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A COMPARISON OF ACHIEVEMENT LEVELS IN MATHEMATICS AND SCIENCE, AND CURRENT ATTITUDES, OF SECONDARY STUDENTS IN A SIX-PERIOD DAILY SCHEDULE, WITH THOSE OF STUDENTS IN A ROTATE-EIGHT BLOCK SCHEDULE

Brad J. Heger
University of Missouri-St. Louis, bjheger@ladue.k12.mo.us

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by

BRAD J. HEGER
A.B. English, St. Louis University – St. Louis
M.Ed. Secondary Education, University of Missouri – St. Louis

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Advisory Committee

Thomas Schnell, Ph.D.
Chairperson
Connie K. Koch, Ed.D.
Carole Murphy, Ed.D.
Lloyd I. Richardson, Ph.D.

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Abstract

In part one of this study, secondary students' mathematics and science achievement levels in a Six-Period Daily (SPD) schedule were compared with those in a Rotate-Eight Block (REB) schedule (eight macroperiods in a two day rotation). In part two, alumni were surveyed to compare current opinions of the schedules' effectiveness overall and on two subscales.

Archival test data and demographic information were obtained on two graduated classes in a selected suburban Midwestern high school, enrollment grades 9 to 12 of approximately 1000 students. Stratified random samples of 50 students from each class were selected based upon treatment, academic ability, ethnicity, and gender.

Grade Point Averages (GPAs) and Missouri Assessment Program (MAP) test scores in mathematics and science were examined through univariate three-way analyses of variance (ANOVA) of the differences in the post-treatment means. Where initial equivalence was not found, ANOVA was used to study effects for subgroups. All main effects and interactions were tested. Gender was taken into account by equalizing numbers across subgroups to the extent possible.

No statistically significant results or trends based on treatment were discovered as main effects or interactions in part one. The "achievement gap" between African-American and Caucasian students was confirmed in all achievement measures except science GPA, where only ability, not ethnicity or treatment, was found to be of significance as a main effect. Though not of statistical significance, a pattern favoring low ability REB subgroups and high ability SPD subgroups was noted.

Analysis of survey results indicated that groups and subgroups differed significantly in scores for effectiveness of the schedules overall, and for the classroom activities subscale. Groups and subgroups consistently rated the effectiveness of the SPD higher. On only one measure did any subgroup rate the REB higher than the SPD: Caucasian males rated effectiveness of classroom activities slightly higher in the REB. The largest opinion differences were exhibited between African-American males and Caucasian males. African-American males rated the SPD classroom activities higher than did any other subgroup, and the REB lower (at exactly neutral) than did any other subgroup.

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Chapter 1

Introduction

The medical and scientific communities continue to make inroads in mapping the activities of the brain and the mysterious workings of human learning. Educators use this and other information and theory concerning varying intelligences and learning styles to attempt to build frameworks for student achievement. As more and more information comes to light, educators grapple with the implications for structuring learning experiences. Do students need class lessons of a particular length to match their attention spans? How should a student's day be structured to make the natural learning processes most effective? How much time does one need to address each student's learning style effectively? What should a student's daily schedule of classes look like if it is to be structured optimally for success and compatibility with human learning needs? Knowledge in these areas "may translate into new initiatives and teaching strategies that can help students reach higher levels of achievement" (Sousa, 2003, p. 4).

In a very practical sense, these questions in the last several decades have translated into a debate, often bitter, among educators. The release of *A Nation At Risk* in 1983 placed considerable pressure on American educators. The widely-used Carnegie Unit, a seat-time measure of standardizing credits and secondary school requirements, came under criticism as being ineffective, and too restrictive, as a means of measuring mastery of a subject. Just over a decade after the release of *A Nation at Risk,* the National Commission on Time and Learning released its report, *Prisoners of Time* (1994). The Commission stated, "Learning in America is a prisoner of time. For the past 150 years, American public schools have held time constant and let learning vary" (p. 7). Educators in both the United States and Canada

engaged in strong dialogues through the 1980s, 1990s, and into the new century, defending or attacking traditional and alternative scheduling models for the secondary schoolhouse.

The emergence of the Copernican Plan in 1983 represented one attempt to address what was considered by some to be the impersonal and inefficient nature of secondary school schedules brought about by the utilization of the Carnegie Unit. Under the Copernican Plan, different means of awarding credits were proposed, along with other changes, including the use of "macroperiods" of 90 minutes to two to four hours in length (Carroll, 1994a). By the early 1990s, North Carolina and Virginia schools had taken the lead in providing schedules that included "macroperiods" (Akins, 2000). In the Midwest, the emergence of the "Hillcrest Plan" in Springfield, Missouri, which also utilized macroperiods, began to garner support (Hillcrest High School, 2005).

Throughout the 1990s large numbers of school districts across the United States adopted "alternative" models of secondary school schedules, devoting scarce resources and finances to make the transition to a different model. In Missouri, growth of what has come to be called nationally "block scheduling" went from three schools before 1990, to 163 schools in the 1997 school year, with the 8-block system predominant, followed by the 10-block and then the 4-block (Simpson, 1997). In addition, "modified" block schedules that combined components of two or even three or more schedule types, though not as common, also appeared. By the end of academic year 1999-2000, over 180 Missouri schools had moved to one or another form of block schedule (Stewart, 2002, p. 71).

Districts moving away from traditional schedules risked significant expenditures of time, money and other resources in the hope that their students' learning needs would be more effectively met by restructuring the school day. The goals stated for restructuring the

secondary school day often included making overall more effective use of teachers' and students' academic time (Canady & Rettig, 1995; Schoenstein, 1995). Student achievement would then presumably be improved. Sousa warns that such restructuring will fail to improve student achievement if "not accompanied by a concrete plan to enhance instruction and student learning. More of the same will not raise student achievement if 'the same' refers to poor instruction, low motivation and minimal expectations" (2003, p. 234). Restructuring was often done also in the hope of improving school climate, encouraging teacher recognition of varying student learning styles to escape strictly lecture-based instruction, and/or improving students' levels of achievement (Benton-Kupper, 1999; Black, 1998; Canady & Rettig, 1995, 1996, 2003; Carroll, 1994a, 1994b; Hottenstein, 1998, 1999; Hottenstein & Malatesta, 1993; Queen, 2000; Schoenstein, 1995). In 1994 Cawelti surveyed high school principals and teachers across the United States to explore which restructuring efforts were most utilized, or were likely to be in the near future. Figures from his *High School Restructuring: A National Study,* indicated that 25% of the nation's high schools either had block scheduling in place in some form, or expected to have it in place (up to 40%), by 1997 (Brown, 1997; Zhang, 2001). In North Carolina, secondary schools that used block scheduling went "from 6 schools (1.6% of all high schools) in the 1992-93 school year to 288 schools (71.8%) in the 1999-2000 school year" (Zhang, 2001, p. 1).

Canady and Rettig identified three major types of block schedules that seemed to be emerging in the early 1990s, all of which made use of macroperiods in some way: the Four By Four (4x4) Block, the A/B Block, and the Trimester Block (Canady & Rettig, 1995). By 2003 they recognized that few districts had adopted the trimester, and identified two major types as predominant, the 4x4 Block and the A/B Block, along with various hybrids of each

(Canady & Rettig, 2003). They noted that the 4x4 seldom appeared in its pure form, but was nearly always modified in some way, usually to accommodate standardized testing reviews.

One of the most commonly recurring alternative models adopted was the "A/B Block" schedule. This model derives its name from the A-day, B-day format used. Three, four or five periods meet every other day in an alternating, or rotating, format for up to six, eight or even ten secondary school course credits (Carnegie units). Canady & Rettig (2003) note that by the late 1990s the A/B also seldom appeared in its pure form. Instead, hybrid forms of some sort, designed to meet a school's specific needs and circumstances, were the rule rather than the exception. This seemed to be true particularly among schools where students and staff considered their schedules to be successful (Canady & Rettig, 2003).

The most popular of the A/B formats is the "Rotate-Eight Block," closely associated with the Hillcrest scheduling model developed at Hillcrest High School in Springfield, Missouri (Hillcrest High School, 2005). In the Rotate-Eight model, eight subjects, or in many instances seven subjects and one study period (often known by such names as "Academic Period," "Networking Period," or "Seminar") carry through traditional quarters, semesters and academic years. With only four periods meeting each day, proponents claim improved school climate as evidenced in more efficient use of time, reduced stress for teachers and for students, and better learning environments, than in the traditional six or seven period day, as well as fewer discipline problems (Carroll, 1994b; Schoenstein, 1995; Jenkins, Queen & Algozzine, 2002). With the loss of instructional minutes limited to only three "passing times" between the four classes, and only four "start-ups" and "shut downs" claiming time from class, more minutes are routinely reclaimed for instructional time, and fewer minutes therefore lost for the non-instructional "housekeeping" chores required of each teacher

(Hottenstein, 1999). In addition, claims are also made that better depth of learning can be achieved in the 90 minutes or so allotted to each period, as compared to the typical 45 to 55 minute periods in traditional schedules. In theory, 90 minute periods allow learners to process information in their own learning style – provided, of course, that teachers are honoring those styles in the additional time available by actually teaching to their students' styles (Canady & Rettig, 1996; Sousa, 2003).

The debate over what sort of schedule best meets the needs of learners has been confused by the multitude of schedules that can be labeled "block" schedules, and in particular by the surface similarity of the two most popular types of block schedules, the Rotate-Eight Block (REB) Schedule and the Four by Four (4x4) Block Schedule. Like the Rotate-Eight, the 4x4 also meets in four macroperiods, generally of 80 to 95 minutes each, per day. Unlike the Rotate-Eight, however, the 4x4 does not rotate with an A and B day format; rather, in the 4x4 the same four classes meet every day. In this way, students in the 4x4 complete one traditional semester's work in a quarter, and a traditional year's work in one semester. Considerable criticism of this style of schedule results from the complications that arise from finishing an entire year of sequential courses in 18 weeks (Howard, 1998; Kramer, 1997a, 1997b; Lindsay, 2004; Miles & Blocher, 1996; Thomas, 2001). Many performing arts, mathematics, and modern language teachers in particular have been vocal in decrying the detrimental effects they perceive in the complications inherent in the 4x4 schedule (Lindsay, 2004). Researchers often have noted the extended macroperiods of meeting time in each schedule, and treated the types of block schedules as equivalent, based on the use of the extended "macroperiods" for classes (Akins, 2000; Gordon, 1997; Hottenstein, 1998; Simpson, 1997).

In addition, focus in recent years on the "achievement gaps" experienced by African-American and other student groups has led to numerous efforts to address and improve the educational experiences of these students (Sousa, 2003; Williams, 2005). The federal government has raised the stakes in public school districts across the country with the passage of what is popularly termed the "No Child Left Behind" (NCLB) Act of 2002. The NCLB Act requires states to administer National Assessment of Educational Progress (NAEP) tests in alternate years in reading and in mathematics to all fourth and eighth graders. A report by Education Trust (2005), *Stalled in Secondary: A Look at Student Achievement Since the No Child Left Behind Act,* is part of a growing body of studies examining the achievement levels of students on state assessments as a result of NCLB, some calling for comparable mandatory testing at the secondary level in all states. While NCLB and the NAEP tests continue to be controversial (Sousa, 2003; Williams, 2005), more access for researchers to states' data allows more opportunities than ever before for analysis of students' achievement levels on statewide standardized assessments. In the context of reporting effects of the 4x4 schedule in North Carolina, Zhang states that, in general, "Block scheduling is still fairly new in the United States, although it has spread rapidly. Block scheduling may take years to show real effects (good or bad). Quantitative research about the impact of the high school schedule is badly needed…" (Zhang, 2001, p. 11).

Statement of the Problem

The purpose of this study was to compare the effects of Rotate-Eight Block (REB) scheduling with traditional Six-Period Daily (SPD) scheduling on a selected Midwestern suburban secondary school's students' achievement in mathematics and science, and to examine the current attitudes of graduates concerning the instruction they received in those

schedules. The instruments used were the Missouri Assessment Process (MAP) tests in mathematics and science given to all tenth grade students in Missouri annually, and mathematics and science grade point averages (GPA_{MA} and GPA_{SC}). The Class of 2004 at a selected Midwestern suburban high school received instruction in the format of a Rotate-Eight Block (REB) schedule for the two high school years (2000-2002) leading to their grade 10 MAP mathematics and science tests. The Class of 2002 received instruction in the format of a Six-Period Daily (SPD) schedule in the two high school years (1998-2000) leading to their grade 10 MAP mathematics and science tests. A stratified random sample of each class was selected based on ethnicity and ability level. Gender was also taken into account. Equivalency of the groups, the Class of 2004 and the Class of 2002, was determined on the basis of the MAP scores obtained in grade 8 mathematics. In addition, a survey mailed to alumni of the Classes of 2002 and 2004 was used to compare the groups' current opinions about the effectiveness of each schedule. Subgroups examined within the treatments were based on ethnicity and gender.

Hypotheses

The independent variables for the study were type of schedule (Six-Period Daily / Rotate-Eight Block), ethnicity (African-American / Caucasian), and general academic ability (higher / lower). The dependent variables were achievement level on the mathematics portion of the MAP, achievement level on the science portion of the MAP, and current opinions as expressed in a survey.

The main hypotheses to be tested and their corresponding null hypotheses were as follows.

H1 There is a statistically significant difference in the scores obtained on the mathematics portion of the MAP by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the scores obtained by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

$H1_0$ There is no statistically significant difference in the scores obtained on the mathematics portion of the MAP by students in a suburban Midwestern high school who received instruction in a Rotate-Eight Block schedule format (experimental group) compared to the scores obtained by students who received instruction in a Six-Period Daily schedule format (comparison group) regardless of ethnicity or ability level.

H2 There is a statistically significant difference in the mathematics grade point averages (GPA_{MA}) obtained by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the mathematics grade point averages (GPA_{MA}) obtained by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

$H2_0$ There is no statistically significant difference in the mathematics grade point averages (GPA_{MA}) obtained by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the mathematics grade point averages (GPA_{MA}) obtained by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

H3 There is a statistically significant difference in the scores obtained on the science portion of the MAP by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the scores obtained

by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

$H3_0$ There is no statistically significant difference in the scores obtained on the science portion of the MAP by students in a suburban Midwestern high school who received instruction in a Rotate-Eight Block schedule format (experimental group) compared to the scores obtained by students who received instruction in a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

H4 There is a statistically significant difference in the science grade point averages (GPA_{SC}) obtained by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the science grade point averages (GPA_{SC}) obtained by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

$H4_0$ There is no statistically significant difference in the science grade point averages (GPA_{SC}) obtained by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the science grade point averages (GPA_{SC}) obtained by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

H5 There is a statistically significant difference in the survey scores obtained from graduates of a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the survey scores obtained from graduates who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or gender.

$H5_0$ There is no statistically significant difference in the survey scores obtained from graduates of a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the survey scores obtained from graduates who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or gender.

Importance of the Study

A schedule change of the magnitude considered when a school determines it will move from a traditional to an alternative schedule is necessarily an expensive endeavor. Initial study, discussion, training, implementation, monitoring and evaluation must all be included in accounting the economic costs of such a schedule change, to say nothing of the inevitable emotional strain brought about by any systemic change (Canady & Rettig, 1995; Howard, 1997, 1998; Lindsay, 2004; Miles & Blocher, 1996). Such change requires careful planning if it is to be effective and successful (Hottenstein, 1999; Schoenstein, 1995; Shortt & Thayer, 1997). In addition, most block schedules require additional (and therefore more expensive) staffing to support the same class sizes as were kept in the traditional six or seven period daily schedules. School districts cannot afford to expend resources on programs of unsure consequence.

Hottenstein (1999) identifies three key areas typically used to measure the success of a scheduling model: school climate, teacher-student interaction/performance in the classroom, and quantitative student achievement results. Of these three factors, efforts to measure quantitatively student achievement by schedule type have been less numerous and are much more recent. In this age of NCLB and NAEP, analysis of standardized test results at the secondary level is a logical step in monitoring these education programs' effectiveness.

Past studies often focused on the similar length of the individual class periods used within the differing types of schedules, and the A/B and 4x4 types of block schedules, along with hybrids of each, were considered a single type for the purposes of many of those studies. Previous studies often reported attendance, discipline, and graduation rates; perceptions of how the programs were implemented; and perceived advantages and disadvantages, typically through Likert scale opinionaires (Finley, 2000; Hamdy & Urich, 1998; Wilson & Stokes, 1999; Wronkovich & Hess, 1998; Zhang, 2001). This study of the effectiveness of the Rotate-Eight Block (REB) schedule differentiated the Rotate-Eight Block from other types of block schedules, and utilized standardized test data and grade point averages, along with graduates' reported opinions.

Three major questions were explored.

- Do students in a REB schedule have different achievement levels in mathematics compared to levels achieved by students in an SPD schedule?
- Do students in a REB schedule have different achievement levels in science compared to levels achieved by students in an SPD schedule?
- Do graduates who had a REB schedule currently hold different opinions toward their experience in that schedule, compared to opinions currently held by graduates who had an SPD schedule?

A study of the effectiveness of this particular type of A/B block schedule on student achievement also could be an important aspect of determining whether specific student groups benefit from such a schedule, and perhaps on whether a district should dedicate funds to changing to, or maintaining, such a schedule.

As time goes on, more and more quantitative data will become available so that more schools can take advantage of a more extensive research base. More studies of the effectiveness of schedule types have begun to focus on data from standardized testing. If in fact a particular type of schedule correlates positively with increased achievement in a particular student population, the findings could be useful in helping address the closing of achievement gaps. Ultimately, the importance of the study is the importance of trying to find the best possible conditions under which students achieve success in learning.

Definition of terms

For the purposes of this study, certain terms were defined as described below.

Achievement level in mathematics. Two measures were used to define achievement level in mathematics: the score reported on the Grade 10 MAP test in mathematics, and the student's mathematics grade point average derived from all mathematics classes taken in grades 9 and 10.

Achievement level in science. Two measures were used to define achievement level in science: the score reported on the Grade 10 MAP test in science, and the student's science grade point average derived from all science classes taken in grades 9 and 10.

Demonstrated general academic ability. The class rank of the student in grade 10 based on overall grade point averages computed from all courses completed in grades 9 and 10 was used to define demonstrated general academic ability. Students in the upper half of their class were considered "higher level" demonstrated general academic ability, and students in the lower half of their class were considered "lower level" demonstrated general academic ability.

Rotate-eight block (REB) schedule. A schedule in which students typically take seven classes at a time, accompanied by an eighth period designated as an "academic lab," "networking," or "seminar" period, on an A-day/B-day rotation of four 90-minute periods each day. Traditional semesters are maintained in the school year calendar.

Six-period daily (SPD) schedule. A schedule in which students typically take six classes at a time, each class meeting in 55-minute periods each day. Traditional semesters are maintained in the school year calendar.

Limitations of the study

A limitation on the study was that the focus was narrow, including stratified random samples from two tenth grade classes at one selected Midwestern suburban school district with one high school of approximately 1000 students.

Another limitation on the study was the history of the participation of this suburban district in the St. Louis Voluntary Desegregation Plan. For the duration of this plan and as it began to phase out, up to approximately one half of the African-American students attending district schools lived outside the school district limits in the City of St. Louis, and so were not resident students in this suburban school district. Their presence and participation in the study greatly enriched the data available, but requires an understanding that, in spite of the school's geographic position in the suburbs of St. Louis, the data analyzed were not wholly obtained from the suburban setting.

Another limitation was that the achievement data were taken from each student's sophomore year, so that even though the state MAP tests were administered to all students under the same conditions, the students had experienced only two years of the schedules under study at the time of the testing.

While the teaching staff remained generally the same with very little turnover from the Class of 2002 to the Class of 2004, the vast majority of that teaching staff had no direct previous experience in teaching in a block schedule, as opposed to the school's long tradition in a six-period daily schedule. Teachers were provided training for teaching in the extended periods of the block schedule, but direct experience in block teaching was limited to a handful of teachers who piloted a limited number of block-style classes with volunteer student participants from the Class of 2001. A few newcomers to the teaching staff (after 2000) had also taught in block-style schedules at their previous schools.

A final limitation of the study is that the surveys were conducted three years after graduation and five years after completion of grade 10 for the Class of 2002, and one year after graduation and three years after completion of grade 10 for the Class of 2004, so that memory must be acknowledged as a possible confounding factor.

Chapter 2

Review of Related Literature

Overview

Chapter 2 provides a review of literature pertaining to block scheduling of various types, including the Rotate-Eight Block schedule. The review is separated into three major sections. The first covers related literature from the United States and Canada. The second focuses more specifically on literature from the states of North Carolina and Virginia, states where advocates of block scheduling actively promoted its utilization in those states, and then across the country. The third section focuses most specifically on studies conducted in Missouri and the region near St. Louis.

United States and Canada

While there has been much written about block schedules, both positive and negative, some of the earliest and most clearly negative results were those found in the Bateson studies of 1990. These studies were conducted in Canada and compared the test results of students on a standardized science test of 40 questions. Bateson found that students in 4x4 scheduling configurations scored significantly lower on this test than students in "single period" (six or seven periods daily) configurations (Bateson, 1990). The students in the single period configurations were tested at the end of the course at the end of the academic year; the students in the block configurations were tested at the end of the academic year, not necessarily the time they finished the course (since the 4x4 year-long courses are "semesterized"). While the 4x4 results may have some significance for students' learning in longer daily blocks of time, the 4x4 differs significantly from the Rotate-Eight Block schedule in that the Rotate-Eight Block allows students to take a year to complete what in a

traditional schedule is a year-long course, and a semester to complete what in a traditional schedule is a semester-long course. Critics are quick to point out that merely having twice as much time in a class period does not in any way guarantee twice the learning (Howard, 1998; Kramer, 1997a, 1997b; Lindsay, 2004).

In a 1993 study, Hottenstein and Malatesta found an advantage of the 4x4 style schedule in that failure rates in 4x4 schedules declined (Hottenstein & Malatesta, 1993). Similarly, Schoenstein (1995) found that both teachers and students reported that the school environment became less stressful for them with implementation of the 4x4 style block schedule, once teachers learned to plan and teach in longer blocks of time.

Howard followed one experienced Advanced Placement calculus and physics teacher ("R.") through a change from a more traditional Six-Period day into an A/B block schedule of seven 90-minute for credit periods, and one "Choice Learning" period, a voluntary course in which there were no grades and no enrollment taken, in the last Wednesday and Friday slots of the schedule (1997). This change of schedule in R.'s school included little or no training in teaching in longer periods, and was characterized as a "surprise" to many of the teaching staff. The schedule was changed the following year so that the "Choice Learning" period became "Enrichment," and rotated between the first and second periods, again without assessments and built on extra credit activities. The following year R.'s school went to an eight-credit Rotate-Eight Block schedule. Among Howard's conclusions was that staff development was absolutely essential for a successful change to a block schedule. R. reported resentment in having to volunteer additional teaching time on Saturdays, early mornings, lunch periods and other "free time" to bring his class' scores on the AP exams close to where they were before the change to the new block schedules, and that the number

of "5" scores among his students dropped immediately by one third in the change to a block schedule (Howard, 1997). The same study reports that the block schedule was found to be popular among students and parents (Howard, 1997), reflecting a criticism commonly made by opponents to block scheduling that proponents of block schedules rely too little on quantifiable results and too much on popularity (Lindsay, 2004). Often, the results appear inconclusive or contradictory.

Trenta and Newman reported that while many measures they attempted were not significant, all of those that were significant, supported block scheduling. The results of this study were based on data collected on grade point averages, attendance rates, and ACT scores for 500 students who had been in 4x4 block schedules for one to three years (2002). While types of block schedules were differentiated, only the 4x4 schedule used in a selected Ohio secondary school was the focus of the study. The staff and students had reported satisfaction with the 4x4 schedule in earlier surveys, and the Trenta and Newman study was stated by the researchers to be an attempt to obtain "'hard data,' data not derived from opinions or attitudes of either supporters or critics but rather data that was a measure of achievement" (Trenta & Newman, 2002, p. 56).

North Carolina and Virginia

Studies in 1996 and 1997 were conducted by the North Carolina Department of Public Instruction (NCDPI) and published in 1998. These were statewide summaries of scores on the state's standardized "End of Course" (EOC) tests in five required subjects. These scores, "when adjusted for parent education level and performance before moving to a block schedule, show few statistically significant differences between block and non-blocked schools" (NCDPI, 1998). It is also important to note that in North Carolina, 65% of 254 high

schools had gone to 4x4 block scheduling by the 1996-1997 academic year (NCDPI, 1998). Trends in the length of time a school was on a block schedule were found to be statistically significant only on the English II EOC Test. For that test, length of time in block scheduling correlated positively with improved scores. Also, Algebra I, biology, and U.S. History showed possible trends in which the longer students experienced block scheduling, the better those students' performance on EOC Tests (NCDPI, 1998). Most North Carolina high schools on block schedules initiated implementation of the 4x4 schedule in the three academic years from 1995-1998 (Zhang, 2001). A study completed for the North Carolina State Board of Education in 1999 of the EOC test results for the class of 1999 (grade 12) through the class of 2003 (grade 8) indicated that "4x4 scheduling has significant positive impact on student achievement with Algebra I and ELPs [Economic, Legal, and Political systems]. English I also is impacted positively, but Biology and U.S. History are not significantly affected" (NCDPI, 2000).

Lawrence and McPherson found that students who had been in 4x4 block schedules at two North Carolina high schools in 1996-1998 were outperformed in all four EOC areas by students at the same two schools who had been in traditional schedules in 1994-1996, but were not adjusted for parent education levels. Mean scores in Algebra I, Biology, English I and U.S. History all favored the traditional schedule (2000). The authors suggested that use of classroom grades as an indicator may not be borne out by research based on standardized tests (Lawrence & McPherson, 2000, p. 181). Shortt and Thayer suggested that the length of time in the block schedule could be a factor in students' performance, as teachers needed time to adjust to the new lengthened periods and overall lessened time in class per semester (1997). These findings were similar to the findings of Skrobarcek et al. as reported by

Lawrence and McPherson, who found that high school students in 4x4 block classes in Algebra I consistently performed below students in traditional schedules in Algebra I (Lawrence & McPherson, 2000).

A longitudinal study covering the academic years 1992-1993 through 1999-2000 by Zhang for the North Carolina Department of Public Instruction indicated North Carolina high school students in 4x4 schedules outperformed students in traditional schedules on most End of Course tests, after adjusting for "concomitant variables…. The mean percentage of minority students (Pct_MS), mean percentage of students with free reduced-price lunch (Pct_FRL), and mean percentage of students whose parents' education level is at high school diploma or lower (Pct_Low-PEL) from 1997 to 2000 are concomitant variables that can be obtained from the state testing database. These are very important variables that strongly relate to student academic performance" (Zhang, 2001, p. 3). ANCOVA analysis of the mean scores, after controlling for the above concomitant variables, indicated that for Algebra I "Students in the 4x4 schools significantly outperformed students in the traditional schools across four years from 1997 to 2000 (Zhang, 2001, p. 8). For English I, Biology, ELP and U.S. History EOC tests, "The 4x4 might have some positive effect on student performance" (Zhang, 2001, p.10), but the differences found were statistically insignificant. Zhang notes that while some previous findings were confirmed, others were not, confirming that results of attempts to determine correlations between block schedules and student achievement continue to be mixed and inconclusive: "Some findings of the study support previous studies in certain areas, such as U.S. History in the study of Hess et al. (1998) and English in the study of Veal & Schrieber (2000). Other findings are contrary to previous studies, such as Algebra I in the studies of Wronkovich et al. (1997), Cobb et al. (1999), and Veal &

Schrieber (2000), Biology in the study of Hess et al. (1998), and English I in the study of Cobb et al. (1999) and Veal & Schreiber (2000)" (Zhang, 2001, p.11).

Studies by the Virginia Department of Education (1999) examined not only the length of time schools had been on some form of block scheduling, but also included the A/B block format as distinguished from the 4x4 block format, and from the traditional "single period" format. In addition, the Virginia study distinguished between secondary schools in urban, suburban and rural districts. In Virginia in 1998-1999, 106 schools were reported on the single period traditional schedule, 95 schools on the A/B block schedule, and 86 schools on the 4x4 block schedule (Virginia Department of Education, 1999). Results on the Stanford Nine (used as part of the Virginia State Assessment program) indicated that students in the A/B format scored highest, followed by students in the 4x4 format, followed by students in the single period format in reading and in mathematics. Students in the A/B were found to lead in the Virginia Standards of Learning (SOL) Tests in English, history, mathematics and science as compared to students in the 4x4 or the single period format (Virginia Department of Education, 1999).

Missouri

Reed (1995) examined block scheduling as a portion of his study on restructuring initiatives in Missouri. In the context of Reed's study, block scheduling was not further differentiated beyond Cawelti's (1994) definition in the 1994 national survey of high schools supported by the Education Research Service. Block scheduling was defined on the survey instrument as "At least part of the daily schedule is organized into larger blocks of time (more than 60 minutes, for example) to allow flexibility for varied instructional activities" (Reed, 1995). It appeared as one of "thirty-six restructuring initiatives [organized] under the

following five headings: school organization, curriculum/teaching, community outreach, monetary incentives, and technology" (Reed, 1995). Reed utilized surveys of Missouri high school principals to uncover how closely plans for restructuring initiatives in Missouri followed the pattern of results found in the national survey. Types of block scheduling were not specifically differentiated from one another, but "block scheduling" was mentioned by 28.8% of the principals surveyed as the restructuring initiative "most frequently being considered for implementation during the next school year" (Reed, 1995). The next closest considerations for implementation were reported as "teacher team responsibility (16.7%), and teacher-advisee system (16.7%)" (Reed, 1995). Block scheduling was reported as already "fully implemented" in 1995 by 16.7% of the respondents in the Missouri study, and already "partially implemented" in 1995 by another 3.0% of those respondents (Reed, 1995).

Also in Missouri, building on research by Gordon (1997) and Simpson (1997), Akins researched four factors related to climate (Akins, 2000). Akins' longitudinal study produced similar results to those found by Gordon and Simpson (Akins, 2000). No significant differences in cumulative grade point average, discipline referrals, or discipline suspensions between 221 senior students in 15 schools in block schedules, as compared to 198 senior students in 13 schools in more traditional schedules, were found (Akins, 2000). Significant differences in the rates of absenteeism were found, however, with the students in block schedules being absent at a higher rate. No significant difference had been found in Gordon's 1997 study, and no long term trend of statistical significance was found when longitudinal data were examined (Akins, 2000).

Akins' study (2000) also examined quantifiable student achievement data in the core areas of science, mathematics, and language arts based on standardized testing. Scores

reported on the ACT and the PSAT were examined, revealing no significant differences in achievement between students in block versus traditional schedules, except in the area of writing. In the area of writing, students attending schools with a traditional schedule outperformed students attending schools with a block schedule, with both 4x4 and Rotate-Eight schedules included as "block schedule" schools. While Akins noted the differences between the 4x4 and the Rotate-Eight Block schedules, he did not further differentiate any of the data obtained on the basis of the two types of schedules, nor did Gordon or Simpson in the earlier studies.

Baker also undertook a study in Missouri of quantifiable student academic achievement, reported in 2001. He looked at ACT scores along with average daily attendance rates, number of disciplinary referrals, and dropout rates before and after the implementation of block scheduling, as well as survey results from principals. He drew his data from five southwest Missouri high schools in close proximity to one another, all of which had adopted Rotate-Eight Block schedules that included a Seminar Period. Baker acknowledged that he made no attempt to adjust for levels of student ability, levels of teacher in-service or levels of teachers' teaching abilities (Baker, 2001, p. 41). He identifies four basic types of block schedules. He terms the Rotate-Eight the "traditional block schedule" and identifies the "modified block schedule" as one "closely aligned to the traditional block schedule except for a schedule change on a specific day of the week, such as Friday. Known also as the Hillcrest Plan, this plan allowed for students to attend four classes on Monday and Wednesday and four different classes on Tuesday and Thursday. Friday was considered closure day as students attended all eight classes for approximately 43 minutes" (Baker, 2001, p. 42). The third type is identified as the "intensified block schedule," which has also

been called the "4x4" or the "semester block schedule." The fourth is the "flexible block schedule," a term attached to the flexible scheduling typically found in middle schools to allow team teaching in core subjects. In flexible scheduling, core teachers on a team determine how long their portion of the lesson will be, while the remainder of the day remains organized in 45 or 50 minute segments.

Baker found that the mean ACT scores obtained at the five participating high schools in his study showed a positive change in over half the years after implementation of Rotate-Eight Block schedules, but that the changes were not statistically significant (Baker, 2001). He found also that the number of disciplinary referrals assigned at the participating high schools was not statistically significant, but that the number of referrals "actually increased after implementing" the Rotate-Eight Block schedules (Baker, 2001, p. 122). This increase in disciplinary referrals would generally be surprising to advocates of block scheduling, as decreases in discipline problems have often been reported in the past (Carroll, 1994b; Jenkins, Queen & Algozzine, 2002; Schoenstein, 1995). Lastly, the dropout rates significantly decreased for the participating high schools, as the "average dropout rate decreased 2.192 percent for the three years after eight-block scheduling when compared to the three years previous to eight-block scheduling" (Baker, 2001, p. 122). Baker's recommendations for continued study included studies of the possible relationships between eight-block scheduling and gender, special education students, minority groups, different standardized tests, and different regions of Missouri.

In another Missouri regional study, Brown investigated mathematics and science achievement results in 1997 in Missouri and Illinois, based on an analysis of the effects of "extended block scheduling" on high school seniors' ACT average mathematics and science

scores. Her study compared the ACT averages of students at selected high schools that had been on a block schedule for a minimum of three years, compared to ACT averages for seniors at those same high schools before the change to the block schedule was effected, and after the new enhanced version of the ACT was initiated in 1989-1990. No individual student's scores were used; rather, a mean for the school was compared to the mean score for the comparable class at the school. The assumption was acknowledged that "the independent variable of scheduling was the main difference between the groups, as they had shared the same teachers, curriculum, and other aspects of the school environment" (Brown, 1997, p. 49). Brown identified "8-block," "trimester block," and "4x4" block schedules, analyzing data from the block schools collectively under the term "extended block scheduling," which she considered "synonymous" with "block scheduling" for the purposes of her study (Brown, 1997, p. 12). "Extended block scheduling" was defined as "A type of school scheduling which reduces the amount of classes per day to no more than five, and which increases the amount of time per class to 75-100 minutes" (Brown, 1997, p. 12). Increases favoring block schedules were found both in mathematics and in science, with those in science being larger, though "the size of the increases in the mean scores in this study were found to be statistically explained as being only due to chance" (Brown, 1997, p. 60). The largest increases found, though not statistically significant, were those favoring girls in block schedules for science (Brown, 1997).

In 1999, Anderson reported use of a survey instrument that explored the effects of block scheduling on teaching strategies in Missouri high schools. The data obtained were differentiated and analyzed by four categories of schedules, including three types of block schedules in addition to the "traditional 6 or 7 hour class schedule (non-block)": "10 block or

10 block modified / 8 block or 8 block modified schedule / other block schedule models (4 block, etc.)" (p. 9). High school teachers in 50 Missouri schools were surveyed as to the use of certain instructional strategies. Twenty-five of the schools were categorized as "non-blocked," while the other 25 were categorized as one or another of the three identified types of "blocked" school. The instructional strategies included in the survey questions were listed for participants as "community service projects, computer aided instruction, cooperative teaching techniques, discussions, experimental learning, group work, individual assignments, labs, lecture, research projects, self-reflection activities, interdisciplinary teaming, field trips, student journaling, and writing across the curriculum" (Anderson, 1999, p. 9). Analysis of the data revealed statistically significant differences in the teachers' reported use of the strategies in four of the individual comparisons. Traditional schedule teachers reported significantly more use of the research project than either the 10-block schedule teachers or the 8-block schedule teachers. In addition, the 10-block teachers reported significantly more use of discussions than the traditional schedule teachers or the 8-block schedule teachers (Anderson, 1999, p. 72-73). These "mixed" results are not what proponents of block scheduling might expect, since one claim for advantages of block scheduling is that the additional time available in a block period allows more extensive use of varied teaching strategies (Black, 1998; Canady & Rettig, 1995; Carroll, 1994a; Hottenstein, 1999; Jenkins, Queen & Algozzine, 2002; Queen, 2000; Rettig & Canady, 1999; Stokes & Wilson, 2000).

In another 1999 study of Missouri schools, Holschen, utilizing qualitative study methods, limited his focus to examine only the teaching of mathematics. He examined the methods used at two St. Louis, Missouri, Lutheran high schools after those schools had moved to a Rotate-Eight Block schedule. If indeed the longer periods are available, do

teachers, in this case specifically mathematics teachers, in fact use them to vary teaching strategies? Two different data sources (mathematics teachers and mathematics students) and four different data collection methods (interviews, surveys, essays, and classroom observations) were used. Holschen explored changes in teaching methods, in coverage of material, and in teachers' attitudes. At the time of the study, both schools had moved from a more traditional Six-Period Daily schedule to a Rotate-Eight Block schedule, one four years previous, and the other just two years previous. Using eight quality criteria applied to eleven different inquiry areas, Holschen was able to state in his findings that at the school that had been in the block schedule for four years, mathematics teachers "have made some of the needed adjustments in their teaching to take advantage of the longer periods which the schedule provides" (Holschen, 1999, p. 159). He goes on to identify larger percentages of class periods dedicated to student-centered activities, regular use of cooperative learning, less teacher lecture than in the traditional format, and "attitudes of teachers and students towards teaching and learning mathematics in the block schedule" that were very positive (Holschen, 1999, p. 160). He was able to state the experience there "mirrored what the available literature suggests about teaching in the block schedule. The longer blocks of time can be an improvement over the traditional schedule if teachers are willing to change from a lecture approach to a student-centered participatory approach to teaching" (Holschen, 1999, p. 160).

At the school that had been in block scheduling for only two years, the conclusions reached were different. The teachers there were "using few student-centered participatory activities in their lessons," and were "very concerned about having less total time for instruction in a year." Yet at the same time, some teachers allowed "a large portion of classroom time for study time" while other teachers attempted "to cover all of the content

that was covered in the traditional schedule by teaching two lessons in one 90-minute period. This usually means the teacher has to use even more teacher-centered, direct instruction which defeats the intent of the block schedule" (Holschen, 1999, p. 160-1). He summarized this part of his findings by stating that teachers at the second school were overall "not as happy with the block schedule [as those at the first school]," and that it was "likely that teachers' attitudes toward teaching mathematics in the block schedule will gradually improve as they gradually change the way in which they teach mathematics" (Holschen, 1999, p. 161). Holschen recommended further research to examine whether students "who have learned mathematics under the block schedule, still achieve at or above the same level as students who learned mathematics in the six-period day" (Holschen, 1999, p. 164).

A Missouri case study completed in 2000 by Finley also found that teaching had changed after a "modified block schedule" was implemented. "Modified" block schedules were defined in the study as combinations of traditional, A/B, and or 4x4 schedules. Finley gives the example of "a school that chooses to have a traditional seven-period schedule three days a week and an alternate block schedule the other two days" (Finley, 2000, p. 15). Finley conducted the case study at a large suburban high school implementing such a schedule in Missouri. While containing components of various schedules, and while strictly not classified as any of them, this case study examined issues often associated with the more widespread A/B and 4x4 block schedules: implementation issues, delivery of instruction issues, learning opportunity issues, and school climate issues. Among Finley's conclusions was the statement that "While it was clear that instruction had changed, the impact on student learning was not as clearly determined" (Finley, 2000, p. 73). Interview and survey data supported the notion that the "change of routine" was welcome, and that positive feelings expressed were due at

least in part to a strong feeling of staff ownership. Implementation was such that interview and survey data also bore out a statement by a mathematics teacher, who "when asked if his positive feelings regarding the modified block scheduling could be attributed to faculty involvement from the beginning, the mathematics teacher responded, 'there's no doubt about it, because we didn't have to go for it'" (Finley, 2000, p. 78). Much of the supportive literature for block scheduling in general emphasizes the need for effective implementation, including the feeling of ownership by staff (Canady & Rettig, 1995; Hamdy & Urich, 1998; Hottenstein, 1998, 1999; Hottenstein & Malatesta, 1993; Jenkins, Queen & Algozzine, 2002; Queen, 2000; Shortt & Thayer, 1995).

In addition, Finley reported three themes that emerged from the data that seem important for schools interested in block scheduling to examine. The first involved the Academic Improvement Minutes (AIM) period, which "was created with the purpose of every student being assigned to a homeroom with the availability to do a variety of activities that would help them academically. These activities were to include opportunities for students to go to another teacher's classroom to retake or make up tests, work on homework, study for tests, or get additional help from that teacher" among other more structured and some unstructured activities (Finley, 2000, p. 84). In spite of the many positive uses of the AIM period that were identified, so were many "non-productive and/or negative uses of time [which] included students sleeping, playing cards, wandering the halls, listening to radios, and leaving school to eat breakfast or lunch" (Finley, 2000, p. 87). Schools in the A/B rotating block schedule format that use "Seminar" or "Academic Lab" as one of the periods share many of these concerns, as well as the advantages.

A second theme that Finley identified was the recurring mention of lack of a planning period one day a week for each teacher, especially as a "fatigue factor on those days" (Finley, 2000, p. 93). Finley noted that "Although teachers were clearly speaking from differing perspectives, data suggested that this [lack of a planning period once a week] was a major concern for some and a minor inconvenience for others," as 71 percent agreed they had been able to adapt to not having a planning period, while 15 percent responded that they "strongly disagreed" that they had been able to adapt to not having a planning period (Finley, 2000, p. 94-95).

The third theme reported to emerge was the differing benefits received from the modified block schedule for high achieving students and low achieving students. An ideal view would be that all students would benefit, but the reality seemed to be different. Finley noted that teachers felt "lower achieving students were more difficult to motivate, gave up on things easier, and were frustrated more easily. These characteristics were compounded in the 90-minute period" (Finley, 2000, p.96). The teachers also suggested that a solution "was to prepare to vary the learning activities to meet their [the lower achieving students'] needs. As the mathematics teacher stated, 'you do have to vary what you are doing depending on the level of students that you're teaching'" (Finley, 2000, p. 96-97). On the other hand, "the wise use of time by higher achieving students was also observed during the AIM period. The art teacher was particularly fond of the block days when discussing his advanced students. He said, 'they (advanced kids) love it. They really flourish in that kind of situation. It's very beneficial'" (Finley, 2000, p. 97). While these sorts of concerns over AIM / Seminar / Academic Lab periods do not specifically arise in a 4x4 configuration, they are particularly relevant to schools that utilize Rotate-Eight Block schedules that include such a period.

A 2002 Missouri study "did not take into consideration the different formats of block scheduling" other than the "delivery system with classes meeting for 75-90 minutes a day" (Stewart, 2002, p. 72). Stewart's study did, however, take into consideration the length of time the schools had participated in block scheduling, requiring for inclusion in the study a minimum of three years participation by the completion of the 2001 school year. A second consideration was the size of the school by enrollment, comparing indicators of academic achievement in selected Missouri high schools with student enrollment under 1084, and those over 1084. Ten schools were used, and comparisons were drawn on graduation percentages, ACT test scores, and dropout rates. Findings indicated that graduation rates improved with block scheduling, but were not statistically significant. Similarly, the ACT test scores showed no statistically significant difference. Dropout rates improved with block schedules at a statistically significant level. These results held true for both larger and smaller schools (Stewart, 2002).

In 2001 Spencer completed a study of the possible influence of block scheduling on African-American students in a large suburban high school in west St. Louis County, Missouri. She identified five types of scheduling designs according to the definitions first presented by Canady and Rettig (1995), including as one of those five "single-period schedules, consisting of six, seven, or eight daily classes, varying between 40 to 60 minutes in length" (Spencer, 2001, p. 30). She notes also Canady and Rettig's 1995 classifications of block schedules into the "A/B rollover," the "Four By Four semester plan (Accelerated plan)," the "Trimester" plan (a "quarter-on, quarter-off model" in which "students can take two core courses and related subjects over a 60-day period"), and their catch-all hybrid category of "a variety of 180-day combinations with short and long periods of instruction,

remediation, enrichment, and staff development days for teachers" (Spencer, 2001, p. 30). Spencer focused on four academic years of archival data (1996 through 2000) for all African-American students in the school to determine whether length of time in an A/B block schedule reflected statistically significant differences in the grade point averages, transfer-out rates, and dropout rates among African-American students. She found no statistically significant relationship in transfer or in dropout rates, but found a significant difference in the area of grade point averages. Her analysis found a significant difference in "lower failure rates after 2 or 3 years with a block schedule than [African-American students] had with zero or one year. The relationship is not perfectly linear in that failure rates tended to be a little higher in year four than they had been in year three" (Spencer, 2001, p. 57).

In addition, because the high school at which the study occurred was a participant in the St. Louis Voluntary Desegregation Transfer Program, Spencer was able to disaggregate data by resident and non-resident African-American students, as well as by gender. A significant difference was found in the dropout rates for resident and non-resident African American students, with resident students more likely to remain in school, though the rates for both groups were noted to be low (Spencer, 2001, p. 43). No significant relationship was found for transfer out rates among these populations, nor were any differences found in the subgroups pertaining to the findings that indicated improvement in failure rates, with one exception. The failure rate for non-resident students, while improved at a significant rate, was significantly less improved than the failure rate for resident students (Spencer, 2001, p. 57).

Summary

In summary, a review of related literature reveals that the types of block schedules have most often been studied in the aggregate, based on the longer classroom sessions of 80

to 90 minutes common to each type. Fewer studies focus on the differences between any one particular type of block schedule and another. Of studies that focus on a particular type, the 4x4 type of block schedule is most often the subject. More recent studies have begun to make use of quantifiable data from standardized testing, with earlier efforts utilizing mostly survey instruments and opinion surveys. The results of these efforts have been mixed.

Chapter 3

Methodology

Overview

This study was designed in two parts. The first part compared the mathematics and science achievement levels of students in a Six-Period Daily (SPD) schedule with those of students in a Rotate-Eight Block (REB) schedule in a selected suburban Midwestern U.S. high school. Stratified random samples were selected based upon the treatment (schedule type), demonstrated general academic ability, ethnicity, and gender. Grade Point Averages (GPAs) and Missouri Assessment Program (MAP) test scores in mathematics and science were used as dependent measures in the comparisons. In the second part of the study, a survey of graduated students from each type of schedule was conducted to compare current post-graduate opinions of the experiences in each schedule.

The designs of the two parts of the study, the sample selection, and statistical analyses of the data are described in the following sections.

Design

Test data and demographic information were obtained from archival information on two graduated classes in a selected suburban Midwestern high school with an annual enrollment, grades 9 to 12, of approximately 1000 students. The school district in which the school is located expressed an interest in the results of the study at the time the study was proposed, and provided extensive support in providing access to demographic information and test data from archival sources. (See Appendix A.) Both groups of students took the MAP tests in mathematics in grade 8, and the MAP tests in mathematics and in science in grade 10. MAP test information can be found in Appendix B.

The research design for the first part of the study was quasi-experimental in nature. A pretest-posttest comparison-group design was used in comparing MAP scores by means of a three-way analysis of variance. Also included in the achievement comparisons were univariate three-way analyses of variance (ANOVA) of the differences in post-treatment means of GPAs in mathematics and in science. All main effects and interactions were tested. Where initial equivalence of the subgroups was not found, a three-way analysis of variance was used to study the effects of the treatment on achievement for subgroups. All main effects and interactions were tested for these subgroups.

A stratified random sample of 50 students from each of the two classes was selected to conduct the first portion of the study. Demographic information about the subjects is found in Appendix B.

Equivalence of the comparison and treatment groups and subgroups was determined by a series of univariate analyses of variance of the MAP scores reported on the mathematics test taken in grade 8. A three-way analysis of variance of the posttest means was conducted to investigate the main effects and interactions. Where initial equivalence could not be established between groups, subgroups of interest were further analyzed in a three-way analysis of variance. All interactions and main effects were tested.

Mathematics achievement was defined by two measures. The first was the score reported on the grade 10 MAP test in mathematics. The second was a mathematics grade point average (GPA_{MA}) obtained from an examination of each student's transcripted grades. Grades in mathematics classes taken in the first four high school semesters (freshman and sophomore years) were separated from all other grades, and used to calculate a mathematics GPA separate from the overall cumulative GPA. Each mathematics semester grade of A was

valued at 4.0, each B at 3.0, each C at 2.0, each D at 1.0, and each F at 0.0 to determine a mathematics grade point average. In those instances in which transcripts indicated credits of one quarter rather than one semester, the credit points were pro-rated to one half the weight of semester credit points.

Science achievement was similarly defined. The first measure was the score reported on the grade 10 MAP test in science. The second was a science grade point average (GPA_{SC}) obtained from an examination of each student's transcripted grades. Grades in science classes taken in the freshman and sophomore years were separated from all other grades and used to calculate a separate science GPA, in similar fashion to the calculation of the mathematics GPA.

For the second portion of the study, survey information was gathered through an original survey of graduates concerning their current opinions about the schedules they experienced in high school. A copy of the survey administered is found in Appendix C. The subjects were students who graduated with the Class of 2002 and with the Class of 2004.

While there was some turnover in teaching staff during the intervening two years between the groups, there is no reason to assume the quality of the instructors for each group was not equivalent. Nearly all instructors at the site in the 2001 and 2002 school years were thoroughly familiar with the Six-Period Day schedule format of 55-minute periods, which had been in place for many years. Nearly all instructors at the site in the 2003 and 2004 school years were new to the Rotate-Eight Block schedule format of 90-minute periods. All, however, had received school district sponsored training in the prior two years on implementing longer class periods, and a few had taught in longer periods as part of a pilot study.

MAP testing conditions can also be assumed to have been equivalent for the groups, as the MAP tests are conducted in the same controlled fashion annually at the site and across the state. There is no reason to assume any extraneous variables were unequal across the groups, because the stratified selection of the subjects was random to control bias in the composition of the groups.

Samples

For the first portion of the study, stratified random samples were selected. The samples were stratified random rather than merely random in order to better represent the characteristics of the populations studied. The first (comparison) group was comprised of students who experienced a Six-Period Day (SPD) schedule, and the second group (experimental) was comprised of students who experienced a Rotate-Eight Block (REB) schedule. The stratified random selection process was designed to take into account general academic ability, ethnicity and gender.

General academic ability was determined by class rank based on cumulative grade point average on all courses taken through the first four semesters of high school. Those students with class ranks in the upper half of the population in grade 10, based on cumulative grade point average in all subject areas, were defined to be of higher demonstrated general academic ability, and those students with class ranks in the lower half of the population, based on cumulative grade point average in all subject areas, were defined to be of lower demonstrated general academic ability. Fifty percent of the students selected for the stratified random sample were of upper general academic ability, and 50% were of lower general academic ability.

Ethnic identity and gender were taken from MAP test demographic data, as self-reported by each student at the time the test was taken. Students who identified themselves as other than Caucasian or African-American on their grade 10 MAP tests were not included in the study. Caucasian and African-American students who entered the class after grade 8, or whose records were otherwise incomplete for the purposes of the study, were not included in the sample selection process.

The total population of African-American students included in the SPD schedule (comparison) sample selection was 67 (31%), and the population of Caucasian students included in the sample selection was 149 (69%), so that $N_{SPD} = 216$. Of the 50 students included in the SPD schedule sample, 25 are male and 25 female, and 25 are of upper general academic ability and 25 of lower general academic ability. Fourteen identify themselves as African-American (28%) and 36 identify themselves as Caucasian (72%), so that $n_{SPD} = 50$. See Appendix B.

The total population of African-American students included in the REB schedule (experimental) sample selection was 62 (26%), and the population of Caucasian-American students included in the sample selection was 179 (74%), so that $N_{REB} = 241$. Of the 50 students included in the experimental sample, 25 are male and 25 female, and 25 are of upper general academic ability and 25 of lower general academic ability. Fourteen identify themselves as African-American (28%) and 36 identify themselves as Caucasian-American (72%), so that $n_{REB} = 50$. See Appendix B.

Analysis of MAP test results, and of math and science GPAs

Equivalence of the comparison and experimental samples was determined through analysis of the scores reported on the MAP mathematics tests taken in grade 8. Univariate

analyses of variance (ANOVA) were used to establish equivalence of the groups. Analysis was based on schedule type, ethnicity, and general academic ability. Gender was also taken into account. The software package SPSS 14.0 was used for all descriptive statistics and analyses. Significance was set at the .05 level.

Achievement levels in mathematics and in science were calculated and analyzed on the basis of scores reported on the MAP tests in mathematics and science in grade 10, and also on the basis of the mathematics grade point average and the science grade point average in grade 10. A three-way analysis of variance (ANOVA) was used on each post-treatment achievement measure to study the main effects and interactions of treatment, ethnicity, and ability level. The first independent variable tested was type of schedule, which was divided into two levels, SPD schedule as experienced by the Class of 2002, and REB schedule as experienced by the Class of 2004. The second independent variable tested was ethnicity, examined at two levels: African-American and Caucasian. The third independent variable tested was ability level, examined at two levels: higher academic ability, and lower academic ability. All interactions and main effects were tested. Gender was also taken into account. The general linear model in the statistics software package SPSS 14.0 for Windows (2005) was used for all statistical computations.

Surveys of graduates

Surveys were mailed to random samples of 75 members of each of the two graduated classes, stratified by gender and ethnicity. All students who graduated with the classes of 2002 and 2004 were included in the random selection process for the receipt of surveys, so that $N_{2002} = 232$, and $N_{2004} = 253$. (See Appendix D.) Additional mailings and follow-up

phone calls and e-mails were used to increase the rate of participation. All the graduates surveyed had reached 18 years of age.

A total of nine survey items required responses on a 5-point Likert-type scale from "Strongly Agree" to "Strongly Disagree" (Appendix C). The nine items surveyed divide into three areas: questions regarding graduates' current perceptions of their own personal participation in the schedule experienced (items 6 through 9), questions regarding graduates' current perceptions of the effectiveness of classroom activities in the schedule experienced (items 1 through 5), and the overall effectiveness of the schedules (all items, 1 through 9). All IRB requirements and guidelines were observed. (See Appendix C.)

Analysis of survey results

Demographic data on respondents is included in Appendix D. Individual responses and descriptive results of the responses to each survey item are included in Appendix E. Reliability of the original survey and its subscales was measured by calculation of Cronbach's alpha, adjusted by the Spearman-Brown formula, as discussed in Chapter 4 and reported in Appendix F. Responses were numerically scaled from 5 ("strongly agree") to 1 "strongly disagree." Four of the nine items (Items 2, 4, 6, and 8) were reverse-scored. A 2 x 2 x 2 three-way analysis of variance (ANOVA) was used to analyze the survey scores. The first level of the analysis was treatment (schedule type, Six-Period Day or Rotate-Eight Block). The second level was ethnicity, African-American or Caucasian. The third level was by gender. All interactions and main effects were tested. Results are reported in Chapter 4.

Summary

The first part of this study was designed to compare the mathematics and science achievement levels of students in a Six-Period Daily (SPD) schedule with those of students in

a Rotate-Eight Block (REB) schedule in a selected suburban Midwestern high school. Stratified random samples were selected from the population based upon treatment (SPD or REB), demonstrated general academic ability (upper or lower), ethnicity (African-American or Caucasian), and gender (female or male). MAP grade 8 mathematics test scores were used to establish equivalence of groups and subgroups. MAP grade 10 test scores and GPAs in mathematics and science were used in the comparisons of the achievement levels.

In the second part of this study, graduates of each type of schedule were surveyed in order to compare their current opinions regarding the perceived effectiveness of the schedules.

Chapter 4

Results

Overview

This chapter presents the findings of the study. The purpose of this study was twofold. The first part of the study compared the effects of the treatments on a selected Midwestern suburban secondary school's students' achievement in mathematics and science. The experimental treatment consisted of Rotate-Eight Block (REB) scheduling in grades 9 and 10, and the comparison treatment consisted of Six-Period Daily (SPD) scheduling in grades 9 and 10. The second part of the study utilized an original survey to examine the current opinions of graduates concerning those schedules.

Three major research questions were examined overall. In the first part of the study two major questions were investigated:

- Do students in a REB schedule (experimental group) have different achievement levels in mathematics compared to levels achieved by students in an SPD schedule (comparison group)?
- Do students in a REB schedule (experimental group) have different achievement levels in science compared to levels achieved by students in an SPD schedule (comparison group)?

These questions were investigated by means of mathematics and science MAP tests, along with mathematics and science grade point averages (GPAs). Students were grouped by treatment (REB and SPD schedules), ethnicity (African-American and Caucasian), and ability level (higher and lower). The effects of gender were also taken into account.

Univariate analyses of variance (ANOVA) were used to analyze the data. To determine the significance of treatment effects, the null hypotheses were tested for the significance of the effects of the individual factors and for the significance of the effects of interactions. All main effects and interactions were tested. A 2 x 2 x 2 three-factor univariate analysis of variance, treatment by ethnicity by ability, was used. The general linear model in SPSS for Windows, version 14.0 (2005) was employed to conduct all analyses. Significance was set at the .05 level.

Part two of the study investigated the third research question, as measured by an original survey:

- Do graduates who had a REB schedule (experimental group) currently report different opinions toward their experience in that schedule, compared to opinions currently reported by graduates who had an SPD schedule (comparison group)?

Univariate analyses of variance (ANOVA) were used to analyze the data obtained from the survey. The research hypothesis was tested by attempting to reject its null hypothesis. The null hypothesis was analyzed for the effects of treatment, ethnicity, and gender, and for the effects of interactions between the factors. A 2 x 2 x 2 three-factor analysis of variance, treatment by ethnicity by gender, was used. The first factor, treatment, was examined at two levels of schedule type, REB (experimental) and SPD (comparison). The second factor, ethnicity, was examined at two levels, African-American and Caucasian. The third factor was gender. All main effects and interactions were tested. Reliability of the survey was tested by calculation of Cronbach's alpha (index of internal consistency). The general linear model in the statistics package SPSS for Windows, version 14.0 (2005) was used for all calculations and analyses. A significance level of .05 was employed throughout.

The following sections describe

- the research hypotheses and the corresponding null hypotheses used to test initial equivalence of the treatment groups and subgroups on the pre-treatment measure and to test statistical significance of results on the post-treatment measures,
- the results of the statistical analyses performed on the pre-treatment measure to establish equivalence of the experimental and comparison groups, and
- the results of the statistical analyses performed on the post-treatment measures in part 1 and in part 2 of the study.

Research and null hypotheses, part 1 of the study

Four hypotheses and their corresponding null hypotheses were used in investigating the first two research questions. Those were as follows.

H1 There is a statistically significant difference in the scores obtained on the mathematics portion of the MAP by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the scores obtained by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

$H1_0$ There is no statistically significant difference in the scores obtained on the mathematics portion of the MAP by students in a suburban Midwestern high school who received instruction in a Rotate-Eight Block schedule format (experimental group) compared to the scores obtained by students who received instruction in a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

H2 There is a statistically significant difference in the mathematics grade point averages (GPA_{MA}) obtained by students in a suburban Midwestern high school who experienced a

Rotate-Eight Block schedule format (experimental group) compared to the mathematics grade point averages (GPA_{MA}) obtained by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

$H2_0$ There is no statistically significant difference in the mathematics grade point averages (GPA_{MA}) obtained by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the mathematics grade point averages (GPA_{MA}) obtained by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

H3 There is a statistically significant difference in the scores obtained on the science portion of the MAP by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the scores obtained by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

$H3_0$ There is no statistically significant difference in the scores obtained on the science portion of the MAP by students in a suburban Midwestern high school who received instruction in a Rotate-Eight Block schedule format (experimental group) compared to the scores obtained by students who received instruction in a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

H4 There is a statistically significant difference in the science grade point averages (GPA_{SC}) obtained by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the science grade point averages (GPA_{SC}) obtained by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

$H4_0$ There is no statistically significant difference in the science grade point averages (GPA_{SC}) obtained by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the science grade point averages (GPA_{SC}) obtained by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

Equivalence of the experimental and comparison groups

The means (m) and standard deviations (sd) of the scores on the grade 8 MAP mathematics examinations for the comparison group (SPD schedule, Class of 2002) and for the experimental group (REB schedule, Class of 2004) are shown in Table 1, along with those for ethnicity groups and ability level groups within each treatment group.

Univariate analyses of variance (ANOVA) were conducted to test pre-treatment equivalency of all groups. The pre-treatment measure was the grade 8 MAP mathematics score. The factors of treatment, ethnicity, and ability level were analyzed for main effects and for interactions. A three-factor (2 x 2 x 2) univariate analysis of variance (ANOVA) was used. All main effects and interactions were investigated. Results are shown in summary Table 2.

Table 1

Means (*m*) and Standard Deviations (*sd*) of the Grade 8 MAP

Mathematics (Pre-Treatment) Scores

	REB			SPD			All		
Ethnicity	*N*	*m*	*sd*	*N*	*m*	*sd*	*N*	*m*	*sd*
Ability									
African-American									
Higher	3	734.00	9.17	4	707.00	23.31	7	718.57	22.54
Lower	11	681.45	37.27	10	690.90	29.64	21	685.95	33.37
Subtotal	14	692.71	39.78	14	695.50	28.12	28	694.11	33.83
Caucasian									
Higher	22	758.86	25.02	21	755.52	28.86	43	757.23	26.69
Lower	14	704.14	40.10	15	719.60	30.36	29	712.14	35.63
Subtotal	36	737.58	41.29	36	740.00	34.16	72	739.07	37.66
Total	50	725.02	45.30	50	727.94	38.22	100	726.48	41.72
Higher	25	755.88	24.96	25	747.76	33.04	50	751.82	29.27
Lower	25	694.16	39.77	25	708.12	32.76	50	701.14	36.75

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)
SPD = Six-Period Day Schedule (Comparison Treatment Group)

Table 2

Analysis of Variance (Treatment x Ethnicity x Ability) of the Grade 8 MAP Mathematics (Pre-Treatment) Scores

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	Part Eta Squared
Between Subjects						
Treatment (T)	29.40	1	29.40	0.03	0.861	0.000
Ethnicity (E)	15485.20	1	15485.20	16.34	0.000	0.151
Ability (A)	25236.76	1	25236.76	26.62	0.000	0.224
T x E	875.68	1	875.68	0.92	0.339	0.010
T x A	3035.30	1	3035.30	3.20	0.077	0.034
E x A	481.36	1	481.36	0.51	0.478	0.005
T x E x A	309.79	1	309.79	0.33	0.569	0.004
Within Subjects						
Error	87206.77	92	947.90			
Total	52949654.00	100				

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)
SPD = Six-Period Day Schedule (Comparison Treatment Group)

As presented in summary Table 2, the results of the univariate analyses of variance (ANOVA) of the means obtained on the grade 8 mathematics MAP test revealed

- no significant treatment effects.
- a significant ethnicity effect ($p < .001$). Caucasian students outperformed African-American students in both treatment groups.
- a significant ability effect ($p < .001$). High-ability students outperformed low-ability students in both treatment groups.
- no significant interaction effects.

The results presented in Table 2 established overall initial equivalence of the experimental and comparison treatment groups based on lack of statistical significance found in the differences of the means of the grade 8 MAP mathematics (pre-treatment) scores for students in the SPD schedule, as compared to pre-treatment differences of the means for students in the REB schedule. (See Table 2.)

Groups based on ethnicity did not exhibit equivalence on the pre-treatment measure. Ethnicity was found to be statistically significant as a main effect influencing grade 8 MAP mathematics (pre-treatment) scores ($p < .001$), so that initial equivalency of the Caucasian and African-American groups was not established. (See Table 2.) Caucasian students as a group scored significantly higher on the pre-treatment measure than did African-American students as a group.

Groups based on ability level were not equivalent on the pre-treatment measure. Ability level was found to be statistically significant as a main effect influencing grade 8 MAP mathematics (pre-treatment) scores ($p < 0.001$), so that initial equivalency of the higher-ability and lower-ability groups was not established. (See Table 2.) Higher-ability

students as a group scored significantly higher on the pre-treatment measure than did lower-ability students as a group.

No interaction effects of any order were found to be statistically significant at the .05 level. On the basis of no significant interaction effects discovered, ethnicity and ability level subgroups were found to be equivalent across the treatments; that is, students of the same ethnicity and the same ability level were found to have no significant differences in the means of scores obtained on the pre-treatment measure (the grade 8 MAP mathematics test) regardless of treatment group.

In summary, overall sample groups based on treatment (REB schedule or SPD schedule) were found to be initially equivalent, on the basis of no statistically significant differences found between the means of the scores obtained by the experimental treatment group (REB schedule) and the comparison treatment group (SPD schedule) on the pre-treatment measure, the grade 8 mathematics MAP test. Subgroups within ability-level and ethnicity groups were found to be initially equivalent across treatments on the basis of no statistically significant differences found in interactions.

Results of analyses of mathematics post-treatment measures

The post-treatment instrument used in testing research hypothesis 1 and its null hypothesis (H1, $H1_0$) was the Missouri Assessment Program (MAP) test in mathematics administered to all tenth grade students in Missouri annually. The post-treatment instrument used to test research hypothesis 2 and its null hypothesis (H2, $H2_0$) was grade point average in mathematics (GPA_{MA}) as accumulated in the four high school semesters leading up to the MAP tests. All analyses were performed using the general linear model in the statistics package SPSS, version 14.0 for Windows (2005).

Research hypothesis 1 (H1) was tested by attempting to reject its null hypothesis ($H1_0$) for the first post-treatment measure in mathematics. To examine statistical significance for the effects of treatment, ethnicity, and ability level, analyses of variance were performed. A three-factor (2 x 2 x 2) univariate analysis of variance (ANOVA) was used. Gender was also taken into account by equalizing gender across subgroups to the extent possible. Research hypothesis 2 (H2) was tested by attempting to reject its null hypothesis ($H2_0$) for the second post-treatment measure in mathematics, grade 10 mathematics grade point averages (GPA_{MA}). Tables 3 and 5 present the means and standard deviations on the grade 10 mathematics MAP test measure, and on the grade 10 mathematics grade point averages (GPA_{MA}) measure, respectively. Summary Tables 4 and 6 present the overall results of the analyses of variance performed on the respective measures.

As presented in Table 4, the results of the univariate analyses of variance (ANOVA) of the means obtained on the grade 10 mathematics MAP scores indicated

- no significant treatment effects.
- a significant effect for ethnicity ($p < .001$). Caucasian students outperformed African-American students within both treatment groups.
- a significant ability effect ($p < .001$). High-ability students outperformed low-ability students within both treatment groups.
- no significant interaction effects.

No significant effects or interactions were found on the basis of treatment (schedule type) for the first mathematics post-treatment measure, grade 10 mathematics MAP tests, therefore the null hypothesis could not be rejected for these groups. The research hypothesis

Table 3

Means (*m*) and Standard Deviations (*sd*) of the Grade 10 MAP Mathematics (Post-Treatment) Scores

	REB			SPD			All		
Ethnicity	*N*	*m*	*sd*	*N*	*m*	*sd*	*N*	*m*	*sd*
Ability									
African-American									
Higher	3	756.33	27.06	4	741.25	34.93	7	747.71	30.32
Lower	11	691.73	41.03	10	695.70	41.46	21	693.62	40.24
Subtotal	14	705.57	46.52	14	708.71	43.90	28	707.14	44.42
Caucasian									
Higher	22	779.91	33.82	21	779.86	28.10	43	779.88	30.79
Lower	14	722.21	45.25	15	734.13	31.85	29	728.38	38.66
Subtotal	36	757.47	47.55	36	760.81	37.14	72	759.14	42.39
Total	50	742.94	52.37	50	746.22	45.33	100	744.58	48.76
Higher	25	777.08	33.51	25	773.68	31.92	50	775.38	32.44
Lower	25	708.80	45.26	25	718.76	40.07	50	713.78	42.60

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)
SPD = Six-Period Day Schedule (Comparison Treatment Group)

Table 4

Analysis of Variance (Treatment x Ethnicity x Ability) of the Grade 10

MAP Mathematics (Post-Treatment) Scores

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	Part Eta Squared
Between Subjects						
Treatment (T)	.57	1	.57	.00	.983	.000
Ethnicity (E)	17095.55	1	17095.55	13.32	.000	.126
Ability (A)	45368.64	1	45368.64	35.36	.000	.278
T x E	525.13	1	525.13	.41	.524	.004
T x A	957.50	1	957.50	.75	.390	.008
E x A	45.15	1	45.15	.04	.852	.000
T x E x A	49.93	1	49.93	.04	.844	.000
Within Subjects						
Error	118054.18	92	1283.20			
Total	55675304.00	100				

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)
SPD = Six-Period Day Schedule (Comparison Treatment Group)

could therefore not be accepted on the basis of the first measure for mathematics achievement.

Table 5 presents the means and standard deviations on the second measure for mathematics achievement, grade 10 mathematics grade point average (GPA_{MA}).

As presented in Table 6, the results of the univariate analyses of variance (ANOVA) of the means obtained on the grade 10 mathematics grade point average (GPA_{MA}) indicated

- no significant treatment effects.
- a significant effect for ethnicity ($p = .002$). Caucasian students outperformed African-American students within both treatment groups.
- a significant ability effect ($p < .001$). High-ability students outperformed low-ability students within both treatment groups.
- no significant interaction effects.

No significant effects or interactions were found on the basis of treatment (schedule type) for the second mathematics post-treatment measure, grade 10 mathematics grade point averages (GPA_{MA}); therefore, the null hypothesis could not be rejected for these groups. The research hypothesis could therefore not be accepted on the basis of the second measure for mathematics achievement.

Table 5

Means (*m*) and Standard Deviations (*sd*) of the Grade 10

Mathematics (Post-Treatment) GPAs (GPA_{MA})

	REB			SPD			All		
Ethnicity	*N*	*m*	*sd*	*N*	*m*	*sd*	*N*	*m*	*sd*
Ability									
African-American									
Higher	3	2.92	.58	4	3.06	.43	7	3.00	.46
Lower	11	1.67	.84	10	2.03	.90	21	1.84	.87
Subtotal	14	1.94	.94	14	2.32	.92	28	2.13	.93
Caucasian									
Higher	22	3.44	.44	21	3.54	.43	43	3.49	.43
Lower	14	2.37	.65	15	2.36	.76	29	2.36	.70
Subtotal	36	3.02	.75	36	3.05	.83	72	3.04	.79
Total	50	2.72	.94	50	2.84	.91	100	2.78	.92
Higher	25	3.38	.48	25	3.47	.46	50	3.42	.47
Lower	25	2.06	.81	25	2.22	.82	50	2.14	.81

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)
SPD = Six-Period Day Schedule (Comparison Treatment Group)

Table 6

Analysis of Variance (Treatment x Ethnicity x Ability) of the Grade 10 Mathematics (Post-Treatment) GPAs (GPA_{MA})

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	Part Eta Squared
Between Subjects						
Treatment (T)	.35	1	.35	.86	.356	.009
Ethnicity (E)	4.12	1	4.12	10.20	.002	.100
Ability (A)	20.59	1	20.59	50.97	.000	.356
T x E	.17	1	.17	.42	.518	.005
T x A	.01	1	.01	.03	.875	.000
E x A	.00	1	.00	.00	.973	.000
T x E x A	.10	1	.10	.26	.615	.003
Within Subjects						
Error	37.17	92	.40			
Total	857.85	100				

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)
SPD = Six-Period Day Schedule (Comparison Treatment Group)

Results of analyses of science post-treatment measures

The post-treatment instrument used in testing research hypothesis 3 and its null hypothesis (H3, $H3_0$) was the Missouri Assessment Program (MAP) test in science administered to all tenth grade students in Missouri annually. The post-treatment instrument used to test research hypothesis 4 and its null hypothesis (H4, $H4_0$) was grade point average in science (GPA_{SC}) as accumulated in the four high school semesters leading up to the MAP tests. All analyses were performed using the general linear model in the statistics package SPSS, version 14.0 for Windows (2005).

Research hypothesis 3 (H3) was tested by attempting to reject its null hypothesis ($H3_0$) for the first post-treatment measure in science, grade 10 science MAP test scores. To examine statistical significance for the effects of treatment, ethnicity, and ability level, analyses of variance were performed. A three-factor (2 x 2 x 2) univariate analysis of variance (ANOVA) was used. Gender was also taken into account by equalizing gender across subgroups to the extent possible. Research hypothesis 4 (H4) was tested by attempting to reject its null hypothesis ($H4_0$) for the second post-treatment measure in science, grade 10 science grade point averages (GPA_{SC}). Tables 7 and 9 present the means and standard deviations on the grade 10 science MAP test measure, and on the grade 10 science GPA (GPA_{SC}) measure, respectively. Summary Tables 8 and 10 present the overall results of the analyses of variance performed on the respective measures.

Table 7

Means (*m*) and Standard Deviations (*sd*) of the Grade 10

MAP Science (Post-Treatment) Scores

	REB			SPD			All		
Ethnicity	*N*	*m*	*sd*	*N*	*m*	*sd*	*N*	*m*	*sd*
Ability									
African-American									
Higher	3	730.33	27.54	4	725.00	25.31	7	727.29	24.11
Lower	11	681.18	32.47	10	698.40	33.34	21	689.38	33.24
Subtotal	14	691.71	36.95	14	706.00	32.76	28	698.86	35.03
Caucasian									
Higher	22	743.55	19.08	21	752.29	28.25	43	747.81	24.12
Lower	14	702.43	34.14	15	709.73	28.19	29	706.21	30.86
Subtotal	36	727.56	32.63	36	734.56	35.03	72	731.06	33.79
Total	50	717.52	37.24	50	726.56	36.45	100	722.04	36.94
Higher	25	741.96	20.02	25	747.92	29.15	50	744.94	24.93
Lower	25	693.08	34.44	25	705.20	30.21	50	699.14	32.64

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)
SPD = Six-Period Day Schedule (Comparison Treatment Group)

Table 8

Analysis of Variance (Treatment x Ethnicity x Ability) of the

Grade 10 MAP Science (Post-Treatment) Scores

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	Part Eta Squared
Between Subjects						
Treatment (T)	775.88	1	775.88	.97	.328	.010
Ethnicity (E)	5311.64	1	5311.64	6.62	.012	.067
Ability (A)	25278.20	1	25278.20	31.48	.000	.255
T x E	17.21	1	17.21	.02	.884	.000
T x A	443.49	1	443.49	.55	.459	.006
E x A	62.35	1	62.35	.08	.781	.001
T x E x A	572.28	1	572.28	.71	.401	.008
Within Subjects						
Error	73876.81	92	803.01			
Total	52269288.00	100				

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)
SPD = Six-Period Day Schedule (Comparison Treatment Group)

As presented in Table 8, the results of the univariate analyses of variance (ANOVA) of the means obtained on the grade 10 science MAP scores indicated

- no significant treatment effects.
- a significant effect for ethnicity ($p = .012$). Caucasian students outperformed African-American students within both treatment groups.
- a significant ability effect ($p < .001$). High-ability students outperformed low-ability students within both treatment groups.
- no significant interaction effects.

No significant effects or interactions were found on the basis of treatment (schedule type) for the first science post-treatment measure, grade 10 science MAP tests, therefore the null hypothesis could not be rejected for these groups. The research hypothesis could therefore not be accepted on the basis of the first post-treatment measure for science achievement, grade 10 science MAP tests.

Table 9 presents the means and standard deviations on the second post-treatment measure for science achievement, grade 10 science grade point average (GPA_{SC}).

Table 9

Means (*m*) and Standard Deviations (*sd*) of the Grade 10

Science (Post-Treatment) GPAs (GPA_{SC})

	REB			SPD			All		
Ethnicity	*N*	*m*	*sd*	*N*	*m*	*sd*	*N*	*m*	*sd*
Ability									
African-American									
Higher	3	3.08	.14	4	3.06	.63	7	3.07	.45
Lower	11	1.68	.53	10	1.58	.65	21	1.63	.57
Subtotal	14	1.98	.76	14	2.00	.93	28	1.99	.83
Caucasian									
Higher	22	3.18	.58	21	3.41	.44	43	3.29	.53
Lower	14	1.71	.63	15	1.80	.56	29	1.76	.58
Subtotal	36	2.61	.94	36	2.74	.94	72	2.67	.93
Total	50	2.44	.93	50	2.53	.99	100	2.48	.95
Higher	25	3.17	.55	25	3.35	.48	50	3.26	.52
Lower	25	1.70	.57	25	1.71	.59	50	1.71	.58

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)
SPD = Six-Period Day Schedule (Comparison Treatment Group)

Table 10

Analysis of Variance (Treatment x Ethnicity x Ability) of the Grade 10 Science (Post-Treatment) GPAs (GPA_{SC})

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	Part Eta Squared
Between Subjects						
Treatment (T)	.03	1	.03	.11	.746	.001
Ethnicity (E)	.49	1	.49	1.58	.213	.017
Ability (A)	35.35	1	35.35	114.82	.000	.555
T x E	.19	1	.19	.62	.435	.007
T x A	.05	1	.05	.16	.689	.002
E x A	.03	1	.03	.11	.743	.001
T x E x A	.003	1	.003	.008	.927	.000
Within Subjects						
Error	28.32	92	.31			
Total	706.19	100				

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)
SPD = Six-Period Day Schedule (Comparison Treatment Group)

As presented in Table 10, the results of the univariate analyses of variance (ANOVA) of the means obtained on the grade 10 science grade point average (GPA_{SC}) indicated

- no significant treatment effects.
- no significant effect for ethnicity.
- a significant ability effect ($p < .001$). High-ability students outperformed low-ability students within both treatment groups.
- no significant interaction effects.

No significant effects or interactions were found on the basis of treatment (schedule type) for the second science post-treatment measure, grade 10 science grade point averages, therefore the null hypothesis could not be rejected for these groups. The research hypothesis could therefore not be accepted on the basis of the second post-treatment measure for science achievement.

In summary, no statistically significant results or trends were discovered in part 1 of the study based upon treatment. None of the null hypotheses in part 1 ($H1_0$ through $H4_0$) could be rejected, and therefore none of the research hypotheses (H1 through H4) could be accepted.

Research hypothesis and null hypothesis, part 2 of the study

Part two of the study investigated the third research question, as measured by an original survey:

- Do graduates who had a REB schedule (experimental group) currently report different opinions toward their experience in that schedule, compared to opinions currently reported by graduates who had an SPD schedule (comparison group)?

In addition to investigating graduates' current opinions of the effectiveness of the treatment (schedule type) overall, subscales within the survey were designed to investigate the effectiveness of the student's own participation in the treatment (four survey items), and the effectiveness of the classroom activities in the treatment (five survey items).

The research hypothesis and its corresponding null hypothesis (H5, $H5_0$), were as follows.

H5 There is a statistically significant difference in the survey scores obtained from graduates of a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the survey scores obtained from graduates who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or gender.

$H5_0$ There is no statistically significant difference in the survey scores obtained from graduates of a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the survey scores obtained from graduates who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or gender.

Survey results and analyses

Groups and subgroups examined were based on treatment (REB schedule and SPD schedule), ethnicity (African-American and Caucasian), and gender (female and male). Graduates' individual responses are reported in Appendix E. Scores were computed based on the effectiveness of the treatment overall (survey items 1-9), on subscale items related to the effectiveness of the classroom activities in the treatment (survey items 1-5), and on subscale

items related to the effectiveness of the subject's own participation in the treatment (survey items 6-9). Four of the items were reverse-scored (survey items 2, 4, 6, and 8).

Reliability of the survey was measured through computation of Cronbach's index of internal consistency (Cronbach's alpha) on the basis of treatment, ethnicity and gender. The Spearman-Brown formula was applied to account for the small number of items. For the purposes of basic research, the survey was found to be reliable overall, and in both subscales, for all groups and subgroups. Results for treatment, ethnicity, and gender groups are reported in their entirety in Appendix F, summary Tables F1 through F3 respectively, and are followed by results for ethnicity and gender subgroups within the treatments (summary Tables F4 through F7).

Univariate analyses of variance (ANOVA) were used to analyze the data obtained from the survey. The research hypothesis was tested by attempting to reject its null hypothesis for the overall survey results and for each of the two subscales. To determine the significance of treatment effects, the null hypothesis was tested for the significance of the effects of the individual factors and for the significance of the effects of interactions. All main effects and interactions were tested. A 2 x 2 x 2 three-factor univariate analysis of variance, treatment by ethnicity by gender, was used. The general linear model in SPSS for Windows, version 14.0 (2005) was employed to conduct all analyses. Significance was set at the .05 level.

Table 11 presents the means and standard deviations of the scores for the overall effectiveness of the treatment schedules (9 items). The possible score for each of the items ranged from 1 (most negative response) to 5 (most positive response). Items 2, 4, 6 and 8 were reverse-scored. The minimum score possible for each treatment was 9 (completely

negative), and the maximum score possible was 45 (completely positive). A neutral response (3) on every item would have resulted in an overall score of 27.

As presented in summary Table 12, the results of the univariate analyses of variance (ANOVA) of the means obtained for the scores on overall effectiveness of the treatment schedules indicated

- a significant treatment effect (p = .009). Participants' scores for the overall effectiveness of each treatment differed significantly by treatment. Graduates of the SPD (comparison) schedule rated the overall effectiveness of the schedule higher (SPD mean = 34.43) than did graduates of the REB (experimental) schedule (REB mean = 32.12).
- no significant effect for ethnicity.
- no significant effect for gender.
- no significant interaction effects of any order.
- a trend in the interaction effect of treatment and ethnicity (p = .056).

Based on these findings of a significant treatment effect, the null hypothesis can be rejected for the treatment groups, and therefore the research hypothesis can be accepted. Graduates who experienced the REB schedule differed significantly in their opinions of the overall effectiveness of the schedule from graduates who experienced the SPD schedule (REB mean = 32.12, SPD mean = 34.43). A trend was also noted in the interaction of treatment and ethnicity. African-Americans' mean scores for the treatments' overall effectiveness more strongly favored the SPD over the REB schedule than did Caucasians' mean scores (African-Americans' SPD mean = 35.80, REB mean = 29.86; Caucasians' SPD mean = 33.88, REB mean = 32.73).

Table 11

Means (*m*) and Standard Deviations (*sd*) of Scores for the

Overall Effectiveness of the Treatment Schedules

	REB			SPD			All		
Ethnicity	*N*	*m*	*sd*	*N*	*m*	*sd*	*N*	*m*	*sd*
Gender									
African-American									
F	4	32.50	2.38	5	34.40	8.33	9	33.56	6.15
M	3	26.33	2.52	5	37.20	7.19	8	33.13	7.94
Subtotal	7	29.86	3.98	10	35.80	7.48	17	33.35	6.82
Caucasian									
F	11	33.36	5.84	13	34.31	3.77	24	33.88	4.74
M	15	32.27	3.39	12	33.42	4.25	27	32.78	3.77
Subtotal	26	32.73	4.51	25	33.88	3.95	51	33.29	4.24
Total	33	32.12	4.51	35	34.43	5.16	68	33.31	4.95
F	15	33.13	5.07	18	34.33	5.13	33	33.79	5.06
M	18	31.28	3.92	17	34.53	5.34	35	32.86	4.88

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)
SPD = Six-Period Day Schedule (Comparison Treatment Group)

Table 12

Analysis of Variance (Treatment x Ethnicity x Gender) of Scores for the Overall Effectiveness of the Treatment Schedules

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	Part Eta Squared
Between Subjects						
Treatment (T)	169.73	1	169.73	7.35	.009	.109
Ethnicity (E)	6.56	1	6.56	.28	.596	.005
Gender (G)	22.04	1	22.04	.96	.332	.016
T x E	87.54	1	87.54	3.79	.056	.059
T x G	64.66	1	64.66	2.80	.099	.045
E x G	1.46	1	1.46	.06	.802	.001
T x E x G	58.99	1	58.99	2.56	.115	.041
Within Subjects						
Error	1384.83	60	23.08			
Total	77089.00	68				

Table 13 presents the means and standard deviations of the scores for the effectiveness of the student's own participation in each treatment (items 6 – 9). Items 6 and 8 were reverse-scored. The possible score for each of the items ranged from 1 (most negative response) to 3 (neutral response) to 5 (most positive response), allowing a minimum score of 4 (completely negative) on the personal participation subscale, and a maximum of 20 (completely positive). A neutral response on every item would have resulted in a score of 12 for the subscale.

As presented in summary Table 14, the results of the univariate analyses of variance (ANOVA) of the means obtained on scores on the personal participation subscale in each treatment (items 6 – 9) indicated

- no significant effect for treatment.
- no significant effect for ethnicity.
- no significant effect for gender.
- no significant interaction effects of any order.

Based on these findings of no significant treatment or interaction effects, the null hypothesis can not be rejected for these groups, and so the research hypothesis can not be accepted for the personal participation subscale. Graduates of the two types of schedules did not differ significantly in their opinions on the personal participation subscale.

Table 13

Means (*m*) and Standard Deviations (*sd*) of Scores for the Effectiveness of the Student's Own Participation Subscale

	REB			SPD			All		
Ethnicity	*N*	*m*	*sd*	*N*	*m*	*sd*	*N*	*m*	*sd*
Gender									
African-American									
F	4	15.00	2.94	5	15.20	3.19	9	15.11	2.89
M	3	11.33	4.04	5	15.40	4.56	8	13.88	4.58
Subtotal	7	13.43	3.69	10	15.30	3.71	17	14.53	3.71
Caucasian									
F	11	15.09	3.30	13	15.31	2.81	24	15.21	2.98
M	15	13.60	2.41	12	15.25	2.01	27	14.33	2.35
Subtotal	26	14.23	2.86	25	15.28	2.41	51	14.75	2.68
Total	33	14.06	3.01	35	15.29	2.78	68	14.69	2.94
F	15	15.07	3.11	18	15.28	2.82	33	15.18	2.91
M	18	13.22	2.73	17	15.29	2.83	35	14.23	2.93

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)
SPD = Six-Period Day Schedule (Comparison Treatment Group)

Table 14

Analysis of Variance (Treatment x Ethnicity x Gender) of Scores for the Effectiveness of the Student's Own Participation Subscale

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	Part Eta Squared
Between Subjects						
Treatment (T)	28.91	1	28.91	3.39	.071	.053
Ethnicity (E)	4.12	1	4.12	.48	.490	.008
Gender (G)	19.33	1	19.33	2.26	.138	.036
T x E	4.43	1	4.43	.52	.474	.009
T x G	21.59	1	21.59	2.53	.117	.040
E x G	2.83	1	2.83	.33	.567	.005
T x E x G	4.55	1	4.55	.53	.468	.009
Within Subjects						
Error	512.20	60	8.54			
Total	15255.00	68				

Table 15 presents the means and standard deviations of the scores for the effectiveness of classroom activities subscale in each treatment (survey items 1 – 5). The possible score for each of the items ranged from 1 (most negative response) to 5 (most positive response), allowing a minimum score of 5 (most negative) on the classroom activities subscale, and a maximum of 25 (most positive). A neutral response on every item in the subscale would have resulted in a score of 15 for the subscale.

As presented in summary Table 16, the results of the univariate analyses of variance (ANOVA) of the means obtained on scores for the classroom activities subscale in each treatment (survey items 1 - 5) indicated

- a significant treatment effect (p = .010). Graduates' scores differed significantly for the classroom activities subscale by treatment. Graduates of the SPD (comparison) schedule rated the effectiveness of classroom activities significantly higher (SPD mean = 19.14) than did graduates of the REB (experimental) schedule (REB mean = 18.06).
- no significant effect for ethnicity.
- no significant effect for gender.
- a significant interaction effect of treatment by ethnicity (p = .021). In general graduates of the SPD schedule rated the effectiveness of classroom activities significantly higher than did graduates of the REB schedule, while African-American and Caucasian graduates' scores differed significantly. African-American graduates' opinions of the SPD schedule classroom activities were considerably higher than those expressed by African-American graduates in the REB (experimental) schedule (African-Americans' SPD mean = 20.50, REB

mean = 16.43), while Caucasian graduates of the SPD schedule rated the effectiveness of the classroom activities much closer to the level they rated the REB classroom activities (Caucasians' SPD mean = 18.60, REB mean = 18.50). Caucasian males scored the effectiveness of the classroom activities slightly higher in the REB schedule than in the SPD schedule (REB mean = 18.67, SPD mean = 18.17), but other subgroups did not. Caucasian females scored the classroom activities higher in the SPD schedule than in the REB schedule (REB mean = 18.27, SPD mean = 19.00), as did African-American females and males. African-American females' mean scores on the classroom activities subscale indicated more difference between treatments than did Caucasian females' mean scores, but not so much difference between treatments as found in African-American males' mean scores (African-American females' REB mean = 17.50, SPD mean = 19.20; African-American males' REB mean = 15.00, SPD mean = 21.80).

- no other significant interaction effects of any order.

Based on these findings, the null hypothesis can be rejected for these groups and subgroups, and the research hypothesis therefore can be accepted for the classroom activities subscale. Graduates differed significantly by treatment and ethnicity in their opinions of the effectiveness of the classroom activities in each schedule.

Table 15

Means (*m*) and Standard Deviations (*sd*) of Scores for the

Effectiveness of the Classroom Activities Subscale

	REB			SPD			All		
Ethnicity	*N*	*m*	*sd*	*N*	*m*	*sd*	*N*	*m*	*sd*
Gender									
African-American									
F	4	17.50	2.65	5	19.20	5.40	9	18.44	4.25
M	3	15.00	2.00	5	21.80	2.78	8	19.25	4.23
Subtotal	7	16.43	2.57	10	20.50	4.28	17	18.82	4.13
Caucasian									
F	11	18.27	3.23	13	19.00	1.63	24	18.67	2.46
M	15	18.67	1.72	12	18.17	2.55	27	18.44	2.10
Subtotal	26	18.50	2.42	25	18.60	2.12	51	18.55	2.26
Total	33	18.06	2.56	35	19.14	2.96	68	18.62	2.81
F	15	18.07	3.01	18	19.06	2.96	33	18.61	2.98
M	18	18.06	2.21	17	19.24	3.05	35	18.63	2.68

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)
SPD = Six-Period Day Schedule (Comparison Treatment Group)

Table 16

Analysis of Variance (Treatment x Ethnicity x Gender) of the

Effectiveness of the Classroom Activities Subscale

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	Part Eta Squared
Between Subjects						
Treatment (T)	49.52	1	49.52	6.99	.010	.104
Ethnicity (E)	.73	1	.73	.10	.750	.002
Gender (G)	3.16	1	3.16	.45	.507	.007
T x E	39.54	1	39.54	5.58	.021	.085
T x G	6.79	1	6.79	.96	.332	.016
E x G	2.99	1	2.99	.42	.518	.007
T x E x G	19.42	1	19.42	2.74	.103	.044
Within Subjects						
Error	425.18	60	7.09			
Total	24267.00	68				

Summary

In this chapter the results of the two parts of the study were presented. MAP scores in mathematics and science, along with GPAs in mathematics and science, were used to test whether there was a significant difference in the mathematics and science achievement levels of students who experienced a REB schedule (experimental treatment) compared to the achievement levels of students who experienced an SPD schedule (comparison treatment). Four research hypotheses were tested by attempting to reject their corresponding null hypotheses. Univariate analyses of variance (ANOVA) were conducted using a three-way, 2 x 2 x 2 design, to check for the influences of treatment (REB or SPD schedule), ethnicity (African-American or Caucasian) and ability level (higher or lower). Gender was taken into account by equalizing numbers across subgroups to the extent possible. The findings indicated that none of the null hypotheses could be rejected, and therefore none of the research hypotheses in part 1 of the study could be accepted. Students in the two types of schedules did not differ significantly in their mathematics and science achievement levels by any of the measures utilized.

Part 2 of the study utilized an original survey to investigate whether the graduates who experienced the two treatments hold opinions today that differ significantly. Overall effectiveness of the treatment schedule (all nine questions), a subscale on the effectiveness of the student's own participation (four questions), and a subscale on the effectiveness of the classroom activities (five questions) were examined. Internal reliability of the survey was found to be adequate for basic research purposes based on calculation of Cronbach's alpha, adjusted by the Spearman-Brown formula. Three-way, 2 x 2 x 2 (treatment by ethnicity by

gender) univariate analyses (ANOVA) were used to test the scores obtained from the survey overall and on each of the two subscales.

Analysis of the scores obtained from the survey overall indicated that opinions of the overall effectiveness of the schedule from graduates who experienced the SPD schedule differed significantly from opinions expressed by graduates who experienced the REB schedule. Based on these findings of a significant treatment effect, the null hypothesis can be rejected for the treatment groups, and therefore the research hypothesis can be accepted. Graduates who experienced the REB schedule differed significantly in their opinions of the overall effectiveness of the schedule from graduates who experienced the SPD schedule. A trend was also noted in the interaction of treatment by ethnicity. African-Americans' mean scores for the treatments' overall effectiveness more strongly favored the SPD over the REB schedule than did Caucasians' mean scores.

Analysis of the results from the personal participation subscale indicated that the null hypothesis could not be rejected, and so the research hypothesis could not be accepted. Graduates of the two types of schedules did not differ significantly in their opinions on the personal participation subscale.

Analysis of the results from the classroom activities subscale indicated that the null hypothesis could be rejected on the basis of treatment ($p = .010$). An interaction effect of treatment and ethnicity was also found ($p = .021$). Based on these findings, the research hypothesis therefore can be accepted for the classroom activities subscale. The graduates expressed opinions that differed significantly by treatment and ethnicity concerning the effectiveness of the classroom activities in each schedule. Further discussion of these findings and the implications follows in Chapter 5.

Chapter 5

Discussion

Overview

This chapter presents a summary of the study and of its findings. The limitations of the study, discussion of the findings, and implications for further research are included.

Purpose, hypotheses, and overall design of the study

The purpose of the first part of the study was to compare the effects of two types of secondary school schedules on achievement in mathematics and science. Test data and demographic information were obtained from archival information on two graduated classes in a selected suburban Midwestern high school with an annual enrollment, grades 9 to 12, of approximately 1000 students. The school district in which the school is located expressed an interest in the results of the study at the time the study was proposed, and provided extensive support in providing access to demographic information and test data from archival sources. The experimental treatment consisted of Rotate-Eight Block (REB) scheduling in grades 9 and 10, and the comparison treatment consisted of traditional Six-Period Daily (SPD) scheduling in grades 9 and 10.

Stratified random samples were selected based on treatment, ethnicity, ability level and gender. Grade Point Averages (GPAs) and Missouri Assessment Program (MAP) test scores in mathematics and science were used as dependent measures to test whether there was a significant difference in the mathematics and science achievement levels of students who experienced a REB schedule (experimental treatment) compared to the achievement levels of students who experienced an SPD schedule (comparison treatment). Research hypotheses 1 through 4 were tested by attempting to reject their corresponding null

hypotheses. Those research hypotheses and their corresponding null hypotheses, as reported earlier in chapters 1 and 4, were as follows.

H1 There is a statistically significant difference in the scores obtained on the mathematics portion of the MAP by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the scores obtained by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

$H1_0$ There is no statistically significant difference in the scores obtained on the mathematics portion of the MAP by students in a suburban Midwestern high school who received instruction in a Rotate-Eight Block schedule format (experimental group) compared to the scores obtained by students who received instruction in a Six-Period Daily schedule format (comparison group) regardless of ethnicity or ability level.

H2 There is a statistically significant difference in the mathematics grade point averages (GPA_{MA}) obtained by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the mathematics grade point averages (GPA_{MA}) obtained by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

$H2_0$ There is no statistically significant difference in the mathematics grade point averages (GPA_{MA}) obtained by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the mathematics grade point averages (GPA_{MA}) obtained by students who experienced

a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

H3 There is a statistically significant difference in the scores obtained on the science portion of the MAP by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the scores obtained by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

$H3_0$ There is no statistically significant difference in the scores obtained on the science portion of the MAP by students in a suburban Midwestern high school who received instruction in a Rotate-Eight Block schedule format (experimental group) compared to the scores obtained by students who received instruction in a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

H4 There is a statistically significant difference in the science grade point averages (GPA_{SC}) obtained by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the science grade point averages (GPA_{SC}) obtained by students who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

$H4_0$ There is no statistically significant difference in the science grade point averages (GPA_{SC}) obtained by students in a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the science grade point averages (GPA_{SC}) obtained by students who experienced a

Six-Period Daily schedule format (comparison group), regardless of ethnicity or ability level.

Univariate analyses of variance (ANOVA) were conducted in a three-way, 2 x 2 x 2 design, to check for the influences of treatment (REB or SPD schedule), ethnicity (African-American or Caucasian), and ability level (higher or lower). Gender was taken into account by equalizing numbers across subgroups to the extent possible.

Part 2 of the study utilized an original survey to examine whether the graduates who experienced the two treatments hold opinions today that differ significantly. Likert-style surveys were mailed to samples stratified by treatment, ethnicity and gender. The research hypothesis was tested by attempting to reject its corresponding null hypothesis for the survey overall and for two subscales. Research hypothesis 5 and its corresponding null hypothesis, as reported earlier in chapters 1 and 4, were as follows.

H5 There is a statistically significant difference in the survey scores obtained from graduates of a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the survey scores obtained from graduates who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or gender.

$H5_0$ There is no statistically significant difference in the survey scores obtained from graduates of a suburban Midwestern high school who experienced a Rotate-Eight Block schedule format (experimental group) compared to the survey scores obtained from graduates who experienced a Six-Period Daily schedule format (comparison group), regardless of ethnicity or gender.

Three-way, 2 x 2 x 2 (treatment by ethnicity by gender) univariate analyses (ANOVA) were utilized to test the scores obtained from the survey. The survey measured graduates' opinions concerning effectiveness of the treatment schedule overall (nine items) and two subscales: one concerning effectiveness of the classroom activities in the treatment (five items), and another concerning effectiveness of the student's own participation (four items). Computations of internal consistency for the survey overall and for each subscale were conducted by calculating Cronbach's alpha for each group and subgroup, as adjusted by the Spearman-Brown formula.

Summary of the findings

The findings of the study were as follows.

Higher ability groups and subgroups outperformed lower ability groups and subgroups within treatments at a significant level on every academic measure, including the pre-treatment measure, as would be expected by the definition of higher and lower general academic ability.

Caucasian groups and subgroups outperformed African-American groups and subgroups at a significant level on every measure, including the pre-treatment measure, with one exception. There was no significant difference found as a main effect for ethnicity on the science grade point average measure. The only significant main effect found on the science grade point average measure was ability. There were no significant interaction effects.

There were no significant main effects found for treatment (schedule type) in the investigation of any of the hypotheses regarding science and mathematics achievement levels (H1 – H4, $H1_0$ – $H4_0$), nor were there any significant interaction effects found.

Scores from the surveys revealed significant differences by treatment for the overall effectiveness of the schedule type. Graduates of the SPD schedule rated the overall effectiveness of the schedule significantly higher than did graduates of the REB schedule. A summed score of 27 on the nine items was an exactly neutral score; although the mean scores differed significantly, both group means were above neutral. While the REB group mean was 32.12, the SPD group mean was 34.43. An interaction was found with the discovery of a strong tendency ($p = .056$) in the interaction of treatment by ethnicity.

The interaction of treatment by ethnicity indicated that African-Americans' mean scores for the treatments' overall effectiveness more strongly favored the SPD over the REB schedule than did Caucasians' mean scores. In the REB schedule, the mean for African-Americans was only 2.86 points above exactly neutral at 29.86, while in the SPD schedule the mean was 35.80, 5.94 points higher than the REB mean for this subgroup, and a full 8.80 points higher than the exactly neutral mark (27.00). For Caucasians, the REB schedule mean rating was within 1.15 points of the SPD mean score (REB mean = 32.73, SPD mean = 33.88).

Scores from the survey subscale on effectiveness of the participant's personal participation in the schedule indicated no statistically significant main effects or interactions at the .05 level.

Scores from the survey subscale on effectiveness of classroom activities revealed significant differences by treatment ($p = .010$). An exactly neutral summed score for the five items on the classroom activities subscale was 15. Graduates of the SPD schedule scored the effectiveness of classroom activities significantly higher (SPD mean = 19.14) than did

graduates of the REB schedule (REB mean = 18.06). A significant interaction of treatment by ethnicity ($p = .021$) was also discovered.

The interaction effect of treatment by ethnicity indicated that while these subgroups generally rated both schedules above neutral for effectiveness of classroom activities, African-American and Caucasian graduates' scores differed significantly in the schedules. African-American graduates' opinions of the effectiveness of the SPD schedule classroom activities were considerably higher than those expressed by African-American graduates in the REB schedule (African-Americans' SPD mean = 20.50, REB mean = 16.43), while Caucasian graduates of the SPD schedule rated the effectiveness of the classroom activities much closer to the level they rated the REB classroom activities (Caucasians' SPD mean = 18.60, REB mean = 18.50). While Caucasian males rated the effectiveness of the classroom activities slightly higher in the REB schedule than in the SPD schedule (REB mean = 18.67, SPD mean = 18.17), other subgroups did not. Caucasian females rated the classroom activities higher in the SPD schedule than in the REB schedule (REB mean = 18.27, SPD mean = 19.00), as did African-American females and males. African-American females' mean scores on the subscale (REB mean = 17.50, SPD mean = 19.20) revealed more difference between treatments (1.70) than did Caucasian females' mean scores (0.73), but none showed nearly the difference between treatments (6.80) discovered in the mean scores for the African-American males subgroups (REB mean = 15.00, SPD mean = 21.80). Of all the subgroups' mean scores obtained on the subscale, only those of the REB African-American males' were as low as exactly neutral (15.00); all other subgroups scored both the REB and the SPD schedules above neutral in effectiveness in classroom activities.

Limitations of the study

The limitations of the study, as stated in Chapter 1, were as follows.

A limitation on the study was that the focus was narrow, including stratified random samples from two tenth grade classes at one selected Midwestern suburban school district with one high school of approximately 1000 students.

Another limitation on the study was the history of the participation of this suburban district in the St. Louis Voluntary Desegregation Plan. For the duration of this plan and as it began to phase out, up to approximately one half of the African-American students attending district schools lived in the City of St. Louis, which is outside the school district limits, and so were not resident students in this suburban school district. Their presence and participation in the study greatly enriched the data available, but requires an understanding that, in spite of the school's geographic position in the suburbs of St. Louis, the data analyzed were not wholly obtained from the suburban setting.

Another limitation was that the achievement data were taken from each student's sophomore year, so that even though the MAP tests were administered to all students under the same conditions, the students had experienced only two years of the schedules under study at the time of the testing.

While the teaching staff remained generally the same with very little turnover from the Class of 2002 to the Class of 2004, the vast majority of that teaching staff had no direct previous experience in teaching in a block schedule, as opposed to the school's long tradition in a six-period daily schedule. Teachers were provided training for teaching in the extended periods of the block schedule, but direct experience in block teaching was limited to a handful of teachers who piloted a limited number of block-style classes with volunteer

student participants from the Class of 2001. A few newcomers to the teaching staff (after 2000) had also taught in block-style schedules at their previous schools.

A final limitation of the study is that the surveys were conducted three years after graduation and five years after completion of grade 10 for the Class of 2002, and one year after graduation and three years after completion of grade 10 for the Class of 2004, so that memory must be acknowledged as a possible confounding factor.

Discussion of the findings in mathematics and science achievement levels

Students of higher ability can be expected by definition to outscore students of lower ability on academic measures. This reality was confirmed by the results of part one of the study, in which significant differences were found between the means of the scores obtained on every academic measure for groups based on ability in both treatments, not only in post-treatment measures, but also on the pre-treatment measure. In other words, students of higher ability started and ended at higher levels of achievement than did students of lower ability, regardless of treatment condition.

Also confirmed in part one of the study is the existence in this population of the well-publicized "achievement gap" between Caucasian and African-American students. Significant differences were found between the means of the scores obtained on every measure for groups based on ethnicity in both treatments, not only in post-treatment measures, but also on the pre-treatment measure, with one exception: science grade point average. In other words, African-American students started and ended at significantly lower levels of achievement than did Caucasian students, regardless of treatment group, with the one exception of grade point average in science classes (GPA_{sc}). This measure revealed no significant difference at the .05 level by ethnicity. There were no significant interaction

effects. The only significant difference found on this measure was for the main effect of ability. It is encouraging that at least on this one measure for this limited population, in the context of the small sample sizes that could be employed, no "achievement gap" could be found.

There were no significant main effects found for treatment (schedule type) in the investigation of any of the hypotheses regarding science and mathematics achievement levels, nor were there any significant interaction effects found. None of the null hypotheses ($H1_0 - H4_0$), could be rejected, and so therefore none of the research hypotheses in part one of the study (H1 – H4) could be accepted. The mathematics and science achievement levels of these student groups and subgroups did not vary by treatment (schedule type) beyond differences that can be attributed to chance.

An interesting finding, however, was that even though statistically the differences discovered could be attributed to chance, the pattern of differences in the mean improvements scored on the post-treatment measure grade 10 mathematics MAP tests consistently favored certain groups and subgroups. (See Appendix G.) The gains in the means for the grade 10 mathematics MAP test consistently favored lower ability groups and subgroups in the experimental (REB) schedule, as detailed in Appendix G, Table G1. Conversely, the gains in the means consistently favored higher ability groups and subgroups in the comparison (SPD) schedule, as detailed in Appendix G, Table G2.

Analyses revealed these figures statistically can be explained by chance; however, had larger sample sizes been possible, it is conceivable statistically significant results may have been achieved. It is possible the experimental (REB) schedule had some positive effects on performance for lower ability students, and conversely, the comparison (SPD) schedule

may have had some positive effects for higher ability students. Such results would support at least one claim often made by proponents of block scheduling: macroperiods of instructional time allow teachers to connect more effectively with students' preferred learning styles and interests, translating into higher levels of achievement. In this view, lower ability students would presumably have had more and better opportunities to work within their preferred styles in the REB schedule. On the other hand, it is feasible that higher ability students would have found themselves less often working in their preferred learning styles in the REB schedule. Higher ability students would presumably have to adjust in the REB schedule to working with fewer opportunities within their preferred styles.

One might expect these patterns to translate into survey results in which higher ability students scored the SPD schedule as more effective, and lower ability students scored the REB schedule as more effective. These patterns did not, however, so simply transfer into easily interpreted survey results, as discussed in the following section.

Discussion of the survey results

The analyses of the survey conducted in part two of the study indicated that the opinions held today by certain groups and subgroups about the effectiveness of the treatment schedules differed significantly on two of the three measures. One opinion that did not differ significantly between the groups was on the subscale of effectiveness of the student's own participation: while the REB group rated the effectiveness of their personal participation lower (14.06) than did the SPD group (15.29), both were well above the neutral mark of 12.00 for this subscale, and any differences noted between groups or subgroups can be attributed to chance.

It is important to note that in nearly every case in which a difference was found at the .05 level, both schedules were scored above neutral; that is, for all statistically significant main effects and interactions, both treatment schedules received above the "exactly neutral" summed score with the exception of one subgroup in the REB schedule. At 26.33 (standard deviation = 2.00), the African-American male REB subgroup mean for overall effectiveness of the treatment schedule was 0.67 below 27.00, the exactly neutral score for the nine-item scale. While it is true that this same subgroup's mean (11.33, standard deviation = 4.04) was 0.67 below 12.00 (exactly neutral for the four-item subscale) for effectiveness of personal participation, differences for this subscale were not statistically significant at the .05 level. In no other cases did any subgroup mean score fall below exactly neutral, however slightly, on any of the three measures.

Only one instance was discovered of any group or subgroup scoring the REB schedule above the SPD on any of the three measures: Caucasian males scored the effectiveness of the classroom activities in the REB slightly higher than those in the SPD. The REB mean was not higher than the SPD mean for any group or subgroup on any other measure. The widest difference of opinions was found on this measure between African-Americans and Caucasians, and more specifically, between African-American males and Caucasian males. While the mean for the Caucasian male subgroup was slightly higher for the REB (a difference of 0.50, with standard deviations of 1.72 and 2.55), African-American males' mean scores favored the SPD by a difference of 6.80 (SPD 21.80, standard deviation 2.78; REB 15.00, standard deviation 2.00).

This wide difference of opinion by ethnicity was reflected also in the nine-item measure, overall effectiveness of the treatment schedule. While all subgroups' means favored

the SPD on this measure, only one subgroup mean was below the exactly neutral mark (27.00) for the REB: African-American males'. African-American males also rated the SPD higher than did any other subgroup, thus expressing the strongest preference for the SPD that was expressed on the survey (SPD 37.20, standard deviation 7.19; REB 26.33, standard deviation 2.52).

It should not be surprising that in a population in which an academic achievement gap has been found, the groups' opinions about their academic experiences would differ. Nor should it be surprising that African-American males might hold the lowest opinions of academic experiences in general, given the lack of academic success that has been generally attributed to African-American males in the past. It is noteworthy that the opinions expressed concerning the experimental (REB) schedule did not fall much below neutral, or into clearly and indisputably negative opinions, merely lower than other subgroups' opinions.

Of interest is the finding that the highest ratings for the traditional (comparison, SPD) schedule were awarded by African-American males; this is not a schedule which is known for the academic success of its African-American students. Also of interest in this instance is that it is the lower ability groups (in which African-Americans, and especially African-American males, are disproportionately represented in the population at large), who were found to have made the largest gains in the REB schedule. It seems plausible that those students who are least comfortable in an academic environment will be even more uncomfortable in a new and "experimental" academic environment, especially one of the magnitude of a schedule change, where all "the rules" have to be re-learned. In such a case, it may matter little whether that schedule is designed to support all students, especially those not previously experiencing academic success, as has been theorized by block schedule and

REB proponents. A key consideration may well be students' familiarity and comfort with the schedule, perhaps as related to the length of time a school has been in a particular schedule, or perhaps as related to factors of school culture and climate.

Regardless of any possible differences in the academic gains (which statistically were not significant), these students rated the SPD schedule as more effective than the REB schedule on all three measures. While in no group or subgroup was the REB schedule rated as clearly negative, the SPD was consistently rated higher. This finding is at odds with the findings in many other studies in which students (as well as faculty, administration, and parents) expressed opinions favoring block schedules of various types. While not the case in this study, those results of higher satisfaction with block schedules were sometimes found in spite of lower academic scores.

Implications for further research

A review of related scholarly literature found a lack of research based exclusively on this particular configuration of block schedule. While the Rotate Eight Block configuration has often been the object of research, it has most often been included with other kinds of superficially similar schedules, based on the length of the individual instructional macroperiods utilized. In addition, relatively few research efforts have focused on particular ethnicity groups or on special needs students within the REB schedule, and while more studies are beginning to utilize more quantitative data from standardized tests, most in the past have exclusively employed surveys and Likert-type instruments. Further research focused exclusively on the REB configuration, and based on the quantitative results of various standardized tests, is recommended. In addition, further research focusing on the achievements of particular ethnicity groups as well as special needs groups in the REB is

recommended. Rates of attendance, pass and fail rates, graduation and drop out rates are all areas needing further examination.

Further research to investigate whether the Caucasian / African-American achievement gap may be lessened for science GPA based upon these schedule types is recommended.

Further research built upon larger sample sizes could clarify the possibility that lower ability students, whether Caucasian or African-American, may benefit from the REB schedule, for whatever reason. Similarly, continued research built upon larger sample sizes could clarify the possibility that higher ability students, whether Caucasian or African-American, may benefit from the SPD schedule.

Further research to investigate the relationship of student efficacy to achievement within the REB schedule is recommended. In light of the results found in the survey portion of this study, it would seem continued research investigating student, staff and parent opinions is advisable, perhaps most importantly in the area of students' own effective efforts. Without full engagement, students cannot be expected to achieve at their highest level of challenge. To find whether a particular schedule configuration contributes to that effective effort is a valuable and worthwhile endeavor.

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Appendix A

District Information

Enrollment - 3,356

Elementary - 329
Elementary - 333
Elementary - 349
Elementary - 419
Middle School - 781
High School - 1,145

Attendance & Graduation

Student Attendance Days: 177 days
Average Daily Attendance (2004-05): 98%
Graduation Rate: 97% (Class of 2005)
Graduates attending a 2- or 4-year college/university - 96% (Class of 2005)

Financial Issues

Average Per Pupil Expenditure (based on 2004-05 average daily attendance not including debt service): $12,214.75
Students Eligible for Free & Reduced Lunch (2004-05): 9.3%
Teacher Salary Range: $35,000-$94,152
Average Teacher Salary: $55,382
Percentage of Total Budget for Salaries & Benefits: 77%
Assessed Valuation: $1,153,583,800
2005 Tax Rate: Operations - $2.75; Debt Service - $0.23

Teachers & Classrooms

Full-Time Classroom Teachers: 287
Students to Classroom Teachers: 10.7:1
Teachers with 10 or More Years of Experience: 179
Teachers with Advanced Degrees: 157
Average Elementary Class Size (2005-06): 18.5:1

Test Scores

SAT

District:	Average Verbal - 649	Average Math - 662
	Top 25% Verbal - 700	Top 25% Math - 710
National:	Average Verbal - 508	Average Math - 520
Missouri:	Average Verbal - 588	Average Math - 588

ACT

District:	Composite - 25.3
	Top 25% - 29.1
National:	Composite - 20.9
Missouri:	Composite - 21.6

An Exceptional District

The Schools are comprised all or part of ten self-governed communities in St. Louis County, Missouri, and encompasses approximately 18 square miles with a population of more than 27,000 residents.

The student body is a socio-economically diverse group. The 2004-05 graduation rate was 97 percent with 96 percent of the graduating seniors continuing on to college.

The district prides itself on its outstanding teachers and staff. The district's commitment to its teachers is reflected in its unique incentive pay system, now in its 51st year, which rewards outstanding performance.

The parents and community residents are highly active in the schools and serve as members of strategic planning initiatives and curriculum committees.

The district has a budget of $46.7 million for the 2005-06 fiscal year, deriving 95 percent of its revenue from local sources.

The district's seven school buildings, all of brick construction, average approximately 50 years in age. A $40.9 million bond issue passed by the voters in 2001 has resulted in six of the seven buildings having modern heating, ventilation and air conditioning (HVAC) systems. The bond issue also resulted in major library/media centers, classroom and athletic facility improvements to the buildings.

National and Regional Recognitions

The district is considered one of the premier public school districts in the nation. It has received a variety of national and regional recognitions.

- For the past 20 years, approximately 10 percent of the members of each graduating class have been recognized by the National Merit Program as a finalist, semifinalist or commended student.
- A 2003 review of public high schools in *Newsweek* ranked High School in the top 1.7 percent of all high schools in the nation.
- The district has earned the prestigious "Distinction in Performance" Award from the Department of Elementary and Secondary Education (DESE) following the state's annual performance review for the fourth time in the four years the award has been given.
- The district has four Blue Ribbon Schools and two Gold Star Schools.

9703 Conway Road • St. Louis, MO 63124 • Phone 314-994-7080 • Fax: 314-994-0441

Student Instructional Resources
Renée Schuster, Director

DATE: November 18, 2003

TO: Brad Heger

FROM: Renée Schuster

RE: Dissertation

Your dissertation proposal entitled, *A Comparison of Achievement and Attendance Levels of High School Students in a Traditional Six-Period Daily Schedule With Those of Students in a Rotate-Eight Block Schedule* is of interest to School District. It will be of assistance in providing data for our program evaluation process. You have permission to use student demographic, MAP, PLAN, and attendance data. You also have permission to survey graduates. We would like to coordinate your survey with the follow-up surveys we are conducting of our graduates this year. My office can assist you in obtaining the coded student data you will need for your study.

Population, Class of 2002 (N = 216)

Coded Identifier	CUM GPA	Above /Below Median	Gender	Ethnicity
72153	4.000	Above	F	Caucasian
111153	4.000	Above	F	Caucasian
111953	4.000	Above	M	Caucasian
121853	4.000	Above	F	Caucasian
11754	4.000	Above	F	Caucasian
13354	4.000	Above	M	Caucasian
30854	4.000	Above	M	Caucasian
61953	4.000	Above	F	Caucasian
31354	4.000	Above	M	Caucasian
81553	4.000	Above	F	Caucasian
102653	4.000	Above	F	Caucasian
23054	3.983	Above	F	Caucasian
91753	3.980	Above	F	Caucasian
50954	3.966	Above	F	Caucasian
31753	3.964	Above	M	Caucasian
60654	3.963	Above	M	Caucasian
10654	3.954	Above	M	Caucasian
62854	3.900	Above	F	Caucasian
101353	3.896	Above	M	Caucasian
82254	3.889	Above	M	Caucasian
80453	3.875	Above	F	Caucasian
71153	3.875	Above	M	Caucasian
21554	3.860	Above	M	Caucasian
30554	3.860	Above	F	Caucasian
52354	3.851	Above	M	Caucasian
51954	3.833	Above	F	Caucasian
61854	3.816	Above	F	Caucasian
62754	3.813	Above	F	Caucasian
62054	3.813	Above	M	Caucasian
91454	3.808	Above	M	African-American
12754	3.796	Above	M	Caucasian
60754	3.788	Above	M	Caucasian
10454	3.787	Above	M	Caucasian
22954	3.774	Above	F	Caucasian
12254	3.760	Above	F	Caucasian
101253	3.750	Above	F	Caucasian
31153	3.731	Above	M	Caucasian
93053	3.714	Above	M	Caucasian
41053	3.712	Above	M	Caucasian
102353	3.708	Above	F	Caucasian
121753	3.689	Above	M	Caucasian
111753	3.686	Above	F	Caucasian

122853	3.681	Above	F	Caucasian
83153	3.654	Above	F	Caucasian
111053	3.647	Above	F	Caucasian
100953	3.641	Above	F	Caucasian
121153	3.638	Above	F	Caucasian
31754	3.635	Above	F	Caucasian
71153	3.604	Above	M	Caucasian
60754	3.604	Above	F	Caucasian
30354	3.596	Above	F	Caucasian
52454	3.585	Above	M	Caucasian
40854	3.577	Above	M	Caucasian
10854	3.577	Above	F	African-American
121853	3.559	Above	M	Caucasian
42054	3.527	Above	F	African-American
43254	3.519	Above	M	Caucasian
102753	3.500	Above	M	Caucasian
42454	3.489	Above	F	Caucasian
121053	3.489	Above	F	Caucasian
71254	3.479	Above	M	African-American
21154	3.469	Above	F	Caucasian
51054	3.469	Above	M	Caucasian
83153	3.458	Above	F	Caucasian
53053	3.456	Above	F	Caucasian
122553	3.451	Above	F	Caucasian
62754	3.451	Above	F	Caucasian
91253	3.442	Above	F	Caucasian
40654	3.417	Above	M	Caucasian
32154	3.413	Above	F	Caucasian
73354	3.360	Above	M	Caucasian
31754	3.345	Above	F	African-American
122853	3.339	Above	F	Caucasian
110954	3.333	Above	F	African-American
122053	3.319	Above	M	Caucasian
81754	3.315	Above	M	Caucasian
21934	3.313	Above	M	African-American
60853	3.308	Above	M	Caucasian
80953	3.300	Above	M	Caucasian
42053	3.286	Above	M	Caucasian
92953	3.283	Above	M	Caucasian
52254	3.277	Above	F	Caucasian
11253	3.267	Above	M	Caucasian
33254	3.235	Above	F	Caucasian
71753	3.234	Above	M	Caucasian
40554	3.216	Above	F	Caucasian
111353	3.213	Above	M	Caucasian
32854	3.212	Above	F	Caucasian
82854	3.212	Above	F	African-American

110953	3.208	Above	F	Caucasian
92753	3.193	Above	F	African-American
81553	3.163	Above	F	African-American
122653	3.160	Above	F	Caucasian
120653	3.128	Above	M	Caucasian
112553	3.113	Above	F	Caucasian
30454	3.111	Above	M	Caucasian
62354	3.107	Above	M	Caucasian
91752	3.067	Above	M	Caucasian
112253	3.064	Above	F	Caucasian
33154	3.043	Above	F	Caucasian
52654	3.040	Above	M	Caucasian
51453	3.029	Above	F	African-American
31054	3.020	Above	M	Caucasian
102753	3.020	Above	M	Caucasian
92654	3.019	Above	F	Caucasian
63154	3.000	Above	F	Caucasian
40454	3.000	Above	F	African-American
62654	2.998	Above	F	African-American
41054	2.980	Below	M	Caucasian
71453	2.979	Below	F	Caucasian
112353	2.960	Below	M	Caucasian
61754	2.958	Below	M	Caucasian
91553	2.957	Below	M	Caucasian
82653	2.929	Below	F	Caucasian
70852	2.920	Below	M	Caucasian
112853	2.918	Below	M	Caucasian
31253	2.891	Below	M	Caucasian
102453	2.875	Below	M	Caucasian
122553	2.872	Below	F	Caucasian
122153	2.811	Below	F	African-American
63154	2.809	Below	M	Caucasian
31054	2.809	Below	M	African-American
62054	2.796	Below	M	African-American
100553	2.795	Below	F	African-American
91854	2.780	Below	F	Caucasian
123353	2.774	Below	M	African-American
40754	2.765	Below	F	African-American
61554	2.716	Below	F	Caucasian
31654	2.704	Below	F	African-American
13354	2.690	Below	M	African-American
72253	2.681	Below	M	Caucasian
32254	2.667	Below	M	Caucasian
11554	2.652	Below	F	Caucasian
22554	2.646	Below	F	Caucasian
21554	2.638	Below	F	Caucasian
102453	2.638	Below	M	Caucasian

52554	2.600	Below	F	Caucasian
82854	2.591	Below	M	African-American
92154	2.583	Below	F	Caucasian
100553	2.571	Below	F	African-American
92354	2.557	Below	F	African-American
30354	2.542	Below	M	African-American
121753	2.535	Below	M	African-American
21054	2.500	Below	M	Caucasian
31154	2.500	Below	F	Caucasian
52453	2.455	Below	M	African-American
111953	2.417	Below	M	Caucasian
31154	2.406	Below	F	Caucasian
33154	2.404	Below	F	Caucasian
91353	2.383	Below	M	African-American
52454	2.367	Below	M	Caucasian
102353	2.357	Below	M	Caucasian
92953	2.354	Below	F	African-American
31254	2.353	Below	F	African-American
112152	2.341	Below	M	African-American
111653	2.333	Below	F	African-American
52154	2.318	Below	M	African-American
101453	2.308	Below	M	Caucasian
101953	2.304	Below	M	Caucasian
42954	2.296	Below	M	Caucasian
61054	2.281	Below	M	African-American
22654	2.278	Below	M	African-American
92853	2.271	Below	M	Caucasian
61952	2.268	Below	F	African-American
73054	2.267	Below	M	African-American
52453	2.261	Below	M	Caucasian
91654	2.250	Below	M	Caucasian
123153	2.238	Below	M	Caucasian
31853	2.222	Below	M	Caucasian
10854	2.189	Below	F	African-American
110553	2.152	Below	M	Caucasian
90353	2.140	Below	M	African-American
121453	2.130	Below	M	African-American
92353	2.125	Below	M	Caucasian
42154	2.120	Below	M	Caucasian
81154	2.098	Below	M	African-American
110353	2.066	Below	F	African-American
31754	2.064	Below	M	African-American
122653	2.058	Below	M	African-American
122153	2.039	Below	F	African-American
42754	2.010	Below	M	African-American
72854	2.000	Below	M	Caucasian
72853	1.980	Below	F	African-American

21153	1.980	Below	F	African-American
22054	1.917	Below	F	Caucasian
82854	1.917	Below	M	Caucasian
112654	1.815	Below	F	African-American
73053	1.792	Below	M	Caucasian
122452	1.780	Below	M	African-American
80954	1.756	Below	M	Caucasian
91854	1.731	Below	M	African-American
61953	1.704	Below	F	African-American
30454	1.694	Below	M	African-American
82654	1.688	Below	M	Caucasian
21854	1.654	Below	F	Caucasian
40854	1.604	Below	M	African-American
40754	1.596	Below	M	African-American
71453	1.560	Below	M	Caucasian
91953	1.521	Below	M	African-American
43153	1.511	Below	F	African-American
73053	1.489	Below	M	Caucasian
22654	1.489	Below	M	African-American
123352	1.422	Below	M	Caucasian
12954	1.348	Below	F	Caucasian
20654	1.333	Below	M	African-American
42753	1.319	Below	F	African-American
112452	1.300	Below	M	African-American
102353	1.286	Below	F	African-American
10454	1.279	Below	F	African-American
92054	1.250	Below	M	African-American
90754	1.250	Below	F	African-American
52653	1.234	Below	F	Caucasian
22154	1.146	Below	F	Caucasian
111453	1.133	Below	M	Caucasian
110453	1.118	Below	F	African-American
101453	1.039	Below	F	African-American

Population, Class of 2004 (N = 241)

Coded Identifier	CUM GPA	Above /Below Median	Gender	Ethnicity
10536	4.000	Above	F	Caucasian
92535	4.000	Above	F	Caucasian
40736	4.000	Above	F	Caucasian
11536	4.000	Above	F	Caucasian
43136	4.000	Above	M	Caucasian
122135	4.000	Above	M	Caucasian
51636	4.000	Above	F	Caucasian
103135	4.000	Above	F	Caucasian
80936	4.000	Above	F	Caucasian
83435	4.000	Above	F	Caucasian
80935	4.000	Above	F	Caucasian
71935	4.000	Above	F	Caucasian
90836	3.992	Above	F	Caucasian
42636	3.990	Above	M	Caucasian
20636	3.989	Above	F	Caucasian
51636	3.981	Above	M	Caucasian
22636	3.979	Above	F	Caucasian
51735	3.979	Above	F	Caucasian
21236	3.978	Above	M	African-American
92035	3.976	Above	M	Caucasian
122835	3.974	Above	F	Caucasian
51636	3.973	Above	M	Caucasian
40936	3.966	Above	M	Caucasian
93335	3.957	Above	F	Caucasian
111335	3.954	Above	F	Caucasian
60936	3.948	Above	F	Caucasian
72635	3.943	Above	M	Caucasian
120535	3.941	Above	M	Caucasian
90435	3.939	Above	F	Caucasian
91735	3.934	Above	M	Caucasian
62435	3.926	Above	M	Caucasian
91136	3.904	Above	F	Caucasian
41036	3.904	Above	F	Caucasian
71135	3.897	Above	M	Caucasian
21636	3.893	Above	M	Caucasian
91535	3.890	Above	F	Caucasian
111235	3.889	Above	F	Caucasian
82935	3.867	Above	F	Caucasian
50436	3.866	Above	M	Caucasian
122335	3.853	Above	F	Caucasian
20536	3.852	Above	M	Caucasian
111035	3.852	Above	M	Caucasian

92935	3.846	Above	F	Caucasian
120835	3.844	Above	M	Caucasian
90835	3.843	Above	F	Caucasian
62236	3.841	Above	M	Caucasian
11836	3.830	Above	M	Caucasian
50636	3.826	Above	F	Caucasian
82935	3.826	Above	F	Caucasian
122335	3.822	Above	F	Caucasian
11736	3.809	Above	F	Caucasian
50436	3.808	Above	M	Caucasian
102635	3.807	Above	F	Caucasian
110736	3.790	Above	F	African-American
92335	3.786	Above	M	Caucasian
123135	3.775	Above	M	Caucasian
11336	3.773	Above	F	Caucasian
21436	3.767	Above	M	Caucasian
32037	3.758	Above	F	Caucasian
80735	3.734	Above	M	Caucasian
51035	3.729	Above	M	Caucasian
20836	3.728	Above	F	Caucasian
70635	3.725	Above	F	Caucasian
32836	3.725	Above	F	Caucasian
10936	3.724	Above	F	Caucasian
42636	3.711	Above	M	Caucasian
90936	3.709	Above	M	African-American
121735	3.686	Above	F	Caucasian
100436	3.684	Above	F	Caucasian
22336	3.680	Above	M	Caucasian
80836	3.679	Above	F	Caucasian
73335	3.675	Above	F	Caucasian
62136	3.668	Above	M	Caucasian
60636	3.659	Above	F	Caucasian
53036	3.655	Above	M	Caucasian
53136	3.644	Above	M	Caucasian
10536	3.644	Above	F	Caucasian
110935	3.643	Above	F	Caucasian
111035	3.641	Above	M	Caucasian
42336	3.641	Above	M	Caucasian
91436	3.639	Above	F	Caucasian
62135	3.636	Above	M	Caucasian
61236	3.629	Above	F	African-American
122835	3.629	Above	M	Caucasian
13036	3.604	Above	F	Caucasian
60536	3.604	Above	F	Caucasian
60835	3.590	Above	F	Caucasian
122235	3.589	Above	M	Caucasian
80535	3.559	Above	M	Caucasian

32136	3.558	Above	M	Caucasian
91335	3.528	Above	F	African-American
52035	3.526	Above	M	Caucasian
60836	3.513	Above	F	Caucasian
111235	3.503	Above	F	Caucasian
73336	3.500	Above	F	Caucasian
101835	3.493	Above	M	Caucasian
71635	3.484	Above	F	Caucasian
53135	3.467	Above	F	Caucasian
61136	3.462	Above	F	Caucasian
120535	3.452	Above	M	Caucasian
111635	3.450	Above	M	Caucasian
52736	3.411	Above	M	Caucasian
72935	3.411	Above	M	Caucasian
12336	3.403	Above	F	Caucasian
51336	3.381	Above	F	Caucasian
21536	3.367	Above	M	Caucasian
121935	3.354	Above	F	Caucasian
82735	3.346	Above	F	Caucasian
31136	3.322	Above	F	Caucasian
50536	3.322	Above	F	Caucasian
33436	3.311	Above	F	African-American
62835	3.311	Above	F	Caucasian
61635	3.281	Above	F	Caucasian
61236	3.272	Above	F	Caucasian
52036	3.245	Above	M	African-American
12636	3.244	Above	M	Caucasian
121735	3.241	Above	M	Caucasian
22636	3.214	Above	F	Caucasian
72936	3.204	Above	M	African-American
71035	3.186	Above	F	Caucasian
22036	3.180	at median	M	Caucasian
52436	3.159	Below	M	African-American
31036	3.158	Below	M	Caucasian
71235	3.157	Below	F	Caucasian
122435	3.146	Below	F	Caucasian
92235	3.143	Below	F	Caucasian
82836	3.142	Below	F	African-American
41236	3.107	Below	M	Caucasian
100535	3.100	Below	F	African-American
71436	3.100	Below	F	Caucasian
83435	3.085	Below	M	African-American
110735	3.068	Below	M	Caucasian
53336	3.043	Below	F	African-American
61835	3.016	Below	F	Caucasian
13336	3.008	Below	F	Caucasian
93035	3.007	Below	M	Caucasian

93035	3.000	Below	M	Caucasian
43036	2.986	Below	M	Caucasian
81535	2.936	Below	M	Caucasian
31836	2.929	Below	F	Caucasian
22036	2.904	Below	M	Caucasian
102835	2.900	Below	M	Caucasian
82435	2.890	Below	M	Caucasian
42436	2.890	Below	M	Caucasian
71335	2.889	Below	M	Caucasian
51335	2.878	Below	M	Caucasian
72536	2.876	Below	F	Caucasian
21536	2.869	Below	F	African-American
52135	2.863	Below	M	Caucasian
92736	2.857	Below	F	African-American
62136	2.857	Below	M	Caucasian
13436	2.850	Below	F	Caucasian
12636	2.846	Below	F	Caucasian
12136	2.843	Below	F	African-American
101835	2.841	Below	M	Caucasian
21436	2.838	Below	M	Caucasian
101335	2.829	Below	M	Caucasian
100536	2.808	Below	F	Caucasian
31736	2.807	Below	F	Caucasian
20636	2.804	Below	F	African-American
31736	2.796	Below	M	Caucasian
32735	2.763	Below	F	African-American
62335	2.750	Below	M	African-American
111535	2.742	Below	F	Caucasian
60536	2.722	Below	F	African-American
101135	2.721	Below	M	Caucasian
30936	2.718	Below	M	Caucasian
40536	2.712	Below	M	Caucasian
60935	2.681	Below	M	Caucasian
12436	2.667	Below	M	Caucasian
50436	2.659	Below	F	Caucasian
91036	2.658	Below	F	African-American
110335	2.658	Below	M	Caucasian
50836	2.657	Below	M	Caucasian
52135	2.642	Below	M	Caucasian
102636	2.630	Below	F	African-American
52235	2.613	Below	F	African-American
122435	2.607	Below	F	Caucasian
80435	2.607	Below	F	Caucasian
61736	2.566	Below	F	African-American
62635	2.559	Below	M	African-American
32736	2.552	Below	M	Caucasian
60836	2.539	Below	M	Caucasian

81636	2.515	Below	F	African-American
101535	2.500	Below	F	African-American
120735	2.494	Below	M	Caucasian
72236	2.488	Below	M	African-American
22635	2.475	Below	F	Caucasian
81535	2.448	Below	M	Caucasian
102835	2.447	Below	M	Caucasian
113135	2.439	Below	F	Caucasian
101535	2.431	Below	M	Caucasian
60935	2.422	Below	F	Caucasian
100435	2.407	Below	F	Caucasian
21936	2.388	Below	F	African-American
60536	2.357	Below	M	Caucasian
13336	2.350	Below	F	African-American
41536	2.347	Below	F	African-American
63135	2.317	Below	F	African-American
20936	2.293	Below	F	Caucasian
111335	2.272	Below	M	African-American
80835	2.260	Below	F	African-American
12636	2.257	Below	M	African-American
21636	2.252	Below	M	Caucasian
82036	2.243	Below	F	African-American
23136	2.243	Below	M	African-American
61235	2.238	Below	M	Caucasian
123135	2.198	Below	M	African-American
101335	2.188	Below	M	Caucasian
20536	2.162	Below	M	Caucasian
122734	2.147	Below	F	African-American
63036	2.130	Below	M	African-American
92236	2.103	Below	F	African-American
52136	2.063	Below	M	Caucasian
70435	2.057	Below	M	African-American
102735	2.045	Below	M	Caucasian
61636	1.961	Below	M	African-American
101335	1.946	Below	M	African-American
90935	1.923	Below	M	Caucasian
12636	1.861	Below	F	African-American
112535	1.860	Below	M	African-American
101735	1.817	Below	M	African-American
23036	1.803	Below	M	Caucasian
22236	1.768	Below	M	African-American
52836	1.750	Below	M	African-American
43236	1.743	Below	M	Caucasian
111135	1.729	Below	F	African-American
12136	1.704	Below	M	African-American
101535	1.677	Below	F	African-American
82136	1.655	Below	F	African-American

50936	1.587	Below	M	Caucasian
101435	1.480	Below	F	African-American
81836	1.452	Below	M	African-American
12336	1.394	Below	M	African-American
63136	1.366	Below	M	African-American
42835	1.284	Below	M	African-American
42136	1.249	Below	M	African-American
111135	1.162	Below	M	African-American
111835	1.128	Below	F	Caucasian
41736	0.713	Below	M	African-American
103135	0.515	Below	F	African-American

Appendix B

Spring 1998 MAP Data -- Disaggregated -- Missouri Totals

Mathematics Grade 8 (H.S. Class of 2002)

Disaggregate	Reportable	Step1 #	Step1 %	Prog #	Prog %	Near Prof #	Near Prof %	Prof #	Prof %	Adv #	Adv %	MEAN	MEDIAN	LEVEL NOT DETERMINED #	LEVEL NOT DETERMINED %
Female	30285	7009	23.1	11112	36.7	8640	28.5	3232	10.7	292	1	696	698	1567	4.9
Male	30258	7605	25.1	10308	34.1	8198	27.1	3779	12.5	368	1.2	695.4	697	2422	7.4
No Response	2409	661	27.4	843	35	650	27	233	9.7	22	0.9	691.8	693	383	13.7
American Indian or Alaska Native	503	163	32.4	200	39.8	120	23.9	20	4	0	0	680.8	683	37	6.9
Asian	601	88	14.6	147	24.5	191	31.8	147	24.5	28	4.7	715.8	721	33	5.2
Asian/ Pacific Islander	733	119	16.2	200	27.3	225	30.7	158	21.6	31	4.2	711.8	714	42	5.4
Black(not Hispanic)	8417	4685	55.7	2773	32.9	821	9.8	134	1.6	4	0	661	662	1233	12.8
Hispanic	993	361	36.4	364	36.7	201	20.2	62	6.2	5	0.5	681.6	682	121	10.9
No Response	1559	538	34.5	540	34.6	339	21.7	130	8.3	12	0.8	683.8	686	342	18
Other	1419	405	28.5	554	39	338	23.8	103	7.3	19	1.3	689.6	690	84	5.6
Pacific Islander	132	31	23.5	53	40.2	34	25.8	11	8.3	3	2.3	693.5	692	9	6.4

White(not Hispanic)	49328	9004	18.3	17632	35.7	15444	31.3	6637	13.5	611	1.2	702.2	704	2513	4.8
Gifted	2422	55	2.3	165	6.8	660	27.3	1315	54.3	227	9.4	749.5	753	37	1.5
IAP_student	172	41	23.8	86	50	32	18.6	13	7.6	0	0	688.6	688.5	23	11.8
IEP_student	6412	4287	66.9	1670	26	399	6.2	55	0.9	1	0	648.6	651	1603	20
In Bldg <1 year	3639	1247	34.3	1334	36.7	785	21.6	257	7.1	16	0.4	682.6	684	487	11.8
In Dist <1 year	2825	916	32.4	1105	39.1	613	21.7	179	6.3	12	0.4	683.7	685	298	9.5
LEP Stdnts	345	193	55.9	95	27.5	38	11	18	5.2	1	0.3	659.7	661	96	21.8
Map Free& Reduced	7427	2999	40.4	2812	37.9	1300	17.5	302	4.1	14	0.2	676.2	677	769	9.4
Migrant	88	56	63.6	19	21.6	9	10.2	4	4.5	0	0	659.8	659	17	16.2
Modified Admin	2550	1861	73	563	22.1	114	4.5	12	0.5	0	0	641.4	644	478	15.8
Non Free& Reduced	55525	12276	22.1	19451	35	16188	29.2	6942	12.5	668	1.2	698.2	700	3603	6.1
Non IEP	56540	10988	19.4	20593	36.4	17089	30.2	7189	12.7	681	1.2	700.9	702	2769	4.7
Title I	5458	2410	44.2	1979	36.3	838	15.4	218	4	13	0.2	673.2	673	708	11.5
Total	62952	15275	24.3	22263	35.4	17488	27.8	7244	11.5	682	1.1	695.6	697	4372	6.5

Spring 2000 MAP Data – Disaggregated

Missouri Totals - Mathematics Grade 8 (HS Class of 2004)

Disaggregate	Reportable	Adv #	Adv %	Prof #	Prof %	Near Prof #	Near Prof %	Prog #	Prog %	Step1 #	Step1 %
Female	32,835	334	1.02	3,948	12.02	9,487	28.89	11,514	35.07	7,552	23
Male	34,295	493	1.44	4,667	13.61	9,890	28.84	11,402	33.25	7,843	22.87
No Response	380	7	1.84	39	10.26	94	24.74	126	33.16	114	30
American Indian	470	2	0.43	30	6.38	125	26.6	184	39.15	129	27.45
Asian	671	50	7.45	187	27.87	207	30.85	162	24.14	65	9.69
Pacific Islander	114	5	4.39	23	20.18	34	29.82	38	33.33	14	12.28
Black (not Hispanic)	9,926	4	0.04	199	2.00	1,120	11.28	3,226	32.5	5,377	54.17
Hispanic	1,170	8	0.68	79	6.75	273	23.33	435	37.18	375	32.05
White (not Hispanic)	52,535	746	1.42	7,867	14.97	16,961	32.29	18,058	34.37	8,903	16.95
Other	858	3	0.35	79	9.21	250	29.14	306	35.66	220	25.64
No Response	1,766	16	0.91	190	10.76	501	28.37	633	35.84	426	24.12
IEP	8,741	8	0.09	95	1.09	740	8.47	2,563	29.32	5,335	61.03
IAP (504)	187	0	0	5	2.67	51	27.27	91	48.66	40	21.39

LEP Students	382	3	0.79	23	6.02	52	13.61	119	31.15	185	48.43
Gifted	2,760	330	11.96	1,533	55.54	748	27.1	129	4.67	20	0.72
Modified Admin	3,514	4	0.11	14	0.4	228	6.49	1,005	28.6	2,263	64.4
Migrant	70	0	0	0	0	5	7.14	26	37.14	39	55.71
Title I	8,158	28	0.34	420	5.15	1,441	17.66	2,845	34.87	3,424	41.97
In building < 1 year	4,327	42	0.97	337	7.79	864	19.97	1,513	34.97	1,571	36.31
In district < 1 year	3,376	14	0.41	232	6.87	747	22.13	1,273	37.71	1,110	32.88
Free/Reduced	11,807	23	0.19	479	4.06	2,085	17.66	4,238	35.89	4,982	42.2

Spring 2000 MAP Data – Disaggregated

Missouri Totals - Mathematics Grade 10 (HS Class of 2002)

Disaggregate	Reportable	Adv #	Adv %	Prof #	Prof %	Near Prof #	Near Prof %	Prog #	Prog %	Step1 #	Step1 %
Female	29,613	112	0.38	2,629	8.88	8,787	29.67	10,457	35.31	7,628	25.76
Male	29,767	141	0.47	3,283	11.03	8,841	29.7	9,560	32.12	7,942	26.68
No Response	597	1	0.17	38	6.37	140	23.45	193	32.33	225	37.69
American Indian	365	1	0.27	17	4.66	84	23.01	144	39.45	119	32.6
Asian	684	14	2.05	158	23.1	242	35.38	161	23.54	109	15.94
Pacific Islander	149	3	2.01	8	5.37	47	31.54	57	38.26	34	22.82
Black (not Hispanic)	7,651	2	0.03	86	1.12	823	10.76	2,220	29.02	4,520	59.08
Hispanic	868	3	0.35	52	5.99	185	21.31	291	33.53	337	38.82
White (not Hispanic)	46,741	219	0.47	5,340	11.42	15,380	32.9	16,140	34.53	9,662	20.67
Other	871	5	0.57	51	5.86	228	26.18	322	36.97	265	30.42
No Response	2,648	7	0.26	238	8.99	779	29.42	875	33.04	749	28.29
IEP	5,821	0	0	34	0.58	347	5.96	1,303	22.38	4,137	71.07
IAP (504)	147	1	0.68	6	4.08	37	25.17	56	38.1	47	31.97
LEP Students	284	0	0	11	3.87	46	16.2	96	33.8	131	46.13

Gifted	1,349	38	2.82	591	43.81	527	39.07	137	10.16	56	4.15
Modified Admin	1,723	0	0	5	0.29	80	4.64	349	20.26	1,289	74.81
Migrant	35	0	0	3	8.57	3	8.57	12	34.29	17	48.57
Title I	3,476	6	0.17	124	3.57	649	18.67	1,143	32.88	1,554	44.71
In building < 1 year	2,296	4	0.17	86	3.75	467	20.34	745	32.45	994	43.29
In district < 1 year	2,024	3	0.15	89	4.4	432	21.34	703	34.73	797	39.38
Free/Reduced	6,239	5	0.08	213	3.41	1,046	16.77	2,098	33.63	2,877	46.11

Spring 2000 MAP Data – Disaggregated

Missouri Totals - Science Grade 10 (HS Class of 2002)

Disaggregate	Reportable	Adv #	Adv %	Prof #	Prof %	Near Prof #	Near Prof %	Prog #	Prog %	Step1 #	Step1 %
Female	29,628	170	0.57	940	3.17	10,567	35.67	12,261	41.38	5,690	19.2
Male	29,750	494	1.66	1,880	6.32	12,017	40.39	10,111	33.99	5,248	17.64
No Response	543	8	1.47	14	2.58	174	32.04	223	41.07	124	22.84
American Indian	381	1	0.26	12	3.15	137	35.96	162	42.52	69	18.11
Asian	676	14	2.07	55	8.14	271	40.09	205	30.33	131	19.38
Pacific Islander	160	3	1.88	9	5.63	61	38.13	64	40	23	14.38
Black (not Hispanic)	7,689	8	0.1	46	0.6	1,023	13.3	2,855	37.13	3,757	48.86
Hispanic	869	5	0.58	20	2.3	236	27.16	371	42.69	237	27.27
White (not Hispanic)	46,138	583	1.26	2,494	5.41	19,468	42.2	17,452	37.83	6,141	13.31
Other	874	10	1.14	33	3.78	333	38.1	335	38.33	163	18.65
No Response	3,134	48	1.53	165	5.26	1,229	39.22	1,151	36.73	541	17.26
IEP	5,779	4	0.07	35	0.61	643	11.13	1,865	32.27	3,232	55.93
IAP (504)	137	1	0.73	6	4.38	41	29.93	52	37.96	37	27.01

LEP Students	271	0	0	1	0.37	23	8.49	72	26.57	175	64.58
Gifted	1,375	86	6.25	293	21.31	803	58.4	143	10.4	50	3.64
Modified Admin	1,711	1	0.06	4	0.23	151	8.83	539	31.5	1,016	59.38
Migrant	37	0	0	0	0	6	16.22	10	27.03	21	56.76
Title I	3,480	20	0.57	63	1.81	796	22.87	1,336	38.39	1,265	36.35
In building < 1 year	2,324	5	0.22	47	2.02	569	24.48	928	39.93	775	33.35
In district < 1 year	1,990	4	0.2	43	2.16	545	27.39	841	42.26	557	27.99
Free/Reduced	6,247	20	0.32	100	1.6	1,392	22.28	2,453	39.27	2,282	36.53

Spring 2002 MAP Data – Disaggregated

Missouri Totals - Mathematics Grade 10 (HS Class of 2004)

Disaggregate	Reportable	Adv #	Adv %	Prof #	Prof %	Near Prof #	Near Prof %	Prog #	Prog %	Step1 #	Step1 %
Female	31,246	188	0.6	2,743	8.8	9,178	29.4	11,183	35.8	7,954	25.5
Male	31,794	323	1.0	3,490	11.0	9,886	31.1	10,359	32.6	7,736	24.3
No Response	715	6	0.8	81	11.3	222	31.0	235	32.9	171	23.9
Amer. Indian or Alaska Native	358	1	0.3	23	6.4	108	30.2	135	37.7	91	25.4
Asian	740	32	4.3	171	23.1	245	33.1	177	23.9	115	15.5
Black(not Hispanic)	8,677	1	0.0	103	1.2	890	10.3	2,548	29.4	5,135	59.2
Hispanic	1,192	4	0.3	66	5.5	271	22.7	411	34.5	440	36.9
No Response	1,421	14	1.0	146	10.3	404	28.4	482	33.9	375	26.4
Other	901	3	0.3	54	6.0	254	28.2	325	36.1	265	29.4
Pacific Islander	145	0	0.0	12	8.3	50	34.5	54	37.2	29	20.0
White(not Hispanic)	50,321	462	0.9	5,739	11.4	17,064	33.9	17,645	35.1	9,411	18.7
Gifted	2,052	163	7.9	967	47.1	762	37.1	138	6.7	22	1.1
High School Vocational	9,146	42	0.5	733	8.0	2,780	30.4	3,369	36.8	2,222	24.3

IAP(504)	226	2	0.9	9	4.0	50	22.1	105	46.5	60	26.5
IEP Students	7,367	2	0.0	60	0.8	586	8.0	1,914	26.0	4,805	65.2
In Building < 1 year	4,527	28	0.6	294	6.5	1,118	24.7	1,549	34.2	1,538	34.0
In District < 1 year	4,273	26	0.6	306	7.2	1,123	26.3	1,523	35.6	1,295	30.3
In District < 18 months	4,024	27	0.7	349	8.7	1,149	28.6	1,394	34.6	1,105	27.5
LEP 2nd/3rd yr	255	1	0.4	6	2.4	25	9.8	69	27.1	154	60.4
LEP Students	447	0	0.0	6	1.3	47	10.5	132	29.5	262	58.6
Map Free&Reduced	9,629	18	0.2	300	3.1	1,755	18.2	3,353	34.8	4,203	43.6
Migrant	64	0	0.0	2	3.1	23	35.9	16	25.0	23	35.9
Non Free&Reduced	54,126	499	0.9	6,014	11.1	17,531	32.4	18,424	34.0	11,658	21.5
Non IEP Students	56,388	515	0.9	6,254	11.1	18,700	33.2	19,863	35.2	11,056	19.6
Title I	5,186	11	0.2	180	3.5	818	15.8	1,597	30.8	2,580	49.7
Vocational Concentrator	1,394	7	0.5	111	8.0	408	29.3	513	36.8	355	25.5

Spring 2002 MAP Data – Disaggregated

Missouri Totals - Science Grade 10 (HS Class of 2004)

Disaggregate	Reportable	Adv #	Adv %	Prof #	Prof %	Near Prof #	Near Prof %	Prog #	Prog %	Step1 #	Step1 %
Female	31,056	121	0.4	1,005	3.2	11,292	36.4	12,292	39.6	6,346	20.4
Male	31,571	315	1.0	1,795	5.7	13,116	41.5	10,543	33.4	5,802	18.4
No Response	818	9	1.1	55	6.7	321	39.2	294	35.9	139	17.0
Amer. Indian or Alaska Native	351	2	0.6	13	3.7	142	40.5	130	37.0	64	18.2
Asian	729	21	2.9	73	10.0	295	40.5	210	28.8	130	17.8
Black(not Hispanic)	8,581	4	0.0	45	0.5	1,011	11.8	3,019	35.2	4,502	52.5
Hispanic	1,176	3	0.3	27	2.3	298	25.3	461	39.2	387	32.9
No Response	1,399	10	0.7	59	4.2	526	37.6	516	36.9	288	20.6
Other	952	1	0.1	31	3.3	347	36.4	381	40.0	192	20.2
Pacific Islander	154	0	0.0	15	9.7	68	44.2	53	34.4	18	11.7
White(not Hispanic)	50,103	404	0.8	2,592	5.2	22,042	44.0	18,359	36.6	6,706	13.4
Gifted	2,083	124	6.0	540	25.9	1,238	59.4	155	7.4	26	1.2
High School Vocational	9,035	57	0.6	333	3.7	3,365	37.2	3,585	39.7	1,695	18.8

IAP(504)Students	228	0	0.0	11	4.8	73	32.0	95	41.7	49	21.5
IEP Students	7,269	3	0.0	42	0.6	831	11.4	2,384	32.8	4,009	55.2
In Building < 1 year	4,462	15	0.3	123	2.8	1,472	33.0	1,656	37.1	1,196	26.8
In District < 1 year	4,139	13	0.3	120	2.9	1,443	34.9	1,625	39.3	938	22.7
In District < 18 months	4,033	21	0.5	131	3.2	1,479	36.7	1,548	38.4	854	21.2
LEP 2nd/3rd yr	246	1	0.4	0	0.0	16	6.5	43	17.5	186	75.6
LEP Students	434	0	0.0	2	0.5	28	6.5	93	21.4	311	71.7
Map Free&Reduced	9,651	13	0.1	162	1.7	2,183	22.6	3,730	38.6	3,563	36.9
Migrant	70	0	0.0	2	2.9	15	21.4	20	28.6	33	47.1
Non Free&Reduced	53,794	432	0.8	2,693	5.0	22,546	41.9	19,399	36.1	8,724	16.2
Non IEP Students	56,176	442	0.8	2,813	5.0	23,898	42.5	20,745	36.9	8,278	14.7
Title I	5,308	10	0.2	108	2.0	998	18.8	1,790	33.7	2,402	45.3
Vocational Concentrator	1,348	7	0.5	38	2.8	508	37.7	522	38.7	273	20.3

REB (Class of 2004) Sample (n = 50)

Code #	SPD /REB	CUM GPA 9&10	Above /Below Median	Ethnicity	Gender	Gr08 MAP Math	Gr10 MAP Math	Gr10 MAP Sci	Gr10 Math GPA	Gr10 Sci GPA
90686	REB	3.709	Above	Afr-Am	M	742	765	762	3.250	3.250
4877	REB	3.311	Above	Afr-Am	F	724	778	717	3.250	3.000
4872	REB	3.204	Above	Afr-Am	M	736	726	712	2.250	3.000
4240	REB	3.142	Below	Afr-Am	F	666	720	704	2.250	2.250
4885	REB	2.843	Below	Afr-Am	F	670	700	656	2.500	2.000
4252	REB	2.763	Below	Afr-Am	F	666	667	676	1.500	2.250
4187	REB	2.317	Below	Afr-Am	F	649	635	630	2.000	2.250
4896	REB	2.272	Below	Afr-Am	M	683	705	708	1.750	2.000
410312	REB	2.257	Below	Afr-Am	M	725	716	703	3.000	1.500
4229	REB	2.243	Below	Afr-Am	M	725	734	727	2.250	1.500
4837	REB	2.198	Below	Afr-Am	M	671	691	707	1.000	1.750
415561	REB	1.961	Below	Afr-Am	M	671	650	634	0.600	1.250
4247	REB	1.861	Below	Afr-Am	F	749	758	689	1.250	1.000
4254	REB	1.677	Below	Afr-Am	F	621	633	659	0.250	0.750
4217	REB	4.000	Above	Cauc	F	774	819	780	4.000	4.000
4832	REB	4.000	Above	Cauc	F	786	809	777	4.000	4.000
415651	REB	4.000	Above	Cauc	F	779	872	766	4.000	4.000
4810	REB	3.989	Above	Cauc	F	770	795	759	4.000	4.000
4124	REB	3.974	Above	Cauc	F	815	807	749	4.000	3.750
4864	REB	3.954	Above	Cauc	F	750	790	751	4.000	3.750
4870	REB	3.948	Above	Cauc	F	746	764	739	3.750	3.750
4847	REB	3.852	Above	Cauc	M	772	794	739	3.750	3.500
4231	REB	3.844	Above	Cauc	M	810	790	766	3.500	3.000
4159	REB	3.841	Above	Cauc	M	769	790	754	3.250	3.500
492650	REB	3.826	Above	Cauc	F	753	765	728	3.500	3.000
4207	REB	3.680	Above	Cauc	M	767	780	758	3.250	3.250
4158	REB	3.668	Above	Cauc	M	735	780	744	3.250	3.000
4866	REB	3.659	Above	Cauc	F	735	747	723	2.750	2.500
415960	REB	3.590	Above	Cauc	F	726	737	722	3.500	2.750
4865	REB	3.526	Above	Cauc	M	761	769	730	3.250	2.750
4488	REB	3.493	Above	Cauc	M	743	765	739	3.000	2.750
4212	REB	3.484	Above	Cauc	F	740	765	730	2.750	2.750
4126	REB	3.452	Above	Cauc	M	758	762	729	3.250	2.750
4168	REB	3.411	Above	Cauc	M	743	778	742	3.000	2.500
495312	REB	3.354	Above	Cauc	F	750	786	729	3.250	2.250
4148	REB	3.272	Above	Cauc	F	713	694	704	2.750	2.500
4218	REB	3.146	Below	Cauc	F	699	727	669	3.000	2.500
4814	REB	3.143	Below	Cauc	F	711	740	694	2.250	2.750
4222	REB	2.900	Below	Cauc	M	765	815	768	3.500	2.000
4146	REB	2.889	Below	Cauc	M	742	755	730	2.750	1.750
4151	REB	2.876	Below	Cauc	F	732	732	708	2.830	2.000
4250	REB	2.841	Below	Cauc	M	611	653	719	2.500	2.000
4874	REB	2.742	Below	Cauc	F	682	642	675	2.000	1.500
4197	REB	2.718	Below	Cauc	M	721	749	732	2.000	1.250
4086	REB	2.712	Below	Cauc	M	670	695	710	1.250	2.500
4257	REB	2.422	Below	Cauc	F	717	730	693	2.750	1.250
4121	REB	2.357	Below	Cauc	M	749	767	746	2.800	1.750
4256	REB	2.045	Below	Cauc	M	669	685	651	1.750	1.250
4887	REB	1.803	Below	Cauc	M	676	717	662	1.250	0.750
4188	REB	1.743	Below	Cauc	M	714	704	677	2.500	0.750

SPD (Class of 2002) Sample (n = 50)

2938	SPD	3.577	Above	Afr-Am	F	724	760	741	3.000	3.250
2957	SPD	3.527	Above	Afr-Am	F	711	709	701	3.500	3.000
2964	SPD	3.313	Above	Afr-Am	M	720	781	752	2.500	3.750
2103	SPD	3.029	Above	Afr-Am	F	673	715	706	3.250	2.250
2207	SPD	2.811	Below	Afr-Am	F	702	710	712	2.000	2.750
2132	SPD	2.796	Below	Afr-Am	M	684	684	700	2.250	2.000
2216	SPD	2.774	Below	Afr-Am	M	693	746	721	3.250	2.250
2997	SPD	2.455	Below	Afr-Am	M	750	747	710	2.750	1.500
2987	SPD	2.333	Below	Afr-Am	F	683	712	675	3.500	1.500
2200	SPD	2.318	Below	Afr-Am	M	654	622	644	1.500	1.750
299320	SPD	1.333	Below	Afr-Am	M	730	729	759	1.000	1.500
2224	SPD	1.250	Below	Afr-Am	M	679	675	712	1.750	0.750
2991	SPD	1.118	Below	Afr-Am	F	668	688	695	1.250	0.750
2261	SPD	1.039	Below	Afr-Am	F	666	644	656	1.000	1.000
2187	SPD	4.000	Above	Cauc	F	776	795	767	4.000	4.000
81383	SPD	4.000	Above	Cauc	F	798	816	779	4.000	4.000
2099	SPD	3.980	Above	Cauc	F	788	850	771	4.000	4.000
2924	SPD	3.900	Above	Cauc	F	764	786	752	4.000	3.750
2206	SPD	3.875	Above	Cauc	M	811	785	772	3.750	3.500
2253	SPD	3.813	Above	Cauc	M	779	799	785	4.000	3.750
2948	SPD	3.813	Above	Cauc	F	762	768	728	3.750	4.000
2954	SPD	3.788	Above	Cauc	M	778	838	819	4.000	3.500
2147	SPD	3.714	Above	Cauc	M	785	790	776	3.500	3.750
212511	SPD	3.686	Above	Cauc	F	738	771	756	3.750	3.500
2113	SPD	3.681	Above	Cauc	F	733	759	744	3.500	3.500
2194	SPD	3.596	Above	Cauc	F	728	767	728	3.250	3.250
2217	SPD	3.519	Above	Cauc	M	721	742	731	3.500	3.000
2910	SPD	3.489	Above	Cauc	F	744	754	746	3.000	3.000
290782	SPD	3.458	Above	Cauc	F	731	751	694	3.400	3.000
2133	SPD	3.319	Above	Cauc	M	760	763	724	3.000	3.500
2921	SPD	3.300	Above	Cauc	M	762	782	752	3.250	3.000
2108	SPD	3.277	Above	Cauc	F	710	755	728	4.000	3.000
209912	SPD	3.160	Above	Cauc	F	710	757	719	2.750	3.250
2975	SPD	3.107	Above	Cauc	M	732	765	751	2.750	2.750
2188	SPD	3.067	Above	Cauc	M	756	784	776	3.250	2.500
2950	SPD	2.979	Below	Cauc	F	755	774	713	3.250	2.750
2101	SPD	2.958	Below	Cauc	M	752	777	713	3.250	2.000
2176	SPD	2.920	Below	Cauc	M	718	735	711	3.500	2.500
2114	SPD	2.891	Below	Cauc	M	740	755	705	2.500	2.500
2981	SPD	2.667	Below	Cauc	M	707	741	735	2.750	2.250
2240	SPD	2.652	Below	Cauc	F	672	713	666	3.250	1.750
2136	SPD	2.500	Below	Cauc	M	754	741	721	2.250	2.000
2169	SPD	2.500	Below	Cauc	F	674	703	693	2.000	1.750
2951	SPD	2.417	Below	Cauc	M	736	731	721	2.250	1.750
2943	SPD	2.406	Below	Cauc	F	694	712	729	2.250	1.750
2966	SPD	1.917	Below	Cauc	F	691	688	698	0.750	1.250
2092	SPD	1.792	Below	Cauc	M	709	729	659	2.250	1.500
2231	SPD	1.560	Below	Cauc	M	754	780	767	1.750	0.750
2233	SPD	1.422	Below	Cauc	M	692	675	679	2.000	1.000
2258	SPD	1.146	Below	Cauc	F	746	758	736	1.330	1.500

Appendix C

College Of Education
8001 Natural Bridge Road
St. Louis, Missouri 63121-4499
Telephone: 314-516-4378
E-mail: tom_schnell@umsl.edu

"Achievement Levels in Schedules"
Informed Consent Form

I freely and voluntarily consent to be a participant in this research project. I understand that the purpose of this research is to determine whether there is a statistical difference in the test scores (achievement levels) for students who experienced the rotate-eight block schedule as compared to the six-period daily schedule, and in the students' current attitudes toward certain aspects of the high school experience in those different kinds of schedules. I understand that I am being invited to participate because as a member of the High School Class of 2002 or 2004 I experienced the six-period daily schedule or the rotate-eight block schedule in high school. Approximately 150 participants may be involved in this research. I understand the risks, discomforts and inconveniences involved are minimal. I understand that I will not be paid for my participation, and that I cannot expect any direct benefit from my participation.

I understand my participation involves completing a survey of nine questions and authorizing use of my demographic registration information, my MAP test scores (math and science), and attendance records in analyses. No Public Health Information (PHI) will be used. I understand that all data and information will be safeguarded and locked up in a separate geographic location from identifying codes to prevent access by unauthorized personnel. I understand that only the principal investigator will have access to the raw data and to the code numbers protecting my identity. I also understand that any information obtained will be kept fully confidential and only the principal investigator and his academic advisors will have access to it, and that all identifying information and raw data will be destroyed at the completion of the study by shredding. If any other uses are later contemplated, separate consent will be obtained. I understand that I can refuse to participate or discontinue my participation at any time during the study without penalty. I understand that I may refuse to answer any questions I do not want to answer and still remain in the study. The investigator may withdraw me from this research if circumstances arise which warrant doing so. If I decide to discontinue my participation in this study, I will complete the withdrawal letter found at http://www.umsl.edu/services/ora/IRB.html, or request the investigator send me a copy of the withdrawal letter.

I understand that the data will be analyzed in the aggregate without any names, and findings will be reported in the aggregate without any names, so that confidentiality will be protected. No participants will be identified in the study. At the completion of the study, School District will be provided a summary of the findings. If I request a summary, it will be provided. I understand that I am free to ask the principal investigator, his academic advisors, and the chair of the Human Subjects Review Committee questions about the procedure and my rights as a research participant. I know I can contact the principal investigator, Brad Heger, at (314) 983-5406 or at bjheger@ .k12.mo.us. I know I can contact his dissertation study advisor, Dr. Thomas Schnell, at (314) 516-4378. I know I can contact the Chairperson of the Institutional Review Board at (314) 516-5897.

My participation in this research is voluntary. The decision whether to participate will not affect current or future relations with the University of Missouri – St. Louis or the School District. If I decide to participate, I am free to withdraw at any time without affecting those relationships.

I have read and understood the above information and I have been offered a copy of this form.

_____ _____
Participant's Signature Date

_____
Participant's Printed Name

I have offered an explanation of the research procedure in which the participant has agreed to participate, and have offered the participant a copy of this form.

_____ _____
Principal Investigator's Signature Date

_____
Principal Investigator's Printed Name

Class of 02: Respond to each statement by placing an X in the box that reflects your feelings about the statement regarding the six period day schedule you followed freshman and sophomore years.
Class of 04: Respond to each statement by placing an X in the box that reflects your feelings about the statement regarding the rotate eight block schedule you followed.

Please do not respond if you are not yet 18 years of age.

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Teachers generally used a variety of instructional activities within individual class periods.					
Students in class generally were not on task.					
Teachers generally used a variety of assessment techniques.					
Teachers did not emphasize critical thinking skills.					
Teachers interacted positively with me.					
I did not look forward to going to school.					
I received individualized instruction.					
I did not complete my homework.					
I learned to plan my time well.					

CODE #_____

Brad Heger (733658)

Dear High School alumna/alumnus,

I am currently a doctoral candidate in the College of Education at the University of Missouri – St. Louis. I am requesting your assistance in completing a portion of my dissertation study.

The study is entitled "A Comparison of Achievement Levels in Mathematics and Science of Secondary Students in a Six-Period Daily Schedule with Those of Students in a Rotate-Eight Block Schedule." Enclosed is a short survey asking you for your recollection of your experiences at . Please complete the survey and return it (with the consent form) to me sealed in the postage-paid envelope provided. Or, if you prefer, you may return it (with the consent form) to my advisor, Dr. Thomas Schnell, at UMSL / RCEW Suite 11 / 8001 Natural Bridge / St. Louis, MO 63121-4499.

Please also complete the consent forms, and return one with the survey. Keep the other copy for your records. With your consent, I will be accessing your registration materials for demographic information, attendance records, and MAP (Missouri Assessment Program) scores in grade 8 and grade 10. As the researcher, only I will have access to the raw data and to the code numbers protecting your identity. The raw data and identifying codes will be kept only until the study is completed, and will then be destroyed by shredding. The data will be analyzed in the aggregate without any names, and findings will be reported in the aggregate without any names, so that confidentiality will be protected. No participants will be identified in the study.

At the completion of the study, School District will be provided a summary of the findings. If you request a summary, it will be provided.

IF YOU ARE NOT YET 18 YEARS OF AGE, PLEASE DO NOT PARTICIPATE.

Please do not hesitate to contact me at (314) 983-5406, or my advisor Dr. Thomas Schnell at (314) 516-4378, if you have any questions regarding this study.

Sincerely,

Brad J. Heger, A.B., M.Ed.
Doctoral Candidate
University of Missouri – St. Louis

Appendix D

Survey Respondents

Class of 2004 (n = 33)

CODE #	SPD /REB	GEN DER	ETHNICITY
4106	REB	F	Caucasian
4136	REB	F	African-American
4143	REB	M	Caucasian
4144	REB	M	Caucasian
4153	REB	M	Caucasian
4155	REB	F	African-American
4168	REB	M	Caucasian
4176	REB	M	Caucasian
4179	REB	F	Caucasian
4181	REB	M	Caucasian
4205	REB	M	Caucasian
4207	REB	M	Caucasian
4211	REB	F	Caucasian
4219	REB	F	Caucasian
4221	REB	F	Caucasian
4224	REB	M	Caucasian
4226	REB	F	African-American
4231	REB	M	Caucasian
4236	REB	M	Caucasian
4243	REB	F	African-American
4829	REB	F	Caucasian
4832	REB	F	Caucasian
4838	REB	M	Caucasian
4847	REB	M	Caucasian
4850	REB	F	Caucasian
4853	REB	M	African-American
4854	REB	F	Caucasian
4862	REB	F	Caucasian
4867	REB	M	Caucasian
4872	REB	M	African-American
4882	REB	F	Caucasian
4896	REB	M	African-American
4898	REB	M	Caucasian

Class of 2002 (n = 35)

CODE #	SPD /REB	GEN DER	ETHNICITY
2094	SPD	F	Caucasian
2099	SPD	F	Caucasian
2102	SPD	M	African-American
2107	SPD	F	Caucasian
2110	SPD	M	Caucasian
2111	SPD	F	African-American
2114	SPD	M	Caucasian
2143	SPD	F	Caucasian
2146	SPD	M	African-American
2152	SPD	F	African-American
2155	SPD	F	African-American
2157	SPD	F	African-American
2162	SPD	F	Caucasian
2172	SPD	F	Caucasian
2174	SPD	F	Caucasian
2193	SPD	M	Caucasian
2203	SPD	F	Caucasian
2204	SPD	M	Caucasian
2212	SPD	M	Caucasian
2215	SPD	M	Caucasian
2216	SPD	M	African-American
2223	SPD	M	Caucasian
2915	SPD	M	Caucasian
2934	SPD	F	Caucasian
2940	SPD	M	African-American
2943	SPD	F	Caucasian
2945	SPD	M	Caucasian
2946	SPD	M	African-American
2950	SPD	F	Caucasian
2953	SPD	F	Caucasian
2958	SPD	F	Caucasian
2978	SPD	M	Caucasian
2985	SPD	M	Caucasian
2987	SPD	F	African-American
2996	SPD	M	Caucasian

Appendix E

Survey Responses

CODE #	TREAT MENT	GEN DER	ETHN	Tchrs Varied Activ	[~~not~~] On Task	Var Asses sment	[~~not~~] Crit Think	Tchrs Inter act	Clsrm Activ Subsc	[~~not~~] Look Fwd	Recd Indiv Instr	[~~not~~] Cmpl HW	Learn Plan Time	Pers Partic Subsc	Ovrll Effec tive
2111	SPD	F	Af-Am	4	4	3	4	4	19	3	2	4	4	13	32
2152	SPD	F	Af-Am	3	2	2	2	1	10	2	2	3	4	11	21
2155	SPD	F	Af-Am	5	4	5	5	4	23	4	3	5	4	16	39
2157	SPD	F	Af-Am	5	4	4	5	5	23	5	5	4	5	19	42
2987	SPD	F	Af-Am	5	4	4	3	5	21	5	4	3	5	17	38
2102	SPD	M	Af-Am	4	3	4	3	3	17	2	2	2	2	8	25
2146	SPD	M	Af-Am	5	4	3	5	5	22	4	4	5	5	18	40
2216	SPD	M	Af-Am	5	4	5	4	5	23	2	4	5	4	15	38
2940	SPD	M	Af-Am	5	4	5	4	5	23	3	5	4	4	16	39
2946	SPD	M	Af-Am	5	5	5	5	4	24	5	5	5	5	20	44
2094	SPD	F	Cauc	3	4	4	4	5	20	5	4	5	4	18	38
2099	SPD	F	Cauc	4	5	4	4	5	22	3	2	5	3	13	35
2107	SPD	F	Cauc	2	4	4	3	5	18	5	3	5	5	18	36
2143	SPD	F	Cauc	5	3	3	4	5	20	4	3	5	4	16	36
2162	SPD	F	Cauc	4	4	2	3	4	17	4	4	5	3	16	33
2172	SPD	F	Cauc	3	5	4	4	5	21	5	5	5	4	19	40
2174	SPD	F	Cauc	2	3	4	4	5	18	4	4	2	3	13	31
2203	SPD	F	Cauc	4	2	3	4	5	18	2	4	5	4	15	33
2934	SPD	F	Cauc	4	4	3	5	5	21	4	4	5	5	18	39
2943	SPD	F	Cauc	4	4	3	4	4	19	4	4	4	4	16	35
2950	SPD	F	Cauc	4	4	2	3	4	17	3	3	2	2	10	27
2953	SPD	F	Cauc	3	2	4	4	5	18	2	4	1	4	11	29
2958	SPD	F	Cauc	2	4	3	4	5	18	3	4	5	4	16	34
2110	SPD	M	Cauc	3	4	3	4	5	19	4	1	5	4	14	33
2114	SPD	M	Cauc	4	2	4	4	4	18	2	5	4	3	14	32
2193	SPD	M	Cauc	2	4	2	4	4	16	4	4	4	4	16	32
2204	SPD	M	Cauc	4	2	3	4	4	17	4	3	4	2	13	30
2212	SPD	M	Cauc	2	2	2	4	2	12	2	3	2	4	11	23
2215	SPD	M	Cauc	4	4	3	4	4	19	5	4	4	5	18	37
2223	SPD	M	Cauc	4	2	4	4	4	18	5	4	2	4	15	33
2915	SPD	M	Cauc	4	4	4	5	5	22	5	2	5	5	17	39
2945	SPD	M	Cauc	4	4	2	4	4	18	4	4	4	3	15	33

2978	SPD	M	Cauc	4	3	4	2	5	18	5	4	5	3	17	35
2985	SPD	M	Cauc	3	4	4	4	5	20	4	5	4	3	16	36
2996	SPD	M	Cauc	4	4	5	4	4	21	4	4	4	5	17	38
4136	REB	F	Af-Am	4	4	3	4	5	20	3	2	2	4	11	31
4155	REB	F	Af-Am	4	5	2	4	4	19	4	4	3	4	15	34
4226	REB	F	Af-Am	2	2	3	2	5	14	5	4	3	4	16	30
4243	REB	F	Af-Am	4	4	2	3	4	17	5	3	5	5	18	35
4853	REB	M	Af-Am	3	2	4	3	3	15	1	3	2	3	9	24
4872	REB	M	Af-Am	3	2	3	2	3	13	4	4	4	4	16	29
4896	REB	M	Af-Am	4	3	4	3	3	17	2	3	2	2	9	26
4106	REB	F	Cauc	2	3	2	4	2	13	1	4	1	2	8	21
4179	REB	F	Cauc	5	4	5	4	4	22	3	4	5	5	17	39
4211	REB	F	Cauc	4	4	1	2	5	16	3	2	5	4	14	30
4219	REB	F	Cauc	4	3	2	2	4	15	4	4	5	5	18	33
4221	REB	F	Cauc	4	4	3	3	4	18	4	2	4	2	12	30
4829	REB	F	Cauc	5	4	4	4	5	22	4	5	5	3	17	39
4832	REB	F	Cauc	4	4	5	4	4	21	3	3	5	4	15	36
4850	REB	F	Cauc	4	4	4	4	5	21	5	5	4	5	19	40
4854	REB	F	Cauc	4	3	3	2	4	16	4	3	5	5	17	33
4862	REB	F	Cauc	4	2	5	2	3	16	2	4	2	4	12	28
4882	REB	F	Cauc	4	4	4	4	5	21	4	3	5	5	17	38
4143	REB	M	Cauc	4	4	4	3	5	20	5	4	3	4	16	36
4144	REB	M	Cauc	4	4	4	4	4	20	1	4	4	4	13	33
4153	REB	M	Cauc	4	3	3	3	4	17	1	2	4	3	10	27
4168	REB	M	Cauc	4	2	3	4	5	18	2	4	2	1	9	27
4176	REB	M	Cauc	4	3	4	2	5	18	4	4	5	5	18	36
4181	REB	M	Cauc	4	3	4	3	5	19	4	5	2	2	13	32
4205	REB	M	Cauc	4	4	2	3	5	18	3	1	5	5	14	32
4207	REB	M	Cauc	2	3	4	4	4	17	3	4	2	4	13	30
4224	REB	M	Cauc	4	3	3	3	5	18	5	5	3	4	17	35
4231	REB	M	Cauc	4	4	3	5	5	21	3	3	4	5	15	36
4236	REB	M	Cauc	5	4	4	4	4	21	3	3	3	4	13	34
4838	REB	M	Cauc	5	4	4	4	4	21	3	3	4	4	14	35
4847	REB	M	Cauc	4	3	3	4	4	18	4	3	4	3	14	32
4867	REB	M	Cauc	3	3	2	2	5	15	2	4	2	3	11	26
4898	REB	M	Cauc	3	4	4	4	4	19	2	4	5	3	14	33

Appendix F

Table F1

Summary of Internal Consistency

Indices by Treatment*

		REB n = 33	SPD n = 35
Effectiveness of:	# Items	Alpha	Alpha
Subject's Own Participation	4	.553	.566
Classroom Activities	5	.567	.670
Schedule Overall	9	.632	.765

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)
SPD = Six-Period Day Schedule (Comparison Treatment Group)

*The Spearman-Brown formula indicates that for a subscale of 4-5 items a Cronbach's alpha of over 0.30 is adequate for basic research purposes.

Table F2

Summary of Internal Consistency

Indices by Ethnicity*

		African-American n = 17	Caucasian n = 51
Effectiveness of:	# Items	Alpha	Alpha
Subject's Own Participation	4	.833	.421
Classroom Activities	5	.854	.415
Schedule Overall	9	.870	.607

*The Spearman-Brown formula indicates that for a subscale of 4-5 items a Cronbach's alpha of over 0.30 is adequate for basic research purposes.

Table F3

Summary of Internal Consistency

Indices by Gender*

		Female n = 33	Male n = 35
Effectiveness of:	# Items	Alpha	Alpha
Subject's Own Participation	4	.607	.531
Classroom Activities	5	.631	.645
Schedule Overall	9	.730	.717

*The Spearman-Brown formula indicates that for a subscale of 4-5 items a Cronbach's alpha of over 0.30 is adequate for basic research purposes.

Table F4

Summary of Internal Consistency Indices by

Ethnicity Subgroups for REB Treatment*

REB *N* = 33		African-American *n* = 7	Caucasian *n* = 26
Effectiveness of:	# Items	Alpha	Alpha
Subject's Own Participation	4	.834	.453
Classroom Activities	5	.450	.530
Schedule Overall	9	.461	.640

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)

*The Spearman-Brown formula indicates that for a subscale of 4-5 items a Cronbach's alpha of over 0.30 is adequate for basic research purposes.

Table F5

Summary of Internal Consistency Indices by

Ethnicity Subgroups for SPD Treatment*

SPD *N* = 35		African-American *n* = 10	Caucasian *n* = 25
Effectiveness of:	# Items	Alpha	Alpha
Subject's Own Participation	4	.834	.349
Classroom Activities	5	.909	.339
Schedule Overall	9	.921	.580

SPD = Six-Period Day Schedule (Comparison Treatment Group)

*The Spearman-Brown formula indicates that for a subscale of 4-5 items a Cronbach's alpha of over 0.30 is adequate for basic research purposes.

Table F6

Summary of Internal Consistency Indices by

Gender Subgroups for REB Treatment*

	REB $N = 33$	Female $n = 15$	Male $n = 18$
Effectiveness of:	# Items	Alpha	Alpha
Subject's Own Participation	4	.610	.423
Classroom Activities	5	.614	.522
Schedule Overall	9	.694	.544

REB = Rotate-Eight Block Schedule (Experimental Treatment Group)

*The Spearman-Brown formula indicates that for a subscale of 4-5 items a Cronbach's alpha of over 0.30 is adequate for basic research purposes.

Table F7

Summary of Internal Consistency Indices by

Gender Subgroups for SPD Treatment*

	SPD *N* = 35	Female *n* = 18	Male *n* = 17
Effectiveness of:	# Items	Alpha	Alpha
Subject's Own Participation	4	.606	.528
Classroom Activities	5	.652	.705
Schedule Overall	9	.760	.775

SPD = Six-Period Day Schedule (Comparison Treatment Group)

*The Spearman-Brown formula indicates that for a subscale of 4-5 items a Cronbach's alpha of over 0.30 is adequate for basic research purposes.

Appendix G

Grade 10 MAP mathematics gains

Regarding the grade 10 post-treatment MAP mathematics test, an interesting pattern of gains was discovered, though statistically attributable to chance. The lower ability REB group improved its mean score by +14.64, and the lower ability SPD group improved its mean score by +10.64, figures favoring the REB group by +4.00. The Caucasian lower ability subgroup improved +18.07 in the REB schedule, while the comparable subgroup improved +14.53 in the SPD schedule: the REB Caucasian lower ability subgroup gained +3.54 mean points over the SPD Caucasian lower ability subgroup's gain. Even though scores for African-American lower ability students remained significantly below those of Caucasian lower ability students, the REB African-American lower ability subgroup showed the larger gain over its comparable SPD subgroup, with +10.28 in the REB schedule, and +4.80 in the SPD schedule, gains favoring the REB subgroup by +5.48. These differences are summarized in Table G1.

At the other end of the spectrum, the higher ability groups' and subgroups' mean improvements consistently favored the SPD schedule, though again statistically the differences in the scores were attributable to chance. The higher ability SPD group improved its mean score by +25.92, and the higher ability REB group improved its mean score by +21.20. The Caucasian higher ability subgroup improved by +24.34 in the SPD schedule, while the experimental subgroup improved +21.05 in the REB schedule. The African-American higher ability subgroup improved its mean score by the largest margin, +34.25, in the SPD schedule, while that subgroup improved +22.33 in the REB schedule. While their total scores were still significantly lower in both schedules than those of Caucasian higher ability students, African-American higher ability students improved

their mean scores slightly more than did higher ability Caucasian students in the REB schedule, +1.28, compared to a larger improvement margin of +9.91 in the SPD schedule. These differences are summarized in Table G2.

Table G1

Lower Ability Students' Improvements in the Grade 10 MAP Mathematics Mean

Over the Grade 8 MAP Mathematics Mean

	REB (Exp)	SPD (Comp)	DIFFERENCE: m_{REB} - m_{SPD}
African-American			
n	11	10	
Gain in *m*	+ 10.28	+ 4.80	+ 5.48
Caucasian			
n	14	15	
Gain in *m*	+ 18.07	+ 14.53	+ 3.54
Total			
n	25	25	
Gain in *m*	+ 14.64	+ 10.64	+ 4.00

Table G2

Higher Ability Students' Improvements in the Grade 10 MAP Mathematics Mean

Over the Grade 8 MAP Mathematics Mean

	REB (Exp)	SPD (Comp)	DIFFERENCE: m_{REB} - m_{SPD}
African-American			
n	3	4	
Gain in *m*	+ 22.33	+ 34.25	- 11.92
Caucasian			
n	22	21	
Gain in *m*	+ 21.05	+ 24.34	- 3.29
Total			
n	25	25	
Gain in *m*	+ 21.20	+ 25.92	- 4.72