADA. "Discipline" is the number of reported incidents per 100 students enrolled during each academic year rather than the percentage of students involved in disciplinary incidents. "Academic achievement" is (a) state administered mathematics subtest results denoting the percentage of students who took the test and who scored as proficient or better, (b) state-administered communication arts subtest results denoting the percentage of students who took the test and who scored as proficient or better, and (c) the nationally administered ACT scores denoting the percentage of students who took the test and who scored above the national average.

Quantitative methods including, but not limited to SPSS and excel, were used to analyze the data, specifically, trend analysis including moving average plots, tests for equality of variances, paired *t*-tests, and regression analysis. Trend analysis is flexible, makes few assumptions about the shape of the data, and works well in a before–after situation such as this one. Paired *t*-tests work well with small samples, are robust to confounding variables, and are logical tests in a before-and-after situation such as this one. Regression analysis is the best approach for cohort data. Before performing each test, all assumptions were checked for that test (such as normality or homogeneity of variances) to ascertain if the data was a good fit for the analysis.

Research Questions

What impact did implementing a new academic schedule policy have on (a) student attendance, (b) the need to discipline students, and (c) academic achievement over time? Specifically, the research questions are:

1. Did implementing a new high school academic schedule policy coincide with a change in the students' ADA?
2. Did implementing a new high school academic schedule policy coincide with a change in the students' rate of disciplinary incidents per 100 students enrolled?
3. Did implementing a new high school academic schedule policy coincide with a change in the students' state mathematics subtest scores at this school?
4. Did implementing a new high school academic schedule policy coincide with a change in the students' state communication arts subtest scores at this school?
5. Did implementing a new high school academic schedule policy coincide with a change in the students' performance on the ACT?

6. What impact did implementing a new high school academic schedule policy have on the students' cohort test results across all instruments and all years?

Variables

Academic schedule policy is the main grouping variable for this study. Faculty at the high school initiated a change in academic schedule policy to allow for a traditional academic schedule policy to replace its existing AB block academic schedule policy. This change in policy was intended to result in a positive impact on three of the high school's critical areas of student measurable outcomes: (a) attendance, (b) the need to discipline students, and (c) academic achievement. Another grouping variable is school population because enrollment continued to increase due to redistricting efforts. This variable is a confounder for discipline because discipline is reported as the incident rate per 100 students enrolled within the high school. As a result, this particular variable does not distinguish multiple and/or repeated incidents per student, but rather includes all incidents for all students within its data set.

Academic Schedule Policy

The main grouping variable is academic schedule policy. The high school implemented a block academic schedule policy until the end of the 2004–2005 school year. At the start of the 2005–2006 school year, a new academic schedule policy was implemented. This allowed for overall individual course instruction time to decrease from approximately 110 minutes per class to 55 minutes per class. This change in instructional time meant that students could attend more classes on a daily basis: instead of attending only three classes every other day on an AB block schedule, students would attend the same seven classes on a daily basis under the traditional schedule, thus gaining more frequent contact time with each individual teacher each day. Table 1 is a list of the academic schedule type each graduation cohort experienced throughout its stay

at the school through the end of the academic terms for which the data is being applied, 2001–2012.

Table 1

High School Academic Schedule Type by Graduating Cohort, 2001–2012.

Graduating class	9th grade	10th grade	11th grade	12th grade
Class of 2001	Traditional	Traditional	Traditional	Block
Class of 2002	Traditional	Traditional	Block	Block
Class of 2003	Traditional	Block	Block	Block
Class of 2004	Block	Block	Block	Block
Class of 2005	Block	Block	Block	Block
Class of 2006	Block	Block	Block	Traditional
Class of 2007	Block	Block	Traditional	Traditional
Class of 2008	Block	Traditional	Traditional	Traditional
Class of 2009	Traditional	Traditional	Traditional	Traditional
Class of 2010	Traditional	Traditional	Traditional	Traditional
Class of 2011	Traditional	Traditional	Traditional	Traditional
Class of 2012	Traditional	Traditional	Traditional	Traditional

Year-by-Year Variables

Student attendance and discipline data were available by whole school. The data for the academic years ending 2001 through 2005 established the baseline data for student attendance and discipline. The high school's block academic schedule policy had been in effect during the 2004–2005 academic year and the previous 4 academic years. Baseline data, compared against the newly implemented academic schedule policy, could highlight the impact of the school's previous academic schedule policy; it provides a good comparison set for the school's newly implemented academic schedule policy on student attendance and discipline for the academic years ending 2006 through 2012. The academic year ending 2006 includes data for 1 year of the school's newly implemented traditional academic schedule policy, the academic year ending

2007 reflects 2 years of the new policy, and the academic year ending 2008 encompasses 3 years of the new policy implementation. The academic years ending 2009–2012 encompass 4 years of the new academic policy.

Enrollment. For the purpose of this study, enrollment data was not considered an outcome indicator. However, it is presented in Table 2 as a means of demonstrating that the enrollment figures were comparable over multiple years for this particular study. Additionally, it is important to note that including enrollment totals is necessary when discussing the dependent variables attendance and discipline. They are both based on overall student enrollment.

Attendance. The dependent variable attendance (Y_1) consisted of one measure: ADA for each academic year as the school reported it to Missouri DESE through the Core Data system. For the purpose of this study, ADA data was considered an outcome indicator of attendance. Table 2 shows the ADA data for the high school's student body for the academic years ending 2001 through 2010.

Discipline. The dependent variable discipline (Y_2) consisted of the discipline incident rate per 100 students as the school reported it to Missouri DESE through the Core Data system. As an outcome indicator, discipline was measured by incident rate per 100 students enrolled within the high school for each given year (see Table 2). This variable provided limited information because it is sensitive to jumps in student population. One such jump occurred in 2005 due to redistricting efforts once the school moved to a new building.

Table 2

Enrollment, Discipline, and Average Daily Attendance Rates, 2001–2010

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Enrollment	409	411	423	495	635	752	726	742	763	651
Discipline	1.0	0.5	3.8	2.0	18.7	17.8	18.0	14.6	13.0	16.9
ADA (%)	87.87	89.70	88.80	88.90	88.90	89.40	88.90	87.70	88.60	90.20

Source: 2007–08 school accountability report card, by the Missouri Department of Elementary and Secondary Education, 2008, retrieved from http://dese.mo.gov/planning/profile/building; ADA = average daily attendance.

Academic achievement. The dependent variable academic achievement consisted of data from Missouri's annual statewide standardized achievement measures, in particular the mathematics subtest (Y_3), which is typically administered in 10th grade, and communication arts subtest (Y_4), which is typically administered in the 11th grade (see Table 3). The school reported this information to Missouri DESE through the Core Data system. Achievement data from these statewide standardized tests were analyzed according to the percentage of students exceeding the minimum performance criteria on the subtests at the proficient and advanced levels; because the goal of NCLB is for all students to be proficient in mathematics and communication arts, the scores of those within the below basic and basic range were not included in this study.

Academic achievement also consisted of data from the nationwide standardized academic achievement measure known as the ACT, as the school reported it to Missouri DESE through the Core Data system. The dependent variable ACT (Y_5) is considered an achievement measure for this study because it is the most commonly accepted standardized achievement measure for college entrance for Missouri high schools and for state reporting (see Table 3).

Cohort Variables

Unlike the "whole school" data available for student attendance and discipline, individual graduation cohort data was available for more in depth trend and regression analyses in the area of academic achievement. As with student attendance and discipline, data for the academic years ending 2001 through 2005 established baseline data for academic achievement. The years 2001 through 2010 provided cohort data for regression analysis.

Separate analyses were performed for the student outcome academic achievement in two main categories: (a) graduation cohort for each of the individual standardized tests, and (b) each graduation cohort's overall collective standardized test scores. The first was performed to review the impact of the high school's new academic schedule policy on academic achievement when defined by each of the individual standardized tests over time. The latter was performed to review the impact of the high school's new academic schedule policy on academic achievement when defined by overall student achievement by graduation cohort over time. Scores were averaged across the three instruments. Despite the latter being composed of three different types of standardized tests, this data helps to validate the first set of results.

Table 3

Missouri Assessment and ACT Data, 2001–2010

Year ending	Mathematics	Communication arts	ACT
2001	0.0	4.5	12.8
2002	1.0	1.1	3.0
2003	1.0	2.9	0.0
2004	0.0	5.9	5.3
2005	0.7	6.3	9.7
2006	8.9	6.6	8.7
2007	7.0	10.1	3.0
2008	8.0	12.0	8.4
2009	7.9	42.1	3.7
2010	6.9	47.3	5.6

*Note: The school did not test 10th-grade mathematics in 2009. This is based on estimation (see Figure 1). Source: *2007–08 School accountability report card*, by Missouri Department of Elementary and Secondary Education, 2008 from http://dese.mo.gov/planning/profile/building

"Class Of." Indicates to which cohort the test result belonged. For instance, in 2004, the class of 2006 took the mathematics test, and the class of 2005 took the communication arts test.

Number of years in the traditional schedule. For each class and for each test score, it indicates how many years the class has been exposed to the new schedule. This value ignores the likelihood of new students being enrolled in the school because the actual number of new students is potentially small enough to have no effect for the purpose of statistical analysis.

Average academic score. The average academic score is comprised of a given cohort's entire academic data (mathematics, communication arts, and ACT scores) divided by the number

of tests included in the variable. This approach makes sense because all three scores are percentages of students performing "above average."

Instruments

As Table 3 shows, the data set for this study was taken from the Missouri high school for the end of each of the academic terms ending in the springs of 2001–2010. It is important to acknowledge the limitations, if any, of the instruments used to measure student achievement outcomes.

Missouri Assessment Program

The Missouri Assessment Program originated from the Outstanding Schools Act of 1993. Missouri stakeholders developed the MAP Test as a means of measuring skills, knowledge and competencies believed to be important for students to have mastered by the completion of high school. By testing students at various grade levels in different subject areas from elementary to high school, educators and communities could also evaluate the educational programs of Missouri schools on an annual basis.

The validity of the MAP Test is based on three criteria:

1. Proficiency is related to the State Standards, known as the Show Me Standards.
2. Routine examinations of student performance on individual items, their performance as it relates to performance on other items, and performance on the entire instrument
3. Improved classroom instruction based on meeting test expectations

The reliability of the MAP Test depends on the following:

1. Dependability of scale scores
2. Dependability of scores from open-ended items
3. Dependability of achievement-level classifications

4. Comparing MAP reliability data to data from other test (MAP, 2011).

ACT

The ACT has been administered to high school students since the fall of 1959. The following year, the test was administered in 50 U.S. states. Its goal is to predict the postsecondary academic success of first-year college students. The ACT is not an IQ test; it is based on high school curriculum that should be familiar to students. Although students may take the test prior to their junior or senior year in high school, their exposure to additional coursework and more challenging curriculum have the potential to increase their level of success on the test.

The validity and reliability of the ACT have been tested through years of research regarding assessment data in the areas of English, mathematics, reading, science, and the optional writing portion of the test. Research has also been performed in order to determine the impact and/or relationship between the test and ethnic background, gender, grade level, subtests, and curriculum, for instance (ACT, 2011).

Data Collection

The school reported its data by way of the Missouri DESE Core Data system, and Missouri DESE then made the data available primarily through their website. In the year 2009, the 10th-grade students in this study did not take the state standardized mathematics subtest. In order not to lose the entire cohort from the study, the data point was estimated using moving average function and taking the fit point for that year's data. The estimated point is not likely to be correct, but it is likely to be somewhere in the vicinity of what the actual score would have been (see Figure 1).

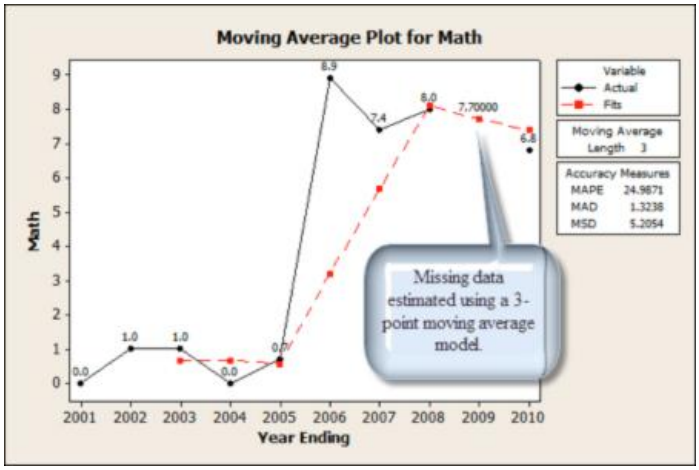

Figure 1. Moving average plot for mathematics.
Because no data existed for 10th-grade students taking the mathematics test in 2009, the point was estimated using a moving average model.

Of interest to this study were the academic years ending 2001 through 2010. The end of the 2005 school year marked the end of the block schedule policy implementation period and the start of the year ending in the spring of 2006 marked the beginning of the traditional academic schedule policy implementation period. Focusing on archival data collected during the block schedule policy implementation period for the academic years ending 2001–2005 allowed for baseline data. Data collected during the next 5 consecutive academic years reflected the implementation of the traditional schedule policy, permitting a comparison of the data in order to determine whether the new academic schedule policy coincided with changes in ADA, the need to discipline, and academic achievement. Each cohort and each test for that cohort had an assigned number of years under the traditional schedule policy, allowing for regression analysis.

CHAPTER 4

FINDINGS

The focus of this study was the impact of implementing a new academic schedule on student attendance, discipline and academic achievement over time. The research questions specific to this study are:

1. Did implementing a new high school academic schedule policy coincide with a change in the students' ADA?
2. Did implementing a new high school academic schedule policy coincide with a change in the students' rate of disciplinary incidents per 100 students enrolled?
3. Did implementing a new high school academic schedule policy coincide with a change in the students' state mathematics subtest scores?
4. Did implementing a new high school academic schedule policy coincide with a change in the students' state communication arts subtest scores?
5. Did implementing a new high school academic schedule policy coincide with a change in the students' performance on the ACT?
6. What impact did implementing a new high school academic schedule policy have on the students' cohort results across all instruments and all years?

Data Quality

The data reflect carefully administered and scored tests with known reliability and validity. Data were downloaded from the Missouri DESE source and then checked to ensure accuracy in analyzing the results and screening for errors. During this process, several issues arose:

- In January 2004, the school moved to a new building and the population later jumped to a much higher level. This resulted in such a large change in the discipline rate so that any change due to the new schedule is obscured.
- In 2009, the school adopted a new statewide testing procedure known as the EOCs, which focuses more on measuring academic objectives by subject and less on measuring a particular subject by grade level as did the MAP. EOCs began to gradually replace the MAP Tests. During this transition, the ACT was the only test that could be consistently associated with any one particular grade level because the state reports scores for 12th-grade students who take the ACT. This has ramifications for a cohort study.
- There is some evidence that after the earliest statewide standardized tests in communication arts and mathematics, an entire cohort went through high school having taken only one statewide test (communication arts) and the 12th grade ACT. One value, the 2009 state level mathematics subtest, is missing. No 10th grade mathematics test was administered that year. It has been estimated based on a 3-point moving average fit in order to preserve some usefulness from the cohort that should have taken that test.

Appropriateness of Data to Answer the Research Question

It has already been established that the instruments effectively measure academic achievement; however, there are limitations in what can be deduced. Causality cannot be proven with this data set alone. The impact of schedule over time can be described, but with caveats such as those having to do with the difference in grade levels at which statewide tests were

administered after 2008 due to the introduction of EOC examinations, which began to replace the MAP subtests.

Causality. Showing a trend over time does not show that the trend was caused by one or another independent variable. Hence, this study is limited in that it cannot show causality; it can, however, show that certain things happened at the same time or that certain variables changed in value during the time period following a significant event (i.e., the change in scheduling policy). To this end, time series plots and trend analyses best illustrate what the data show. Findings here can answer some questions and raise others, but perhaps cannot answer as many as they raise.

"Impact." The regression analyses can not only show that a change occurred over time, they can show the magnitude of that change. For every unit increase in a predictor (i.e., the number of years in the AB or traditional schedule), a certain increase in score can be expected under a given *p*-value.

Assumptions. For each analysis attempted, assumptions were first tested and results given. Trend analyses make no assumptions with regard to normality or variance. Paired *t*-tests require equality of variances. Regression analyses require at least one interval and one nominal variable and more data points than possible data values.

Power. To ensure that the sample size was large enough to detect differences that may actually exist (i.e., to avoid committing a Type II error), a power analysis was performed. Figure 2 shows the results. With a sample size of 10 (the number of years for which data could be identified), and requiring the widely accepted power of .80 (The odds of not missing an effect that is actually there.), a paired *t*-test can detect a difference of just under .50. This is acceptable for this study. Most differences between the means are larger than .50.

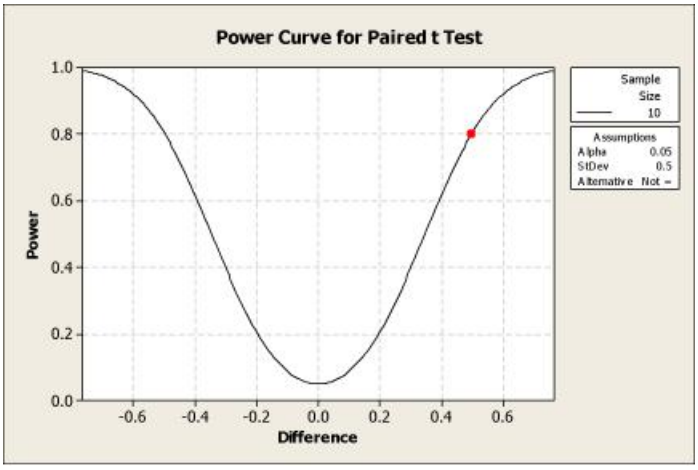

Figure 2. Power curve for paired *t*-test using a sample size of 10.

Descriptive Statistics: Time Series Plots

Figures 3 through 6 show how variables changed over time. The years 2001 through 2005 were block schedule years and served as comparison points for the other years. Average daily attendance (see Figure 3) first went up and then trended downwards for the following two years. Disciplinary events (see Figure 4) jumped before the schedule change but have trended downwards since then with a slight increase in 2007—which was still not to the same level as in 2005. It is possible that the schedule change mitigated the effects of a larger population on the discipline incident rate. The solid black line indicates the schedule before the change; the broken red line, the schedule after the change.

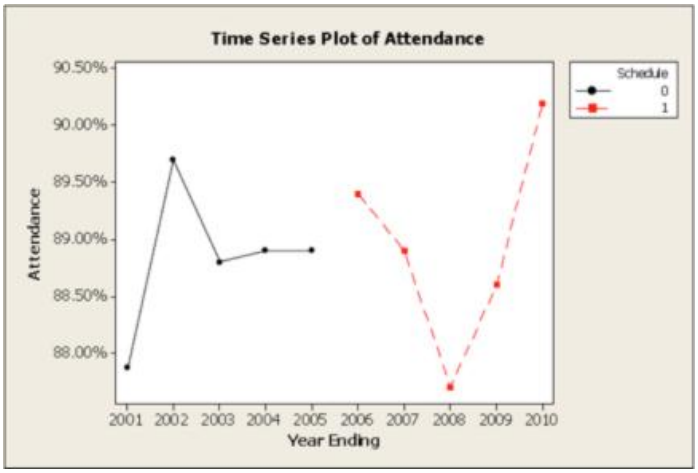

Figure 3. Time Series Plot of Average daily attendance, 2001–2010.

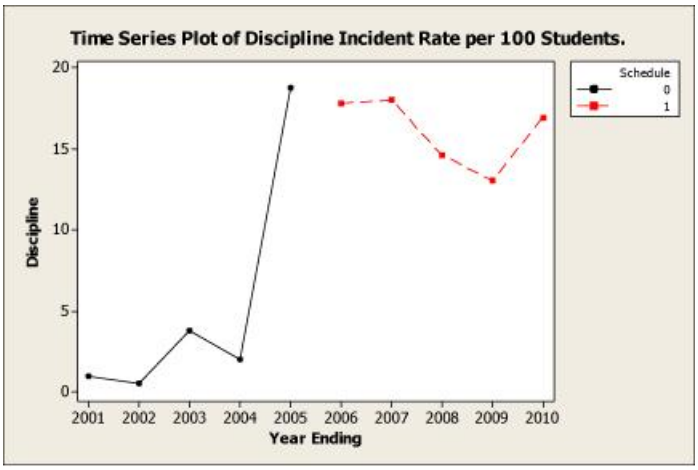

Figure 4. Time series plot of discipline incident rate per 100 students, 2001–2010.

Note that the number of incidents per 100 students is not the same as the percentage of students disciplined. For instance, 14 incidents per 100 students might represent only 10% of the students being involved in these events, some of them multiple times. The solid black line indicates the schedule before the change; the broken red line, the schedule after the change.

With regard to academic achievement, Figure 5 shows an abrupt change for the better in mathematics scores. Figure 6 shows a similar improvement in communication arts scores: after a year that included a modest increase, the following year more students did better. Figure 7 contains ACT scores for seniors who had experienced block scheduling for a decreasing number

of years as traditional scheduling replaced it. Increases in the state's mathematics and communication arts scores did not seem to translate into increases in the national test. Figure 8 contains the three trends together.

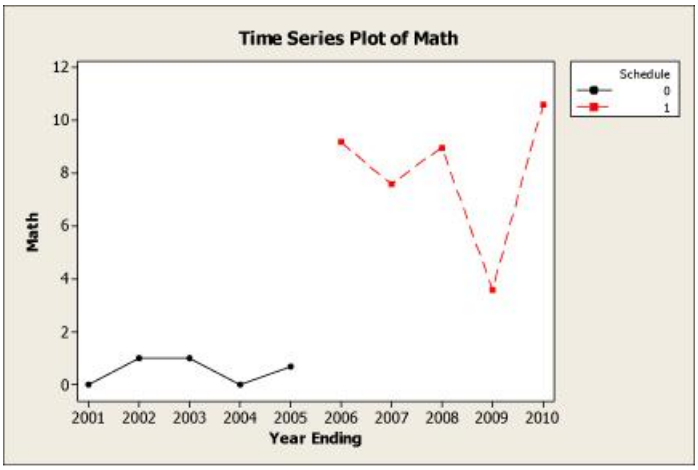

Figure 5. Time series plot of mathematics subtest scores, 2001–2010.

Each score represents the percentage of students taking that test who received a rating of proficient or above. This percentage jumped from a dismal 0.0 all the way to 9.2 over 2 years, then went back down slightly in 2007 only to revive to 9.0 in 2008, drop again, and end at a high value. The solid black line indicates the schedule before the change; the broken red line, the schedule after the change.

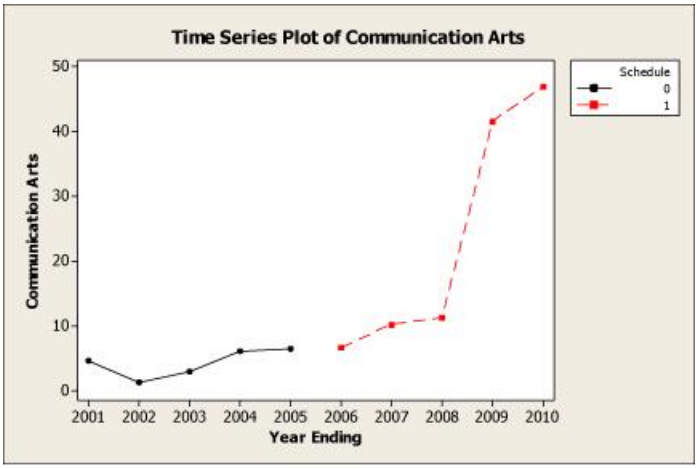

Figure 6. Time series plot of communication arts subtest scores, 2001–2010.

The year 2002 was a tough year, with modest increases in 2003 and 2004 that mark the beginning of three relatively level scores. The year 2007 saw another increase, with a large jump from 2008 to 2009 and even more increase in 2010. The solid black line indicates the schedule before the change; the broken red line, the schedule after the change.

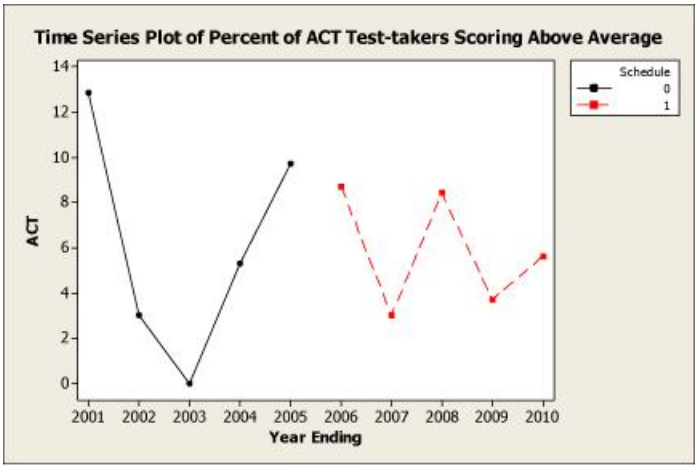

Figure 7. Time series plot of ACT scores, 2001–2010.

The scores represent the percentage of students scoring above the national average on the test. Interestingly, ACT scores contain less variability after the schedule change. The solid black line indicates the schedule before the change; the broken red line, the schedule after the change.

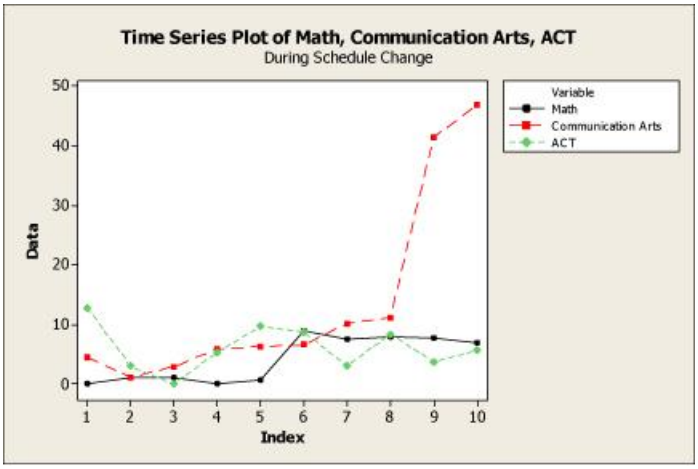

Figure 8. Time series plot of mathematics, communication arts, and ACT scores together by cohort, 2001–2010.

Communication arts scores increased considerably in 2009 and 2010. Mathematics and ACT scores remained relatively level, even going down, in comparison.

Data Analysis: Year by Year

The first five analyses required at least a trend analysis using a moving average model, a test for equal variances and a contrast using one or more paired *t*-tests, usually 2-tailed. The forecasting results for the trend analyses are summarized in Table 4; tests for equal variances are summarized in Table 5, and *t*-test results are summarized in Table 6 for discipline, which also shows a contrast before and after the move to the new building with its associated sudden increase in population. *P*-values are low for mathematics, communication arts, and discipline both by schedule change and by building change. Discipline is confounded by a jump in population.

Table 4

Forecasts and Confidence Intervals Beginning in the Year 2011 for Attendance, Discipline, Mathematics, Communication Arts, and ACT.

		95% CI	
Variable	Estimate	*LL*	*UL*
Attendance	0.89	0.88	0.90
Discipline	14.83	6.24	23.43
Mathematics	7.50	3.31	11.70
Communication Arts	33.17	15.82	50.52
ACT	5.90	-0.25	12.05

Note: CI = confidence interval; LL = lower limit; UL = upper limit.

Table 5

Tests for Equal Variances

					95% CI	
Variable	Group	*SD*	Levene's	*p*	*LL*	*UL*
Attendance	Block	0.006	0.67	0.44*	0.004	0.02
	Traditional	0.009			0.005	0.03
Discipline	Block	7.66	0.64	0.45*	4.29	26.49
	Traditional	2.18			1.22	7.53
	Small Pop.	1.46	0.46	0.52*	0.77	6.90
	Lg. Pop	2.22			1.31	6.37
Mathematics	Block	0.51	0.29	0.60*	0.29	1.76
	Traditional	0.78			0.43	2.69
Communication Arts	Block	2.16	2.71	0.14*	1.21	7.47
	Traditional	19.26			10.78	66.61
ACT	Block	5.13	1.69	0.23*	2.87	17.75
	Traditional	2.62			1.47	9.06

Note: $N = 5$ for all groups. *SD* = standard deviation; CI = confident interval; LL = lower limit; UL = upper limit.
* $p > 0.05$.

Table 6

Contrasts Before and After for All Instruments and for Each Academic Score

	Before		After				95% CI	
Variable	*M*	*SD*	*M*	*SD*	*t*(10)	*p*	*LL/E*	*UL*
Attendance	0.89	0.01	0.89	0.01	-0.23	0.83	-0.02	0.01[b]
Attendance[a]	0.89	0.01	0.89	0.01	-0.25	0.41		0.01[b]
Discipline	5.19	7.66	16.06	2.18	-3.14	0.035[*]	-20.49	-1.25
Discipline[c]	1.81	1.46	17.275	1.825	-12.54	0.001[*]	-19.39	-11.54
Mathematics	0.54	0.51	7.76	0.77	-14.40	0.000 [*]	-8.612	-5.828
Communication Arts	4.14	2.16	24.56	20.40	-2.44	0.036[†]	-20.42	-2.56
ACT	6.16	5.13	5.88	2.62	0.12	0.91	-6.12	6.68

Note: $N = 10$ for all comparisons. CI = confident interval; LL = lower limit (for two-tailed test); E = Estimate (for one-tailed test); UL = upper limit; M = mean; SD = standard deviation; [a]One-tailed test. [b]Difference is too small for this test to detect. [c]Contrasts before and after the building change rather than before and after the schedule change; $^{*}p < 0.05$, two-tailed. $^{**}p < 0.001$, two-tailed. $^{\dagger}p < 0.05$, one-tailed.

Did implementing a new high school academic schedule policy coincide with a change in ADA?

To answer this question required the following steps:

1. Trend analysis,
2. Tests for equal variances,
3. Paired *t*-test, and
4. One-tailed, paired *t*-test.

After performing these steps, it was discovered that the answer to this research question is that any difference is less than half a percent and therefore undetectable using this data set.

Trend analysis. As shown in Figure 9, the best model for this data is a moving average plot with a length of three. Although the jumps in ADA from year to year look large, note that the y axis shows tiny increments. The forecast for the next 4 years is for 88% attendance, with the 95% confidence interval at 87.6% to 90%: a very narrow range. See Table 4 for forecasts and confidence intervals.

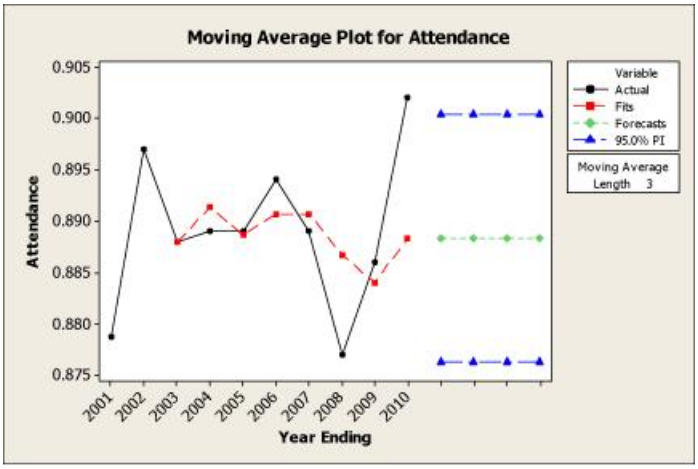

Figure 9. Moving average plot for average daily attendance, 2001–2010.

Test for equal variances. A paired *t*-test does not require that the two groups be normally distributed, but it does require that the two groups have relatively equal variances. To establish that this assumption has been met, a Levene's test was performed, which does not require a normal distribution of the underlying population measurement years (see Table 5). The null hypothesis for both tests is that variances are equal. The alternative hypothesis is that variances are not equal. Levene's test for equal variances ($p = 0.44$) demonstrates a homogeneity of variances among the pre- and postschedule-change groups. This data set is appropriate for a paired *t*-test. Figure 10 show the distributions and boxplots.

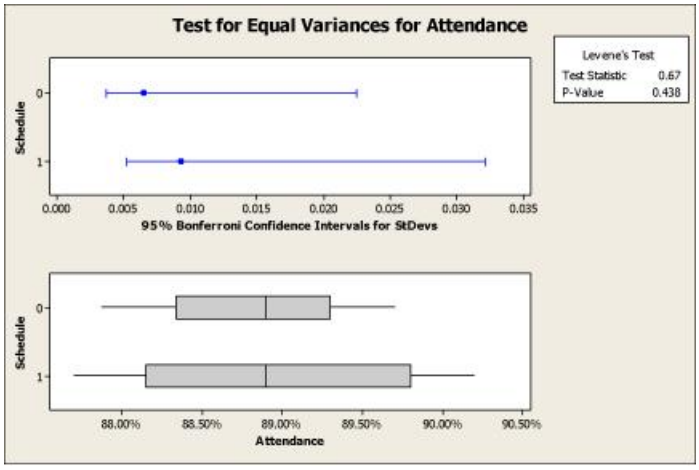

Figure 10. Test for equal variance for attendance, pre- vs. postschedule-change.

***T*-tests.** Treating the school as a subject with pre- and posttreatment values (before and after the schedule change) leads in the direction of using a paired *t*-test to find any possible differences. A student's-t would be inappropriate because the means are dependent—they come from the same "subject," the school. A Paired *t*-test (see Table 6) reveals no significant difference between mean ADA before and after the schedule change ($p = 0.83$). ADA remains relatively steady from 2001 through 2010. This result may be affected by power: any significant difference to be found in this data set would be well below the .50 difference between before and after means that is detectable with a sample size of 10 (see Figure 2). A one-tailed test ($p = 0.41$) also revealed no effect from schedule.

Did Implementing a New High School Academic Schedule Policy Coincide With a Change in the Rate of Disciplinary Incidents per 100 Students Enrolled?

Because of the presence of a confounding variable to which the disciplinary incident rate was peculiarly sensitive, answering this question required the following steps:

1. Trend analysis,
2. Test for equal variances,
3. Paired *t*-test, and

4. Stepwise regression analysis.

After performing these steps, it was discovered that the answer to the research question is that it may have, but the presence of a powerful confounding variable, the sudden increase in student population for the 2004–2005 school year, makes it difficult to be sure.

Trend analysis. The best fit for a trend analysis of disciplinary incident rate is a moving average with a length of three (see Figure 11). Discipline jumped in 2005, and then began to decline with an uptick at 2010. The jump in disciplinary incidents coincided with a move to a new school building with more students.

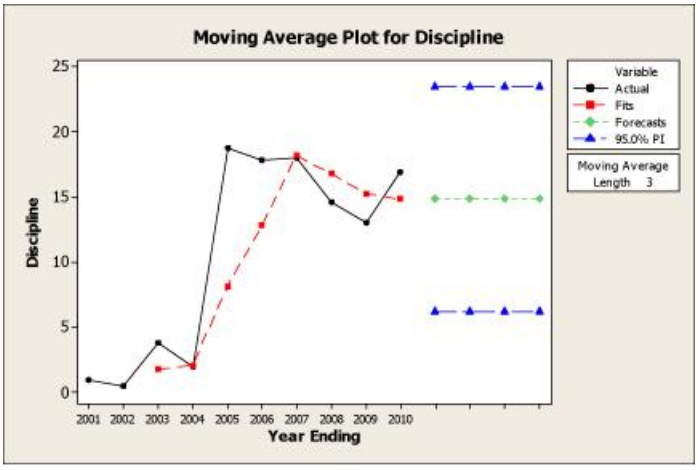

Figure 11. Moving average plot for discipline incident rate per 100 students, 2001–2010.

The number of disciplinary incidents, being a rate per 100 students rather than a percentage of the population who are involved in disciplinary incidents, is extremely sensitive to influential outliers. Having more students in a school may falsely inflate the rate of disciplinary incidents because of one or more influential outliers. One student with frequent disciplinary incidents can drive the rate up for the entire school. Furthermore, the odds of having outliers in a population go up the larger the population (Osborne & Overbay, 2004).

It is also possible that the new building somehow affects students' behavior negatively, but the other explanation, that a larger population contains more influential outliers than a small one, is more likely. It is beyond the scope of this dissertation or this data to screen for multiple disciplinary incidents for each student. The trend, though somewhat interesting, does not tell us as much as it might if the numbers represented a different reality. The following steps illustrate as much as can be understood from this data.

Test for equal variances. Levene's test indicates equal variances (p = 0.45; Table 5). The data is appropriate to use in a paired *t*-test. Figure 12 shows that the preschedule-change estimate does not fall within the 95% confidence interval of the postchange value, and vice versa.

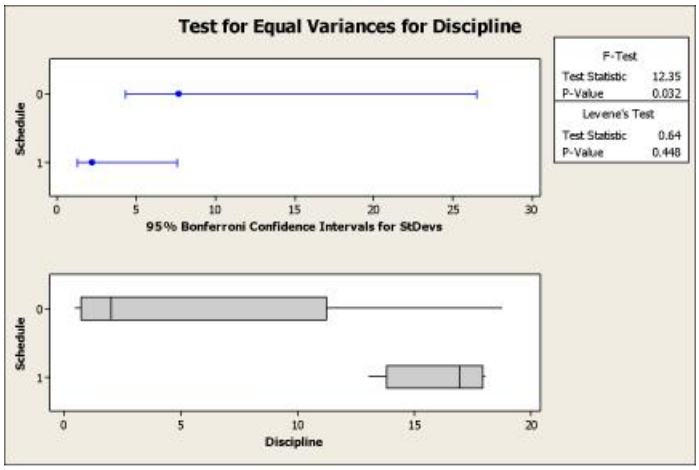

Figure 12. Test for equal variances for discipline by schedule.

Paired *t*-tests. A paired *t*-test of disciplinary instances vs. schedule shows a significant related effect (p = 0.035, Table 6). This must be considered with caution, however. The increase in student population in 2005 could be confounding the effect in evidence from the schedule change in 2006. Even though a paired *t*-test is robust to confounders, it is worth looking at the possibility that a very powerful confounder is not being screened out despite pairing the before-

and after-2006 numbers. A check was made for equal variances in discipline rate before and after the population change (they were equal at $p = 0.46$ for a Levene's test; see Table 5) and then another paired *t*-test was performed (see Table 7 for comparison with the new *t*-test in Table 8). At $p = 0.001$, the null is rejected and the alternative hypothesis that the new population has a higher discipline rate than the old population is accepted. Because this *p*-value is lower, the building change with its concomitant increase in population must be taken seriously when analyzing discipline data for the years that include the change of buildings. In fact it could be obscuring any effect of the schedule change on discipline rate.

Table 7

Paired T-test and CI: Discipline Before and After Schedule Change

	N	Mean	StdDev	*SE Mean*
DisPre	5	5.19	7.66	3.42
DisPost	5	16.06	2.18	0.97
Difference	5	-10.87	7.75	3.46

95% CI for mean difference: (-20.49, -1.25); *T*-test of mean difference = 0 (vs. ≠): *T*-value = -3.14, *p*-value = 0.035.

Table 8

Paired T-test and CI: Discipline Before and After Building Change

	N	Mean	StdDev	*SE* Mean
DisLowPop	4	1.812	1.456	0.728
DisHighPop	4	17.275	1.825	0.912
Difference	4	-15.46	2.47	1.23

95% CI for mean difference: (-19.39, -11.54); *T*-test of mean difference = 0 (vs. ≠): *T*-value = -12.54, *p*-value = 0.001.

Stepwise regression analysis. To evaluate further whether there is a way to isolate any effect of schedule change, a stepwise regression analysis was performed with an alpha-to-enter threshold of 0.15 and found that, with the move to the new building in the regression formula, Schedule did not reach the threshold level (see Table 9). The higher population accounts for an estimated 93.61% of the variance between the before and after groups. Granted, the regression analysis uses two binary variables to predict an interval and is therefore not the best possible statistical test, but the result is nevertheless too strong to ignore with such a low *p*-value and such a high R^2. Given these results, the true answer to the second research question, "Did implementing a new high school academic schedule policy coincide with a change in discipline rate?" is that it may have, but the presence of a powerful confounding variable of change in location makes it difficult to be sure.

Table 9

Stepwise Regression: Discipline Versus Schedule, Building: Alpha-to-Enter: 0.15; Alpha-to-Remove: 0.15

Step	1
Constant	1.812
Building	14.7
T-value	11.53
S	1.97

Notes: R^2 = 94.32 (p = 0.000); Response is discipline on two predictors, with N = 10.

Did Implementing a New High School Academic Schedule Policy Coincide With a Change in State Mathematics Subtest Scores?

The dependent variable "Math" represents the percentage of students who took the state mathematics subtest and scored at proficient or above. To answer this question required the following steps:

1. Trend analysis,
2. Tests for equal variances, and
3. Paired *t*-test.

After performing these steps, it was discovered that the answer this research question is yes ($p = 0.000$). However, the change in testing methods that occurred in the spring of 2009 must be considered when looking at this number.

Trend analysis. For mathematics, the best model for trend analysis was a moving average model using a 3-year average. Figure 13 shows a gradual upward trend, apparently with considerable variation. The year 2009 seems to be a sort of outlier among the postschedule-change years. The model predicts a leveling off of scores at the new, higher level, with a very wide confidence interval that reflects the high variance in this small population of scores (forecast: 7.50; lower: 3.31; upper: 11.70).

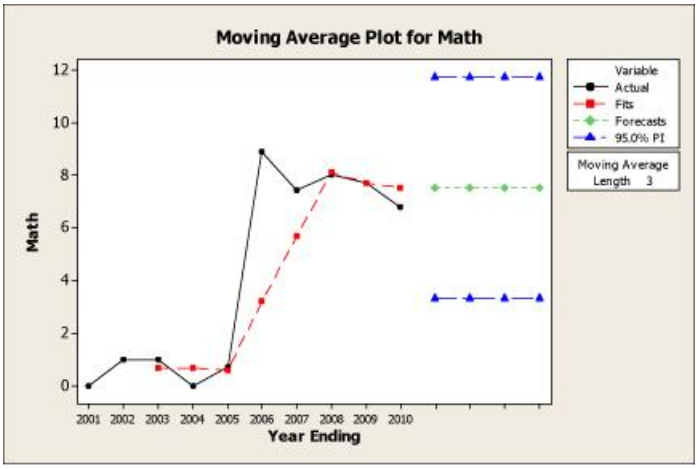

Figure 13. Moving average plot for mathematics, 2001–2010.

The best fit was with a length of three. A trend is evident. One large swing, notably, was from 2005 to 2006, the year after the schedule change.

The sample of mathematics scores is small. However, the best statistical analyses are performed through analysis of the numbers paired with analysis of figures. In Figure 5, two groups are clear: one before and one after the schedule change, each with a different mean. The postchange group has a single outlier. Considered in this way, the two groups have less variance; the variance between 2005 and 2006 is no longer in the data set. Despite the small sample size, a paired *t*-test makes sense.

Test for equal variances. Figure 14 shows the 95% confidence intervals for the standard deviations along with boxplots of their actual values. The *F*-test returned a *p*-value of 0.43 and the Levene's test returned a *p*-value of 0.60. Both tests indicate that the variances are equal.

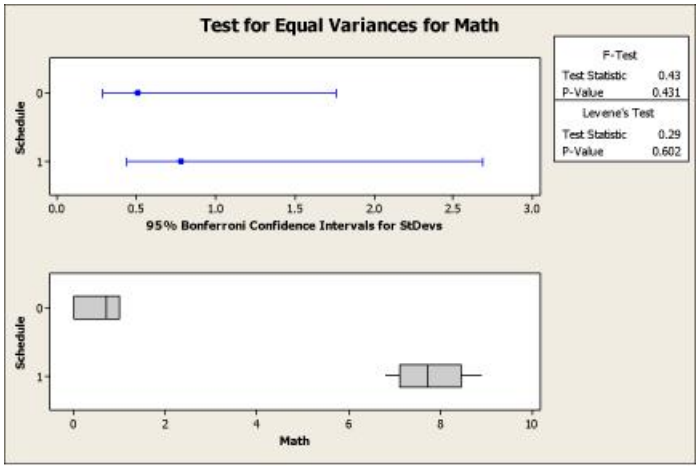

Figure 14. Test for equal variances between mathematics subtest scores and schedule.

The null hypothesis is not rejected and the two groups are considered to have equal variances.

Paired *t*-test. A paired *t*-test makes the most sense because this is a before-treatment and after-treatment model, where the "patient" is the school and the "treatment" is the change in schedule. The means the two groups are not independent because they both relate to the school. Because the scores after and the scores before the schedule change are related to each other, they are paired and compared (see Table 6) to eliminate the impact of the related means on the *t*-statistic. The null hypothesis for this paired *t*-test is that the mean mathematics scores before the schedule change are the same as the mean mathematics scores after the schedule change. According to Table 6, this hypothesis can be rejected: the null hypothesis that the scores are different can be accepted ($p = 0.000$). This must be considered in light of the possible confounding effect from changing testing methods (and possibly grade level) in 2009.

Did Implementing a New High School Academic Schedule Policy Coincide With a Change in State Communication Arts Subtest Scores?

The dependent variable "Communication Arts" represents the percentage of students who took the state communication arts subtest and scored at proficient or above. This data set

contained two points that show evidence of a confounding variable, so to answer this question required the following steps:

1. Trend analysis,
2. Tests for equal variances,
3. Two-tailed paired *t*-test comparing all scores before and after the schedule change,
4. One-tailed, paired *t*-test comparing all scores before and after the schedule change, and
5. Two-tailed paired *t*-test comparing three scores before and three scores after the schedule change.

After performing these steps, it was discovered that the answer to this research question is yes (for $N = 10$, $p = 0.071$ for paired two-tailed test, $p = 0.036$ for paired one-tailed test; for $N = 6$, $p = 0.017$ for paired two-tailed test, no test for equal variances available).

Trend analysis. For communication arts, the best fit again was a moving average model using 3 years to create the average. Because the 2009 change reflects a powerful interacting variable: change in pedagogical and testing styles in 2009, and because the possible effect of this variable is large enough to obscure any impact from a change in schedule, any results must be interpreted with care (see Figure 15).

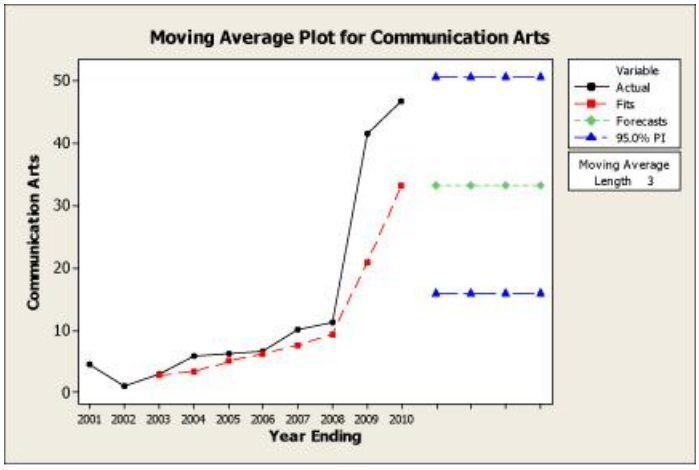

Figure 15. Moving average plot for communication arts scores, 2001–2010.

The best fit used three scores to make the averages. Confidence intervals are again wide and do not encompass any scores before 2009.

Test for equal variances. A test for equal variance (H0: variances are equal; HA: variances are not equal) showed that the null is not rejected ($p = 0.14$) and variance is presumed to be equal across the two groups. Table 5 shows the 95% confidence interval for the variance. Figure 16 contains boxplots and confidence intervals.

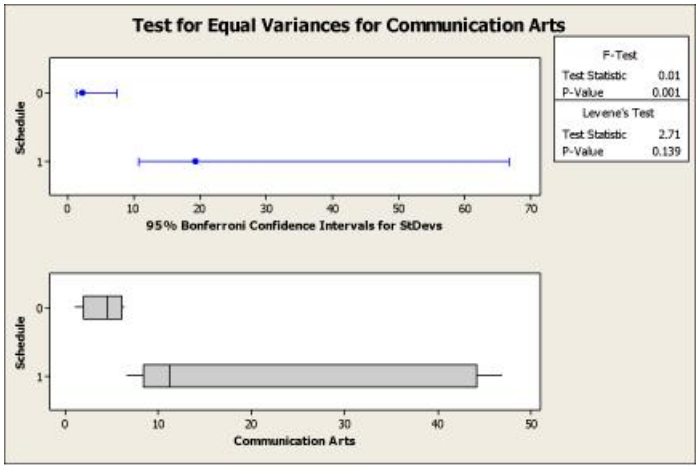

Figure 16. Test for equal variances for communication arts across schedule groups.

Results are acceptable.

Paired *t*-tests. Breaking the communication arts scores down into two groups (pre- and postschedule-change) and using a two-tailed paired t-test to find differences generates a *p*-value of 0.07, just above the alpha of 0.05. The null that the two means are the same is not rejected. A one-tailed test has a *p*-value of 0.036, which is significant: the null that the two means are the same is rejected; the alternative hypothesis that the mean before the schedule change is lower than the mean after the schedule change is accepted. See Table 6 for details.

Nevertheless, the differences between the means cannot be attributed with confidence to the change in schedule. In 2009, the statewide instrument for measuring the communication arts curriculum changed from MAP to EOC. After 1 year of the new instrument's implementation, scores remained low. The next 2 years saw a jump in scores. A paired *t*-test is robust to confounding variables: therefore this finding of a nearly statistically significant difference between the means is notable enough to justify a closer look at the data. Eliminating the two earliest and two latest scores (thus keeping sample sizes equal while eliminating the effect of the confounder) results in a *p*-value of 0.017 despite lower power. However, with such a small *N* the results are hard to interpret. There is no way to check for equality of variances in a sample so small. It seems likely that the variances are more equal in this sample (no big jumps) than in the larger sample, but this cannot be demonstrated. In addition, this result must be considered in light of the possible confounding effect from changing testing methods (and possibly grade level) in 2009.

Did Implementing a New High School Academic Schedule Policy Coincide With a Change in Student Performance on the ACT?

The dependent variable "ACT" represents the percentage of 12th-grade students who scored above the national average for the ACT test. To answer the research question required the following steps:

1. Trend analysis,
2. Tests for equal variances, and
3. Two-tailed paired *t*-test.

After performing these steps, it was discovered that the answer to the research question, "Did implementing a new high school academic schedule policy coincide with a change in ACT scores?" is, statistically speaking, no.

Trend analysis. The best model for analyzing the trend in ACT scores for this high school is again a moving average plot (see Figure 17). The confidence interval is very wide, reflecting a large variance. The shape of the line indicates that scores are not so much changing as settling around a central score that is gradually decreasing. The earlier, prechange group has two seasons: 2 years going down and 2 years going up. After that, the seasons are shorter, with scores still wobbling up and down, but yearly, and seeming to correct and approach a more stable trend as the years go by. However, there is no statistical evidence that average scores are changing as a result of the schedule change.

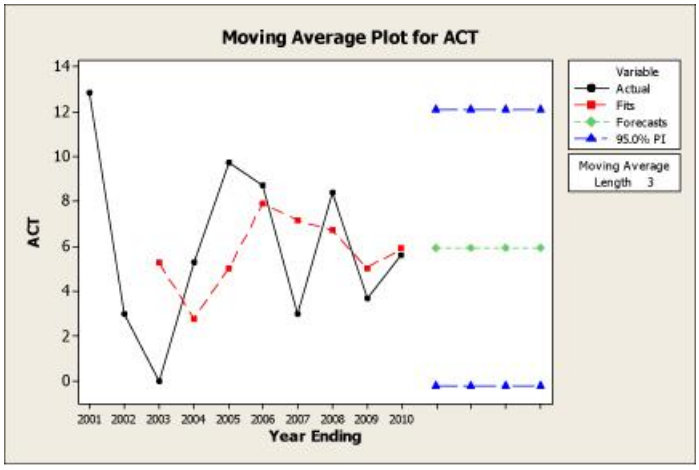

Figure 17. Moving average plot for percentage of students scoring above average on the national ACT test, 2001–2010.

Test for equal variances. Before using a paired *t*-test, a test to see if the variances in the two groups (pre-and post-schedule-change) are equal was performed. In this case, they are (p = 0.229; see Table 5). With *p*-values above an alpha of 0.05, the null is not rejected: the variance does not unduly affect the paired *t*-test results (see Figure 18).

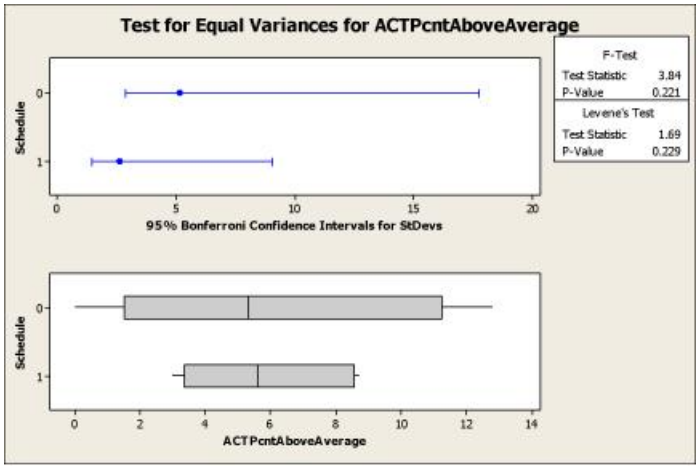

Figure 18. Test for equal variances for ACT.

The null hypothesis that the variances are equal cannot be rejected at alpha=0.05 and using both parametric and nonparametric tests.

Paired *t*-test. As expected after looking at the trend analysis, a *t*-test reveals no significantly significant difference in the means. With $p = 0.91$ (see Table 6), it is highly unlikely that the means in the underlying population differ because of the schedule change.

Data Analysis: Cohort

Analyzing the data by cohort revealed similar results. It was assumed that each cohort spent 4 years in the school, 9th through 12th grade. Most cohorts took these standardized tests:

- State mathematics subtest,
- State communication arts subtest, and
- 12th grade college entrance exam, the national ACT.

Table 1 shows the schedule under which each class studied. A number was associated with each class and each test to indicate how long the new schedule was in place before the test. Using this variable, it was possible to perform regression analyses of number of years in the traditional schedule on each cohort and each test.

What Impact Did Implementing a New High School Academic Schedule Policy Have on Cohort Test Results Across All Instruments and All Years?

Answering this question required descriptive plots and a regression analysis of each test score on how many years the cohort taking the test had been exposed to the traditional schedule policy. Regression analysis demonstrated that the new schedule had an impact on test scores as administered by the state and on overall academic proficiency, but not on ACT scores. *P*-values for these results are comfortably low with an alpha set at 0.05.

Descriptive Plots

A first look at the data shows how cohorts scored on each of the tests as they progressed through their years at this high school. Figure 19 has scores for the classes of 2001–2005 (before

the schedule change), Figure 20 shows scores for the classes of 2006–2009 (during the schedule change) and Figure 21 shows scores for the classes of 2010–2012 (after the schedule change). As the years passed, each class achieved new scores that could be included in this analysis: although the class of 2001 has only one data point (ACT score), the class of 2002 has two points (communication arts and ACT score) and all the following years have all three points until the class of 2011, which has only two, and the class of 2012, which has only one[1]. No pattern is immediately obvious looking at these figures.

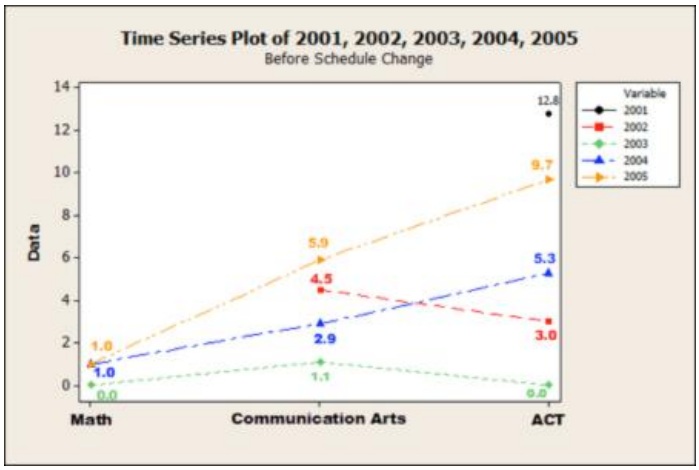

Figure 19. Time series plots by graduating cohort before the schedule change, 2001–2005.

The class of 2001 had one test score in the data set (ACT at 12.8); the class of 2002 had two test scores (communication arts of 4.5 and ACT of 3.0); and the other classes had all three scores.

[1] An assumption that these tests were administered consistently over the years at approximately the same grade levels was impossible to verify except in the case of the ACT. The influence of the new schedule ought to be considered as being on the school environment rather than on the specific class.

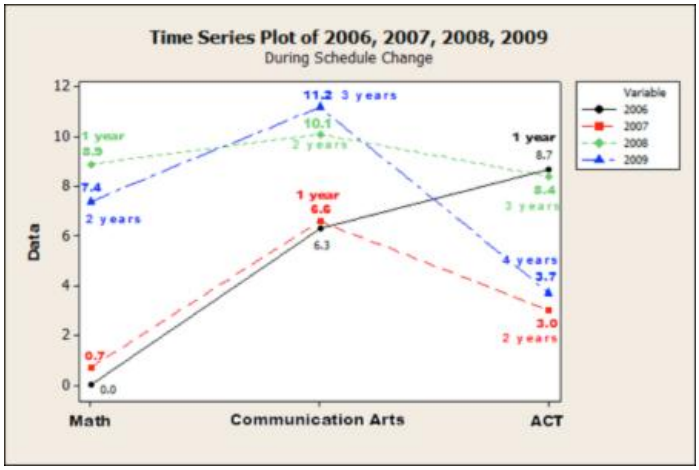

Figure 20. Time series plots by graduating cohort during the schedule change, 2006–2009.

These cohorts experienced the transition from the old schedule to the new schedule. The number of years is color coded to indicate the amount of time a particular cohort spent under the new schedule policy before taking the test.

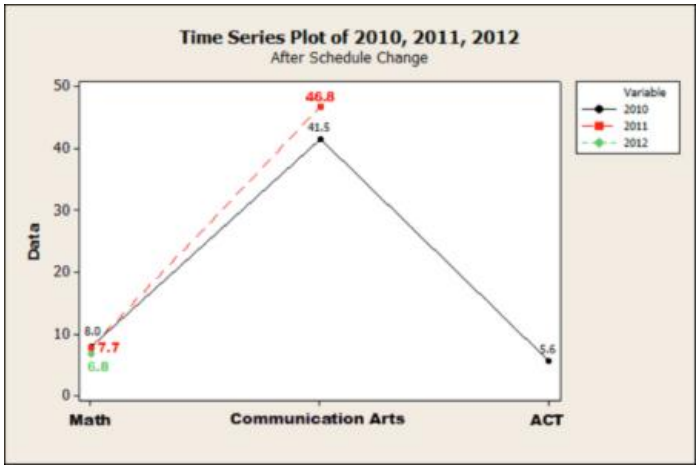

Figure 21. Time series plots by graduating cohort after the schedule change, 2010–2012.

The class of 2010 has all three test scores; the class of 2011 has two scores (mathematics of 7.7 and communication arts of 46.8); and the class of 2012, only one (mathematics of 6.8).

Regression Analyses

Mathematics. Regression analysis of the linear relationship between test scores and the number of years the school had spent in the new schedule revealed that a linear relationship

exists between mathematics scores and the number of years the school has been under the new academic schedule policy. Years of traditional academic scheduling significantly predicted mathematics scores, with B = 1.909, $t(10) = 4.528$, $p = 0.002$ (see *Figure 22*). Years of traditional schooling also explained a significant proportion of variance in mathematics scores, with $R^2 = .719$, $F(1,10) = 20.501$, $p = 0.002$. For every year of traditional scheduling, 1.909% more students are expected to score proficient or higher on the state mathematics subtest. Traditional scheduling accounts for just under 72% of the variance in these scores; the rest is attributable to something else, which is not identified (or identifiable) in this study (Figure 22).

Dependent Variable	Cohort Math Percent Proficient or Above
N	10
Multiple R	0.848
Squared Multiple R	0.719
Adjusted Squared Multiple R	0.684
Standard Error of Estimate	2.166

Regression Coefficients $B = (X'X)^{-1}X'Y$

Effect	Coefficient	Standard Error	Std. Coefficient	Tolerance	t	p-Value
CONSTANT	-0.814	1.293	0.000	.	-0.629	0.547
Years of Trad. Schedule before Measurement	1.909	0.422	0.848	1.000	4.528	0.002

Analysis of Variance

Source	SS	df	Mean Squares	F-Ratio	p-Value
Regression	96.218	1	96.218	20.501	0.002
Residual	37.547	8	4.693		

Figure 22. Regression analysis for mathematics scores.
Note: Two cases are deleted due to missing data.

Communication Arts. Regression analysis of the linear relationship between test scores and the number of years the school had spent in the new schedule revealed that a linear relationship exists. Years of traditional academic scheduling significantly predicted communication arts scores, with B = 1.375, $t(6) = 2.654$, $p = 0.057$ (*Figure 23*). For every year of traditional scheduling, 1.375% more students are expected to score proficient or higher on the

state communication arts subtest. However, years of traditional schooling did not explain a significant proportion of variance in communication arts scores. Any effect is probably difficult to detect because of the change in testing style at year 2009 (see Figure 23).

Dependent Variable	Cohort Com. Arts Percent Proficient or Above
N	6
Multiple R	0.799
Squared Multiple R	0.638
Adjusted Squared Multiple R	0.547
Standard Error of Estimate	1.465

Regression Coefficients B = $(X'X)^{-1}X'Y$

Effect	Coefficient	Standard Error	Std. Coefficient	Tolerance	t	p-Value
CONSTANT	3.175	0.791	0.000	.	4.012	0.016
Years of Trad. Schedule before Measurement	1.375	0.518	0.799	1.000	2.654	0.057

Analysis of Variance

Source	SS	df	Mean Squares	F-Ratio	p-Value
Regression	15.125	1	15.125	7.043	0.057
Residual	8.590	4	2.148		

Figure 23. Regression analysis for communication arts scores.
Note: Two cases are deleted due to missing data.

ACT. A regression analysis of ACT scores on years of the traditional academic schedule policy revealed no statistically significant effect ($p = 0.739$, Figure 24). No linear relationship exists between ACT scores and the number of years a cohort has been studying under the traditional academic schedule policy (see Figure 24). This raises the interesting question of whether there is a linear relationship between mathematics and communication arts scores and ACT scores, but that is beyond the scope of this study.

Dependent Variable	ACT Percent Above Average
N	10
Multiple R	0.023
Squared Multiple R	0.001
Adjusted Squared Multiple R	0.000
Standard Error of Estimate	4.075

Regression Coefficients B = $(X'X)^{-1}X'Y$

Effect	Coefficient	Standard Error	Std. Coefficient	Tolerance	t	p-Value
CONSTANT	6.109	1.865	0.000	.	3.276	0.011
Years of Trad. Schedule before Measurement	-0.049	0.749	-0.023	1.000	-0.066	0.949

Analysis of Variance

Source	SS	df	Mean Squares	F-Ratio	p-Value
Regression	0.072	1	0.072	0.004	0.949
Residual	132.844	8	16.605		

Figure 24. Regression analysis for ACT.
Note: Two cases are deleted due to missing data.

CHAPTER 5

SUMMARY, DISCUSSION, RECOMMENDATIONS, AND CONCLUSION

Summary

This research study is an analysis of school-level data to evaluate a Missouri high school's academic schedule policy shift. The school implemented the new policy for the purpose of (a) increasing student attendance, (b) decreasing the need to discipline students, and (c) improving student achievement. The high school's newly adopted traditional academic schedule policy replaced its previous AB block academic schedule policy at the start of the 2005–2006 school year. Data regarding student attendance and discipline were analyzed and discussed as whole school data for each academic year, using year-by-year and cohort data for each graduating class for the academic achievement student outcomes. These academic achievement outcomes are (a) the state administered MAP mathematics subtest, (b) state administered MAP communication arts subtest, and (c) nationally administered ACT. Data came from the Missouri DESE website archives as the school reported it through the Missouri Core Data system for the academic years ending in the springs of 2001 through 2010.

For this study, student outcome indicators were compared over time. In some instances, the data were compared across the two broad, all-encompassing academic schedule types, block and traditional, instead of specific types of block and traditional schedules. Archival data from the Missouri DESE website was used for this study. Attendance data was discussed as ADA. Discipline was discussed as the rate of incidents per 100 students enrolled during each academic year. Academic achievement was discussed as the percentage of students who took the state administered standardized MAP mathematics and communication arts subtests and exceeded the minimum performance standard. Academic achievement was also discussed as the percentage of

students who took the nationally administered standardized ACT and scored above the national average.

Quantitative methods including, but not limited to SPSS and Excel, were used to analyze the data, specifically, trend analysis including moving average plots, tests for equality of variances, paired *t*-tests, and regression analysis. Trend analysis is flexible, makes few assumptions about the shape of the data and works well in a before–after situation such as this one. Paired *t*-tests work well with small samples, are robust to confounding variables and make sense in a before-and-after situation such as this one. Regression analysis is the best approach for cohort data. Before performing each test, all assumptions for that test (such as normality or homogeneity of variances) were checked to ascertain if the data was a good fit for the analysis.

Discussion

A discussion of the research questions is presented within the context of the literature review and Fowler's theoretical framework for policy analysis (2000). Discussion of each research question in this manner provides for a deeper understanding of both this study's outcomes and academic schedule policy in general. In addition, areas for future research are become evident through the discussion of each research question.

Research Questions

What impact did implementing a new academic schedule policy have on (a) student attendance, (b) discipline, and (c) academic achievement over time? Specifically, the research questions are:

Did implementing a new high school academic schedule policy coincide with a change in the students' ADA? Once all of the tests were performed, the difference was less than half a percent and therefore undetectable using the data set. In essence, it cannot be definitively

concluded that the school's new policy shift coincided with any change in ADA. Although the enrollment continued to increase due to Board-approved redistricting efforts, the ADA remained virtually unchanged. It would seem likely that as more students were enrolled in the school, the ADA would also increase—even despite academic schedule type; however, such minimal gains in ADA are not significant enough to support this theory.

Trenta and Newman's study (2002), although focusing on the relationship between block scheduling and attendance, did not find any significance in the relationship between their academic schedule type and attendance either. In fact, they noticed that the variation in attendance patterns for each grade level made the determination of any relationship unclear. Therefore, it is reasonable that this same variance in grade level attendance patterns may have contributed to the uncertainty regarding the school's academic schedule policy change and ADA. However, it is important to note than an examination of grade level ADA as a potential factor in the relationship between academic schedule policy and ADA is beyond the scope of this study.

Did implementing a new high school academic schedule policy coincide with a change in the rate of the students' disciplinary incidents per 100 students enrolled? The presence of a powerful confounding variable made it difficult to conclude—without a doubt—that the school's new academic policy shift coincided with a change in discipline rate per 100 students enrolled at the school; the confounding variable is the school building. Business expansion near the high school's location resulted in the purchasing of residential and commercial properties within close proximity to the school as well as the land belonging to the school district, which housed the high school's original building. The high school relocated a few years later to a newer building in January 2004. Along with a change in location was the school district's plan to gradually increase the student enrollment to meet the capacity of the new building. The Board-approved

redistricting plan resulted in the enrollment of additional students from one of the two remaining district high schools. Therefore, these and other unforeseen factors associated with moving faculty, staff, and students to a new building tended to overshadow the influence of the dependent variable discipline rate, alone, making it difficult to definitively determine the significance in the new academic schedule policy and its relationship to discipline rate.

Did implementing a new high school academic schedule policy coincide with a change in the students' state mathematics subtest scores? Yes, there was a statistically significant relationship between the new policy shift and the positive change in state mathematics subtest scores. In fact, based on the results, the school can expect 1.90% more students to score in the proficient or advanced range each year that the traditional academic schedule policy is in place. Despite the fact that the percent of students exceeding the minimum performance standard is low, the students at this high school are making gains on the state test in mathematics. Though a small change, this is potentially an important finding.

Early research findings concerning academic schedule policy and student performances on EOC and high school proficiency tests in mathematics supports the findings of this study. Lawrence and McPherson (2000) found that academic performance on the mathematics EOC Exam was higher on the traditional academic schedule than on block academic schedule. Gruber and Onwuegbuzie (2001) found that students who had experienced the traditional academic schedule had higher scores on the mathematics portion of the GHSGT.

In an earlier study by Kramer (1996), an issue unique to mathematics instruction may help to explain why students on a traditional academic schedule tend to do better in mathematics overall in comparison to their block academic schedule counterparts. American mathematics teachers are often known for their use of lecture as their primary instructional style. Kramer

found that under the block academic schedule policy, the use of lecture resulted in students learning less mathematics content, unless the teacher adapted his/her teaching style to include more hands-on, group learning strategies. Theoretically, the increased success of the students at the high school within this study regarding the academic outcome mathematics could be due to the implementation of the new traditional academic schedule policy that lends itself more to a lecture style of teaching, unlike the school's previous AB block academic schedule policy.

Did implementing a new high school academic schedule policy coincide with a change in the students' state communication arts subtest scores? Yes, there was a statistically significant relationship between the new policy shift and the change in state communication arts subtest scores. Much like the previous academic achievement outcome, mathematics, the school can expect a 1.37% increase in the number of students who score at the proficient or advanced level for each year that the traditional academic schedule policy is in place. Despite the fact that the percent of students exceeding the minimum performance standard for communication arts is low, the students at this high school are making gains on the state test in communication arts.

Research revealed that communication arts teachers tend not to favor teaching their subject matter on a traditional schedule because they feel it hinders their creativity and ability to engage in in depth discussion and writing activities during a class session (Kienholz et al., 2003). Yet the research also supported the findings of this study. Gruber and Onwuegbuzie (2001) found that students who had experienced the traditional academic schedule policy had higher scores on the language arts portion of the GHSG Test. Perhaps it is a matter of adapting one's instruction to meet the demands of the academic schedule policy that is in place (Zepeda & Mayers, 2001).

Did implementing a new high school academic schedule policy coincide with a change in the students' performance on the ACT? No, there was no statistically significant relationship between the change in policy and this particular academic achievement outcome. In addition, based on this study, no linear relationship exists between ACT scores and the number of years a cohort has been studying under the traditional academic schedule policy. ACT results for this study were comprised of 12th-grade student scores and the percentage of those taking the test that scored above the national average. Given that Hamdy and Urich (1998) found that 51% of the administrators in their study perceived block scheduling to be better suited for 12th-grade students and Slate and Jones (2000) found that 12th-grade students were the only subgroup that preferred traditional scheduling after only a 1-week block academic schedule policy trial, the fact that no relationship was found in this study further analysis is suggested; however, such analysis is beyond the scope of this research.

Although Hamdy and Urich (1998) and Slate and Jones (2000) focus their research on administrator and student perceptions, Trenta and Newman (2002) focus their efforts on quantitative research, which lends some support for this study. After finding no significant relationship between block academic scheduling and ACT scores, Trenta and Newman also examined this relationship in terms of whether or not block academic scheduling influenced the decline in ACT scores. The variance was so slight that they ultimately validated their previous finding of no significant relationship between block academic schedule policy and ACT scores. Therefore, based on their research and the research within this study, it could be argued that the grouping independent variable: academic schedule type policy, whether block or traditional, does not coincide with any change in student performance on the ACT.

What impact did implementing a new high school academic schedule policy have on the students' cohort test results across all instruments and all years? When all three of the academic achievement outcomes are simultaneously tested and compared, the school can expect to have an additional 2.3% of students scoring on average higher than the norm on all three academic measures. Even though the students at this high school are making gains, they are not progressing at the same rate as the national average. However, the gains in academic achievement are evident that the school did achieve one of its goals for implementing the new academic schedule policy. Perhaps, with academic performance for low income and minority students remaining consistently lower than their counterparts—despite continued gains, additional supplementary programs, specific to the needs of this particular population may need to be implemented in order to ensure greater student success (Nichols, 2005).

Academic Schedule Policy

Fowler's (2000) theoretical framework for policy analysis presents a modified policy model that illustrates the stages and progressions of the policy process: issue definition, agenda setting, policy formulation, policy adoption, implementation, and evaluation. It is this model that served as a framework for this research discussion. The high school within this study appears to have transitioned from each stage of the policy process, except evaluation.

As previously stated, the literature for this study was intentionally selected from within the 10 year span of 1996 to 2005 because it would have been most relevant to the potential academic schedule policy research conducted by the high school in this study when making its decision to advocate for a new academic schedule policy. In using Fowler's (2000) policy process framework, although each of the participating districts and schools within the literature had progressed from issues definition to agenda setting, their progression through the remainder

of the model's stages varied at the time of each study. Some schools and districts were in the beginning stages of policy formulation as they conducted academic schedule type trials (Knight et al., 1999; Slate & Jones, 2000; Veal, 1999). Others had progressed to the policy adoption and implementation stage and were ready for an evaluation to determine the impact of their new academic schedule policy (Gruber & Onwuegbuzie, 2001; Lawrence & McPherson, 2000; Nichols, 2005; Trenta & Newman, 2002; Wilson & Stokes, 1999a, 1999b). Also, some of the districts and schools had engaged in extensive multiyear evaluations of their academic schedule policy in order to determine their needs and the policy's overall effectiveness (Marchant & Paulson, 2001; Stoyko Deuel, 1999). Much of the evaluation stage for these schools focused on qualitative data sources, with a few focusing on quantitative methodologies and even fewer using a holistic approach, consisting of both types of methodology. Even more critical is that there were limited longitudinal studies of 5 or more years, which would have allowed for academic schedule policy adjustment and faculty training.

Although this study was intended to serve as an analysis of the academic schedule policy that was implemented during the 2005–2006 school year, limited access to critical student and class data and issues beyond the scope of this study resulted in the reliance and analysis of data from a public data source. Therefore, the findings of this research were not able to be discussed from a more comprehensive summative perspective, which leads to more formative recommendations. Nevertheless, this information does have the potential to provide valuable insight for a more sophisticated program evaluation of the high school's current academic schedule policy.

Recommendations

The recommendations for an evaluation of the high school's academic schedule policy within the framework of Fowler's (2000) policy process model are related to the final stage: policy evaluation. If the goal of a particular policy adoption is for it to be the best resolution to an issue, real or perceived, then the ultimate coveted characteristic of the policy is its level of success over time. Therefore, once a policy has been implemented, it must be evaluated to determine if the intended goals and objectives have been met. If they have not, a plan must be developed in order to make sure the policy's goals and objectives are achieved before exploring other potential resolutions.

Policy Implementation

Implementing a new academic schedule policy requires more than simply rearranging instructional time and providing a brief overview of the schedule type's format. As indicated in the literature, procedures, programs, and other types of resources must also be included to ensure teachers receive the proper training for meeting curricular and instructional objectives within the newly adopted academic schedule policy. In addition, staff development must be ongoing (Jenkins et al., 2002). Meaningful ongoing professional development potentially increases a newly implemented academic schedule policy's success level.

In both academic schedule policy instances implemented at the high school, consistent and/or ongoing staff development could have been the single most important factor in the overall success of either academic schedule policy in effectively addressing measurable student outcomes, despite the presence of other confounding variables that were indicated in the data analysis for this study. Yet, regardless, both academic schedule policies proved to have had an impact, though not very definitive in some instances. However, according to Kramer (1996), "if

block scheduling were implemented with adequate planning and staff development . . . it is quite possible that achievement would be higher than under a traditional schedule" (p. 767); therefore, a careful analysis of the school's data pertaining to the outcomes of its professional development and instructional practices may or may not have resulted in a need to change its previous AB block academic schedule policy.

Policy Analysis

Policy analysis is equally critical to the success of a newly implemented academic schedule policy. The high school decided to adopt and implement a new academic schedule policy at the start of the 2005–2006 school year. It is not clear if a formal evaluation of the new academic schedule policy was ever performed, and if so, to what extent. According to Marchant and Paulson (2001),

> American education is often accused of jumping on bandwagons and of implementing changes within its schools without fully exploring the impact or effectiveness of such changes. In their efforts to find the characteristics of an education system that will maximize student learning, schools make major structural changes to a system that is not working effectively before fully knowing the impact of the changes themselves. Individual school systems must be willing to fully evaluate the effectiveness of a program once it has been adopted. (p. 12)

Therefore, the high school should conduct a longitudinal comparative analysis that includes a review of the impact of the other policy changes that took place 5 years prior to and five years after the implementation of the new academic schedule policy for a more in depth analysis of the impact of its academic schedule policy on the measurable student outcomes attendance, discipline incident rate and academic achievement.

The high school experienced changes in student enrollment, administration, testing policy, and dress code—any and all of which could have been major contributing factors in the overall success of its previous academic schedule policy and the newly implemented traditional

academic schedule policy, as was the case with the change in building indicated in the analysis of discipline incident rate for this study. Although Gruber and Onwuegbuzie's study (2001) did not explore the impact of the change in attendance policy that took place during their study and Evans et. al's study (2002) did not include changes in the school's discipline policy, both studies indicated that such changes could have contributed to the overall success and/or failure of the newly implemented academic schedule policy within their studies. In fact, during the data analysis for this study, not only was a change in location found to be a major confounding variable, but also the change in testing policy made it difficult to test and examine student performance in mathematics and communication arts by grade level cohort because the EOCs did not test the same grade levels as the MAP when they were introduced at the high school. This change interfered with the cohort data set for the academic achievement outcomes. Therefore, only year-to-year comparisons could be performed for the state-administered subtests, with the assumption that with increased years of exposure to the new academic schedule policy for the school's teachers, student performance would increase over time.

A review of the high school's data by individual graduation cohort for each of the academic year ending 2006, 2007, and 2008 for the duration of each cohort's stay at the high school as illustrated in Table 1 in relation to each dependent variable should be included in the school's evaluation of its academic schedule policy. Due to the fact that each individual graduation cohort experienced either one or a combination of both academic schedule types (block and traditional), a more accurate measure of the impact of the academic schedule policy on student attendance, discipline incident rate, and achievement can be obtained for better analysis.

In addition, the high school should consider evaluating its academic schedule policy based on a review the data from its veteran teachers who taught the same courses at the same grade and academic level (i.e., AP, honors, regular/average track, special education) under both the block academic schedule policy and traditional academic schedule policy over time (Knight et al., 1999). This would give a more accurate portrayal of the classroom experience for both teachers and students. This would also allow the opportunity for teachers to provide content-specific feedback pertinent to the school's needs.

The additional data from each of the aforementioned recommendations would allow for a more fine grained analysis, thereby, permitting the district to gain insights beyond the scope of this research study about the impact of its academic schedule policy change in terms of the high school's intended outcomes and actual consequences. A more granular examination, with individual or even cluster data for various at risk groups, would be extremely useful to future district review of its academic schedule policy. This researcher would be interested in performing such analysis if the district made the data available. Research has shown that:

> Block scheduling may be the answer to raising test scores and grade point averages for one school, whereas a traditional scheduling method may work best for another school. It is only by continuing research in this area, utilizing both quantitative and qualitative techniques that educators can decide whether to retain, modify, or discard [their] method of scheduling. (Gruber & Onwuegbuzie, 2001, p. 40)

It is important to note that student attendance affects individual school funding in Missouri (as in other states). School enrollment and ADA figures reported to Missouri's DESE are used as the basis for determining a percentage of a school's funding allocation. For the high school within this study, the adoption of its new academic schedule policy had the potential to improve student attendance and lead to increased funding, which would allow for the maintenance and addition of various instructional programs and resources of benefit to students,

staff, parents, and the community at large. In states such as California, New York, and Texas, their state administered standardized tests are directly linked to their state's funding of schools. Although Missouri does not fully engage in this practice, it does consider the results of the state administered MAP Test and EOCs when determining whether a particular school and/or district meets AYP and achieves accreditation. For those schools and/or districts falling below the minimum requirement for the academic achievement component, this can result in Missouri DESE's restructuring efforts for the purpose of improvement such as possible changes in leadership or school closures.

Conclusion

Despite the fact that much of the research focus was on block scheduling, both block and traditional academic schedule types were found to be viable options for restructuring high schools. This research study yielded mixed results as did many of those within the literature; therefore, it may be of benefit for schools to adopt the hybrid academic schedule policy that includes both block and traditional academic schedule types, with some courses offered on a daily basis and others on a semester block, AB block, or even quarter block based on the academic need of all its students (i.e., gifted, learning disabled, college bound) and exam schedules (i.e., AP, EOC, and other state tests). In order to ensure success of any academic schedule policy, schools will need to include all of its stakeholders (students, parents, school personnel, and community members), make adaptations to its curriculum, provide meaningful ongoing staff development, carefully review the impact of additional policy changes in the context of a new academic schedule policy and engage in continuous structured evaluation.

Because the findings in this study were exploratory due to the small sample size, no overall definitive conclusions could be made. However, the data did reveal that over time, gains

were made in communication arts and mathematics—a critical subject; therefore, the longer that the traditional academic schedule policy remains in place at the school, the more improvement can be expected. Essentially, in time the school could anticipate a higher success level for all student outcomes (Howard, 1997). With schedule specific, ongoing professional development; stakeholder input; consistency of testing and other school and district-level policies; and longitudinal, qualitative, and quantitative, pre- and postschedule change data pertaining to veteran teachers, each graduating cohort, and gender differences, the high school will be able to continue in its ability to effectively meet its targeted outcomes so that no child will be left behind.

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