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# The Influence of Traditional vs. Balanced School Calendars on Middle School Mathematics Achievement

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## ACCEPTANCE

This dissertation, THE INFLUENCE OF TRADITIONAL VS. BALANCED SCHOOL CALENDARS ON MIDDLE SCHOOL STUDENTS' MATHEMATICS ACHIEVEMENT by DOUGLAS CALLAHAN, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree, Doctor of Education, in the College of Education and Human Development, Georgia State University.

The Dissertation Advisory Committee and the student's Department Chairperson, as representatives of the faculty, certify that this dissertation has met all standards of excellence and scholarship as determined by the faculty.

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# THE INFLUENCE OF TRADITIONAL VS. BALANCED SCHOOL CALENDARS ON MIDDLE SCHOOL STUDENTS' MATHEMATICS ACHIEVEMENT

by

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Under the Direction of Dr. Yinying Wang

ABSTRACT

Middle school mathematics achievement in the US, particularly in low socioeconomic districts, lags behind much of the industrialized world. One strategy to remedy low mathematics achievement is the balanced calendar model for student attendance. The balanced calendar model is popular because it distributes the 180 days of school attendance over the year more evenly than the traditional calendar model. The balanced calendar model features two inter-session periods that allow struggling students additional instruction. The purpose of this dissertation was to investigate the influence of a balanced calendar model on the mathematics achievement of middle school students. The literature review explored the historical origins of both the traditional and balanced calendars, as well as the current national trends for yearlong instruction. In addition, the issue of "summer fade" was explored, and how summer fade was more likely to negatively impact students from low income families. A matched pair research design was utilized. This quantitative approach allowed mathematics achievement scores from schools using different calendar models to be compared while limiting the impact of other variables. A pair match placed schools with *competing* calendars together based on similar student demographics such as ethnicity and income level. Passing rates on standardized assessments for mathematics achievement were compared using chi- square and Fisher exact tests. Twenty-five of the 44 statistical analysis tests showed no significant influence on mathematics achievement between the competing calendar models. Only nine matched pairs were significant with a coefficient indicating that the balanced calendar schools influence mathematics achievement in a positive manner. A negative coefficient on ten of the matched pairs indicated that the balanced calendar influence mathematics achievement in a negative manner. This study suggests that the issue of calendar models warrants a broader investigation.

INDEX WORDS: School calendar year, Mathematics education, Middle school, Socioeconomic status (SES)

**THE INFLUNCE OF TRADITIONAL VS. BALANCED SCHOOL CALENDARS ON MIDDLE SCHOOL STUDENTS' MATHEMATICS ACHIEVEMENT**

by

DOUGLAS CALLAHAN

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the Department of Educational Policy Studies

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# DEDICATION

This dissertation is dedicated to my two daughters, Grace and Megan Callahan. They have sacrificed countless hours watching their father work towards the goal of earning a doctoral degree in Educational Leadership. While the past three years has been trying and difficult, they patiently endured many weekends while dad was focused on coursework and the research study. I'm proud of their endurance and honored by their support during these important years of their childhood. I love them more than they will ever know, and am proud to be their father.

My father, Jack Callahan, passed away unexpectedly while working on this research study. I would also like to dedicate this dissertation to him, knowing that he would have been proud of his son accomplishing a doctoral degree. As the son of a middle school custodian, he watched his son become a middle school administrator and school leader. His success and integrity was an inspiration to me throughout my life, and I am eternally thankful for his love, guidance and support. No matter how much time you have with a loved one, it is never enough.

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To the members of the GSU Ed.D. Cohort III, I am simply honored to have been a member of such a talented and professional group of school and district leaders. I congratulate each of you for your perseverance and endurance. Crossing the finish line with you is a privilege. I anxiously await to see the impact that such a positive and exemplary collection of leaders will soon have on the profession of public education, and on the children for whom we serve.

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# CHAPTER 1

## THE INFLUENCE OF TRADITIONAL VS. BALANCED SCHOOL CALENDARS ON MIDDLE SCHOOL STUDENTS' MATHEMATICS ACHIEVEMENT

The future economic development and global competitiveness of the United States is directly linked to the quality of mathematics education (Moses, 2001; Zinth & Dounay, 2006; Akiba, LeTendre, & Scribner, 2007). In the United States, particularly at the middle school level, mathematics achievement has fallen behind many other industrialized nations (Organization for Economic Cooperation and Development [OECD], 2016). The Programme for International Student Assessment (PISA) ranks the mathematics achievement of fifteen-year-old students in the United States as 27$^{th}$ out of 38 countries identified by the OECD (OCED, 2016). This ranking was similar to student achievement results from Russia, Hungary and the Republic of Slovakia and was considerably below the leading scores of fifteen-year-old students from Korea, Japan and Switzerland (OECD, 2016). Consequently, many school district leaders and policymakers in the United States are seeking interventions that will improve American student achievement in mathematics. One particular remedy was to explore the impact of adopting an alternate school calendar model (Dessoff, 2011; Pedersen, 2012).

The purpose of this literature review was to provide a historical context for the question of school calendars, as well as to explore the body of research and literature related to the delivery of mathematics instruction within a school term. The literature review explored the issues related to traditional and balanced calendars, and the necessitated intervention periods provided to middle school students who struggle academically, particularly in mathematics. Calendar models and intervention periods were explored through the lens of middle school mathematics achievement. Districts utilizing a *traditional calendar* (with a summer school session) offer approximately three weeks of remediation after the conclusion of the school year. This remediation was provided to students whose promotion to the next grade level was uncertain, or academic intervention was recommended to address identified weaknesses (Ballinger, 2006). Districts that have adopted *balanced calendar* models often provided a required or voluntary two or three-week intersession period at the end of each 45-day academic term (Ballinger, 2006). As a result, intersession periods are more frequent, timelier, and offer additional days of instruction. In addition, these balanced calendar interventions were designed to address weaknesses within the most recent nine weeks of instruction, whereas traditional summer school interventions may attempt to address an entire year of academic weakness. To clarify, both calendar models offer 180 days of instructions; the primary difference was the distribution of days throughout the year.

> Since both calendars types consist of the same number of school days, the distinction between the calendars is a matter of the organization of the days around the calendar year and not an expansion in the number of in-school days. (Graves, 2011, p. 1282)

Research on the influence of alternate school calendars, specifically regarding middle school student mathematical achievement, was sparse. Additionally, many studies combined the influences of both single and multi-track models for all ages of students, which serve very different purposes and do not have comparable intersession programs (Winkleman, 2010; Graves, 2011). This research study will compare the mathematics achievement data of middle school students enrolled in single track, *traditional calendar* schools with middle school students enrolled in single track, *balanced calendar* schools. Since many educational leaders and district policymakers are considering the adoption of an alternate to the traditional calendar model, it is important to gain a greater understanding of the impact that the proposed balanced calendar model will have on student achievement (Winter, 2005).

Consequently, the purpose of this study was to determine how the distribution of school days influenced middle school students' mathematics achievement by examining traditional and balanced school calendars.

**Guiding Questions**

The following research questions will guide this study:

1. How does the adoption of traditional and balanced school calendar models influence mathematics achievement for the general population of students within a middle school?
2. How does the adoption of traditional and balanced school calendar models influence mathematics achievement for the population of students identified as eligible for free and reduced lunch within a middle school?

The literature review explored the issues related to traditional and balanced calendars. Both the concepts of calendar models and intersession periods were explored through the lens of middle school mathematics achievement. Balanced calendars often provide intersession periods between grading periods to students who struggle academically, particularly in mathematics (Winkelmann, 2010). Intersession periods are designed to address weaknesses within the most recent nine weeks of instruction, contrasted with traditional summer school, which may attempt to address an entire year of academic weaknesses (Pedersen, 2012). In addition, an examination of the issue of "summer fade" defined by Donohue and Miller (2008), as the loss of learning experienced by students as a result of a long summer vacation, is included; particularly as it relates to middle school students' math achievement from low socio-economic backgrounds.

After a long summer vacation, teachers return to school with excitement and enthusiasm only to quickly realize that many students clearly did not spend their vacations practicing or reviewing essential skills and previous knowledge (Paechter, Luttenberger, Macher, Berding, Papousek, Weiss & Fink, 2015). As a result, the first weeks of school are negatively influenced by summer learning loss, also known as summer fade, and students must be retaught in order to regain lost instructional skills and knowledge (Paechter et al. 2015). Although traditional schedules appropriately accommodated the agricultural demands of the population over a century ago, the vast majority of school-aged children do not work in agriculture during the summer in the 21st century (Pedersen, 2012). Yet, the average summer break is still scheduled for 10- 12 weeks during the summer months.

John Hopkins University researchers Karl Alexander, Doris Entwisle and Linda Olson (2007) extensively studied the impact of such a lengthy vacation away from the classroom. Their longitudinal study concluded that two-thirds of the achievement gap between low income and middle income students can be explained by unequal access to summer learning opportunities. The researchers described the magnitude of the gap between low and middle income learners as a significant inequality that substantially connects to the differing experiences of summer learning during the early years of formal education (Alexander et al. 2007).

A growing number of local school districts have adopted *balanced* school calendars, which schedules the 180 days of school more evenly throughout the year (Ballinger, 2006). Although many calendar models exist, the most common model of a balanced school year is an academic term comprised of 45 days of school followed by a 15-day break, commonly with intersession time built into the three-week period between academic grading terms. This model also allows for a four or five-week summer break, which is considerably shorter than the ten or twelve weeks of vacation provided by the traditional calendar (Winter, 2005). This dissertation explores the impact of these alternative calendar adoptions on middle school mathematics achievement.

The concept of year-round schools has several definitions. The National Association for Year Round Education (NAYRE) defines year round education (YRE) as the "reorganization of the school year to provide more continuous learning by dividing the long summer vacation into shorter, more frequent breaks.

**Definition of terms.**

Students in YRE programs attend identical classes and receive the same amount of instructional time as students on a nine- month calendar (Ballinger, 2006). For the purposes of this research project, a list of terms and definitions is supplied:

*Balanced Calendar Model:* a total 180 instructional days is divided into four blocks. Each block has 45 days of instruction, followed by 15 days of vacation. Summer vacation is approximately 5 weeks (Ballinger, 2006; McMillen, 2001; Winter, 2005).

*Traditional Calendar Model:* a total of 180 school days scheduled most commonly from September to June. Summer vacation is approximately 10-12 weeks. This model was developed in the 1850's as a compromise to accommodate both agricultural labor needs and developing urban industrialization. This model remains the most common model in public education today.

*Intersession:* instructional time provided during the weeks denoted as vacation periods for students requiring or opting for remediation or enrichment programs. On a balanced calendar model, these periods take place four times per year, for two to three weeks per session.

*Traditional summer school:* instructional time provided during an average of four weeks in the summer to provide students who were not promoted a second opportunity to earn advancement to the next grade level.

*Extended calendar*: a calendar with more than 180 days per year, as is found in many industrialized nations, with the United States being the primary exception.

*Single Track Year Round Calendar:* a balanced calendar model where all students attend school on the same schedule, or track. Instructional days and vacation days are the same for the entire student population as well as the faculty.

*Multi- Track Year Round Calendar*: traditionally used to alleviate overcrowding, the student population is divided into four groups, with three groups attending school while the fourth group is on vacation. The groups rotate throughout the year, so that the building is occupied year round. This reduces the need for districts to build new school buildings. Also referred to as a “school within a school” (Winter, 2005).

For the purpose of this study, the focus remains on schools that operate on a balanced, single track system. A single track system means that all students attend school together, and also have vacation periods together. Many schools, most notably the Wake County Public School System in North Carolina, operate a year round calendar use a multi-track system. Such a system is generally used to alleviate overcrowding. A multi-track system utilizes a school building by scheduling a portion of students to attend school while another portion is on vacation. Groups of students rotate between instructional periods and vacation periods so that the building is in constant use, thus serving more students (Glines, 1992; Ballinger, 2006). As a result, multi-track systems do not utilize intersession periods for remediation or enrichment, which are a key component to the single track system. As a result, comparisons between balanced single track calendar models and multi-track models are not direct, and therefore are not a focus of this study.

The results of this research study will help to guide educational leaders, district policy makers and local school leaders as they develop and recommend academic calendars in the future. Additionally, as leaders in districts observe rises in poverty levels, such conversations and proposals to best support these students will be guided by this study. Policymakers, motivated by utilizing research based approaches, may consider the additional support of intersession periods provided by a balanced calendar model as most impactful to student groups, particularly those from lower socioeconomic backgrounds, that traditionally struggle to achieve in mathematics at high levels.

## Literature Review

### Two seminal studies.

Cooper, Nye, Charlton, Lindsey & Greathouse (1996) conducted a meta-analysis project regarding the concept of summer fade. The published report synthesizes 39 separate studies. In the earlier group of studies, a clear loss of mathematical computational skills was determined have been due to summer fade. Researchers determined that approximately one month of grade level equivalency is lost each summer by students on a traditional calendar model, relative to national norms. The average student’s score drops about one tenth of a standard deviation when comparing the spring average to the adjacent fall average (Cooper et al., 1996).

Differences in effect of summer fade were non-existent when comparing genders of students, or ethnicity of students. However, when comparing the income levels of the families of the students, researchers found an increased effect of summer fade in students of lower income levels when compared to middle and high income students. Lengthy summer breaks affected mathematical computation more so than reading levels because students were more likely to forget skills maintained through repetition, such as mathematical algorithms. This negative effect increases and compounds as students grow older. As the age and grade level of the student progresses over the years, the effect of summer vacation shifts from positive to negative and grows more damaging (Cooper, et al. 1996). Cooper's study determined that on average, students lose 2.6 months of grade equivalency in mathematics computation during the summer months. The relative lack of opportunity to practice mathematical computation results in these skills being the most susceptible to decay. The effect of summer vacation would likely be more harmful, perhaps radically so, if it were measured from the final day school to the first day students return the following academic year (Cooper et al., 1996).

Cooper, Valentine, Charlton and Melson (2003) later contend that the positive effect of a modified calendar is cumulative, and that although any measureable effect may be small, the total effect on a child throughout his or her academic career is likely increasingly significant. The researchers recommend a well-designed, longitudinal study to test this hypothesis in grade K- 12. They also emphasize that research more strongly suggests a greater positive effect for students from lower socio- economic backgrounds, hence the inclusion of the second guiding question within this study.

When comparing the income levels of the families of the students, researchers found an increased effect of summer fade in students of lower income levels when compared to middle and high income students (Fairchild & Boulay, 2002). Lengthy summer breaks affect mathematical computation more so than reading levels because students are more likely to forget skills maintained through repetition, such as mathematical algorithms. This negative effect increases and compounds as students grow older (Fairchild & Boulay, 2002; Alexander, 2007;

Smith, 2012). John Hopkins University researchers Karl Alexander, Doris Entwisle and Linda Olson (2007) extensively studied the impact of such a lengthy vacation away from the classroom. Their longitudinal study concluded that two-thirds of the achievement gap between low income and middle income students can be explained by unequal access to summer learning opportunities. Consequently, the authors contend that the academic calendar approximates a natural experiment for isolating the distinct role of public education in cognitive development.

Studies reviewed for this dissertation concluded that family income levels substantially impacted learning opportunities in children's homes and communities. Additionally, with learning gains nearly equal for all income levels, those students of low income backgrounds more quickly lose the gains achieved during the school year due to a lack of home or community based learning opportunities over the summer. Furthermore, Alexander, Entwisle and Olson (2007) argue that if the achievement gap correlates with summer learning differences in elementary and middle school students, and if academic placements and attainments in high school are determined by achievement scores, then summer learning differences help explain the differences in achievement (and consequently opportunities) between low income students and middle and upper income students as they graduate and enter college, or alternately drop out.

After nine years of student longitudinal data were analyzed; the Alexander et al. (2007) study found that 62% of high income students were enrolled in a college preparatory program, while only 13% of low income students were enrolled in the same program. Conversely, 33% of low income students dropped out of high school, while only 3% of high income students dropped out. These findings are characterized as the lasting consequences of the summer learning gap.

> The school year pattern of achievement gain parity (or near parity) across social lines flies in the face of widely held assumptions (if often only whispered) about the learning

> abilities of poor and minority youth. It also flies in the face of widely help assumptions about the failures of public schools burdened by high poverty enrollments. Perhaps these schools and school systems are doing a better job than is generally recognized (Alexander et al., 2007, p. 177).

Students of all income levels can learn at high levels while in school. The difference is the lack of learning that takes place outside of school while school is not is session. Alexander et al. (2007) demonstrate that the significant achievement difference between income levels that develop as students' progress through the grade levels is almost entirely attributable to summer fade. As a result of this seminal research study, educational leaders and policymakers have evidence that low income students' achievement regresses two months every summer, and this regression compounds as multiple summers without schooling pass. This phenomenon is known as "summer fade" (Bracey, 2002; Donohue & Miller, 2008; Duffy, 2011).

Donohue and Miller (2008) adapted the data found in Table 1 from the research study conducted by Alexander et al. (2007). The data illustrates the parity that exists between income levels [Socioeconomic Status (SES)] while students are in school, and shows the summer learning loss for lower income students after each year of not being in school during the summer months. Students begin elementary school on nearly equal achievement levels, but leave elementary school with a significant achievement gap. The gap is created by a cumulative effect of summer learning loss, as the difference in mean scores increases as years pass from first through fifth grades. Students earn scores with a lesser difference between socioeconomic status in first grade, and after each subsequent summer, students from lower socioeconomic backgrounds fall increasingly further behind compared to their higher socioeconomic peers, as noted by the increase in the difference between mean scores in Figure 1.

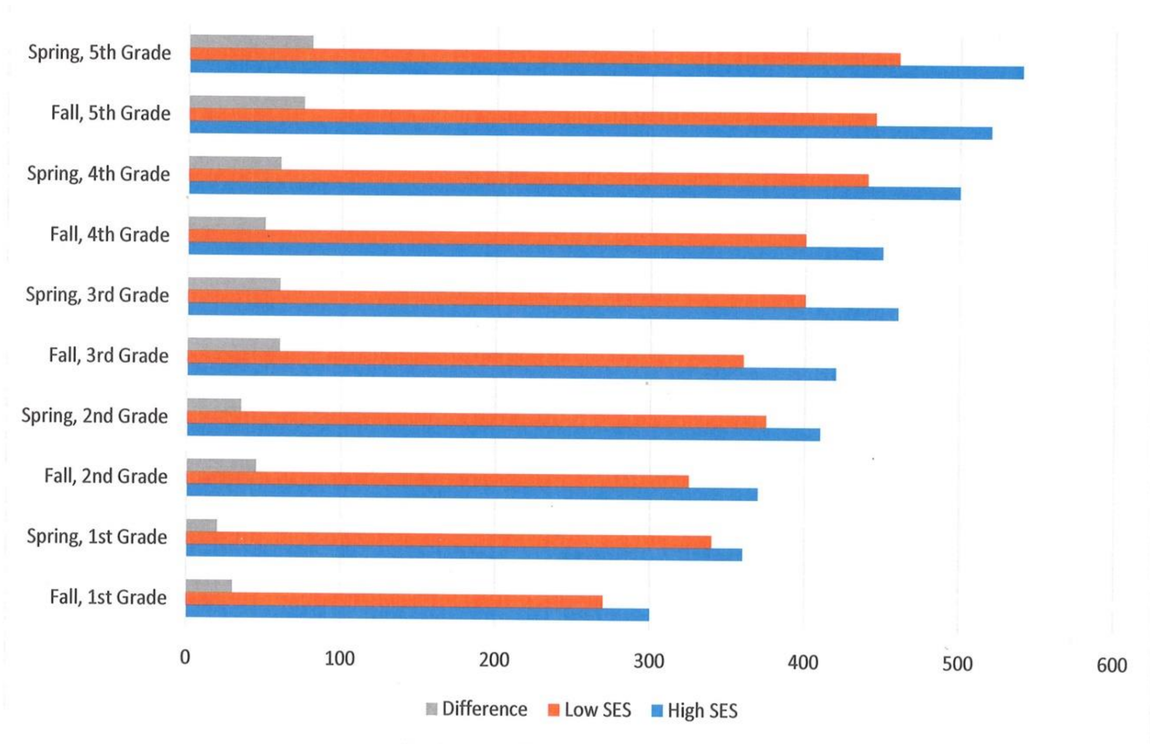


*Figure 1.* Mean Verbal Scores: California Achievement Test by SES (Donohue & Miller, 2008, adapted from research study by Alexander et al. (2007)

**History.**

Why 180 days of instruction? In the United States, 47 of the 50 states require students to attend school for between 175- 180 days, or an equivalent number of hours (NAYRE, 2012). This statistic has remained unchanged since 1980 (Fleming, 2011). Since 2008, 86% of public schools in the United States follow an academic calendar that utilizes only nine or ten months of the year (Kolbe, Partridge & O'Reilly, 2012). What distinguishes today's calendar is not merely that it is 180 days long, but that the calendar was adopted state by state and is now virtually uniform across the country (Rakoff, 1999). The researcher found no evidence that the standard 180 days of instruction was mandated by the Federal Department of Education, but rather it was adopted on a state by state basis largely in the latter part of the 19th Century and early 20th Century.

In a nation that upholds the principle that public education is largely a state, rather than federal responsibility, the number of required school days is surprisingly consistent across the country. Historically however, this has not always been the case. In the early 19th Century, urban areas of the nation held school for eleven months of the year, primarily a result of the large number of immigrants in the nation's cities. Students needed to learn English and factory workplace skills so that they would be employable in the industrialized urban areas of the nation. Many urban areas provided funding for schools to be open 250 days per year, and New York City schools were open year round, with the exception of a three week break in August (Pedersen, 2012; Gewertz, 2008). In contrast, rural area schools were open only in the winter months, often in churches or one-room schoolhouses (Hermansen, 1971).

The trend towards consistency in terms of school calendars began in the 1850s when legislatures passed child labor laws, compulsory attendance laws, and minimum curriculum standards (Dixon, 2011). Children were no longer working in the factories and fields; therefore, they were required to attend school (Pedersen, 2012; Gewertz, 2008). Compromises between elected representatives of the urban and rural areas, in order to comply with the new compulsory attendance laws that were quickly being adopted in the late 19th Century, resulted in academic calendars similar to what we see today (Farbman, 2012; Silva, 2012; Winkelmann, 2010). However, special exceptions and provisions were made for communities in agricultural areas with large fall harvests, which resulted in school closings in the months of September and October (Pedersen, 2012). The approximate duration of a nine-month school year with a lengthy summer vacation was constructed in the years between the Civil War and World War I (Rakoff, 1999). When a majority of U.S. households had one parent who did not work outside the home, the traditional schedule of sending students home in the mid-afternoons and summers was not burdensome (Farbman, 2012). In the 21 Century, this societal structure of one-income households is no longer the reality for most Americans (Farbman, 2012).

The first known public school to implement a balanced calendar model was opened in Bluffton, Indiana in 1904 by Superintendent William Wirt, in an effort to improve the quality of education and address overcrowding (Glines, 1992). Other school leaders looked to this model for guidance in this early period in the history of public education.

Although early 20th Century attempts were made to increase year round schooling, these efforts did not survive the Great Depression, as economic factors made expanding the school year cost prohibitive. In addition, the uniformity needed during the years of World War II ended the few remaining examples of alternative school calendars. After the war, "year round education had faded from the American scene" (Hazelton, Blakely & Denton, 1992, p. 10).

In a national effort to avoid a "rising tide of mediocrity", the groundbreaking report *A Nation at Risk* urged schools to add more time to the typical 180-day calendar (National Commission on Excellence, 1983). The report recommended that an additional hour be added to the standard six-hour day, and that between 20 and 40 days be added to the standard 180-day calendar. At that time, achievement gaps were increasingly widening in the nation's public schools and more instructional time was recommended for students to be able to achieve at higher levels, consequently closing these gaps (Pedersen, 2012; Gewertz, 2008).

According to the Center for American Progress, between 1991- 2007, more than 300 initiatives across the nation were implemented to extend learning time (Gewertz, 2008). Many of these programs are found in high-poverty and high-minority population schools in more than 30 states. In 1994, the estimated number of year-round schools increased to include 33 states and more than 1.5 million students (Shook, 1995). Those figures increased to nearly 2.2 million students enrolled in year round schools by 2005 (Gerard, 2007).

Bardstown City School System in Kentucky implemented a year round calendar in 1995 with the expectation of raising student achievement. Five years after implementation, the dropout rate dropped from 4.5 to 2.7 percent, and the percentage of high school graduates attending post-secondary education institution rose from 62 to 74%. Discipline referral rates dropped and attendance increased. The school system continues to see positive trends today, more than twenty years later (Dixon, 2011).

In the Commonwealth of Massachusetts, a widely watched initiative that began in 2005 to expand learning time provides districts with an additional $1,300 per pupil when 30% more time is added to the district calendar (Gewertz, 2008). Senator Edward Kennedy introduced federal legislation in 2008 that would match federal funds for other districts that followed the Massachusetts model. This program received its sixth round of funding in 2011, supporting 300 additional instructional hours for students in 19 schools spread across nine districts (Silva, 2012). Although there is a fair degree of variation, schools that entered their fourth year of implementation significantly outperformed matched comparison schools when extended learning time is compared to schools on a traditional calendar and schedule (Farbman, 2012).

Such programs are gaining in popularity and availability. During the decade between 2004 and 2014, afterschool enrichment programs have seen a rise in enrollment from 6.5 million to 10.2 million students nationally (Afterschool Alliance, 2014). Michigan, the State which serves as the focus of this study, reports only 13% of students enrolled in afterschool enrichment programs. However, if more programs were available in Michigan, 44% of students not enrolled in such programs would be enrolled should the programs exist, as reported by parents

(Afterschool Alliance, 2014). Additionally, a gap exists between low- and higher-income families, with regard to the opportunity to participate in an afterschool program that provides an academic enrichment and remediation program, and as a result, demand for afterschool programs is higher among lower socioeconomic families when compared to their more affluent peers (Afterschool Alliance, 2014).

More recently, President Barack Obama and Secretary of Education Arne Duncan called for additional days to be added to the school calendar, shortened summer vacations, and advocated adjusting the traditional school calendar across the nation, in an effort to increase U.S. global competitiveness with countries whose students go to school 25% -30% longer than American students (Blazer, 2010; Quaid, 2009). Secretary Duncan began his remarks in 2009 with "Go ahead and boo me" (Schulte, 2009). Duncan continued to state:

> I think the school day is too short, the school week is too short and the school year is too short. When you look at all the creative schools that are getting dramatically better results, the common denominator is that they are all spending more time, doing more after school, doing more on Saturdays and doing more over the summer (Sabatino, Huchting & Dell'Orio, 2013, p. 388).

The American Recovery and Reinvestment Act of 2009, commonly referred to as the Federal Stimulus Bill, created new sources of revenue to support expanded learning time in public schools. A federal investment of $200 million for summer programs alone allowed schools to provide innovative, comprehensive and engaging programs (Smink, 2012). Additionally, increasing learning time for low performing students became an important policy discussion as Congress prepared the reauthorization of the Elementary and Secondary Education Act (Farbman, 2012).

One such program funded by the new federal investment program serves low income students in Providence, Rhode Island. These students benefit from an extra hour added to the school day, as part of a partnership with the Providence After-School Alliance, a privately funded initiative. The expanded school day promotes a deeper understanding of Science, Technology, Engineering and Mathematics (*STEM*) content through field based learning experiences. This combination of public and private funding allows a strategic approach to expanding the school day within a limited budget environment (Fleming, 2011). Similarly, the Apollo 20 Initiative in Houston adds five days to the school year, as well as an additional hour of instructional time, in an effort to address “academically unacceptable” achievement in nine middle schools. After the first year of implementation, math scores improved by an additional three and a half months of progress, as measured by an evaluation conducted by Harvard University (Fleming, 2011).

**Mathematics Achievement and Summer Fade.**

For those students on the traditional 180-day calendar, a summer break is considered a hallmark of the experience of growing up in the United States (Pedersen, 2012). A break of approximately 10-12 weeks is used by families for summer vacation, visits with extended family, athletic opportunities, and many other activities. However, students not enrolled in school for such a long period of time become victims of “summer fade”, a term that has been used by researchers as early as 1924 by Brueckner and Distad. The National Center on Time and Learning (NCTL) states that schools allow students to forget much of what was learned during the previous school year. Summer fade results in the conservative estimate of a two month loss (one month re-teaching and one month not learning new content, or 22%) of the school year (Fairchild & Boulay, 2002).

Research shows that all socioeconomic groups lose ability in mathematics during the summer months, and children from low income families also lose ability in reading as well. The learning loss experienced over the summer contributes to the achievement gap between high poverty students and their more affluent peers (Farbman, 2012). As a result, of the schools that have recently lengthened their school day to eight hours or more, nearly half serve a high proportion of minority students. Similarly, public schools that have adopted and extended or twelve-month calendar are more likely to be located in urban areas, as well as serve high percentages of minority and low income students (Kolbe et al. 2012).

A plethora of studies have established that summer learning loss exists and occurs disproportionately for minorities and disadvantaged youth (Graves, 2011). Researchers have found that summer fade is similar amongst middle and lower income students in the area of mathematics, as these students are less likely to practice mathematical skills outside of the formal classroom setting (Fairchild & Boulay, 2002). Fairchild and Boulay (2012) also contend all students are impacted by learning loss in procedural and factual skills during the summer months.  Research suggests that students with shorter summer breaks are able to retain more knowledge learned during the school year, and therefore have less need for extensive review when the school year begins again in the fall (Fairchild, Smirk & Steward, 2009; Kneese, 2000).

Silva (2012) states that the research is clear regarding the widening gap that exists between poor children and their affluent peers. This gap is largely created by time spent outside of school. Affluent students are more likely to be engaged in summer learning programs, cultural outings, summer camps and access to a wider range of books (Blazer, 2010; Donohue & Miller, 2008). However, far too many students lack the resources to access these opportunities (Donohue & Miller, 2008). As a result, students with lower socio-economic status are watching television, working as hourly employees to support the family income, or providing childcare for younger siblings while parents work often more than one job. In order to alleviate the achievement gap between socio-economic levels, researchers argue that more time in school, or a decreased amount of extended time away from school, results in less time for the differences of summer learning loss to add up and be significant (Silva, 2012). One caveat to such conclusions relate to the fact that standardized assessments are not given on the first and last of days of school, and as a result, measurements related to gain or loss over the summer mistakenly count school days as summer days (Gershenson, 2013; Palardy & Peng, 2015). Many advocates suggest the only way to fairly measure academic growth during an academic school year without factoring summer learning loss is to administer standardized assessments in both the fall and the spring (Palardy & Peng, 2015).

The discrepancy in achievement among groups of differing socioeconomic backgrounds is due in part to the differences in environments and available resources during the summer months, despite the similar achievement gains by the differing groups during the school year (Bracey, 2002; Alexander et al., 2007; Donohue & Miller, 2008). Results from recent studies suggest that although children from differing income levels make similar gains, they differ in their ability to maintain those necessary skills during the summer months. (Edmonds, O'Donoghue, Spano & Algozzine, 2008). Research suggests that up to two-thirds of teenagers today are unprepared for college or careers, most of whom are from low income families (Donohue & Miller, 2008).

In 2015, a study was conducted by Paechter et al. that measured the effects of a nine-week summer vacation on fifth and sixth graders in Austria. The study measured student achievement levels in reading, mathematics and spelling at the end of the school year, at the beginning of the following school year, and again three months into the school year. The study concluded that mathematics achievement, particularly problem solving ability from textual information, as well as spelling propensity, deteriorated during the nine-week summer vacation. The study also indicated that reading achievement increased over the same period of time, crediting families that support reading practice over the summer, while simultaneously neglecting mathematics problem solving skills.

Studies show that students from all backgrounds slip in their math proficiency during the long summer months (Schulte 2009); however, summer learning loss was most evident in areas taught through repetition and practice, such as math computation (Abakwue, 2011). Despite employing statistical controls for variables such as demographics and socioeconomic backgrounds, the research study conducted by Palardy & Peng (2015) found substantial differences between student growth measurements taken once per year when compared to measurements taken separately in the fall and spring. This difference suggests that summer fade is a measurable factor in student growth. School leaders, particularly in schools that serve low socioeconomic families, find that overall student achievement results increase by a quintile when summer learning experiences are included in final school achievement reports (Palardy & Peng, 2015). In today's era of high accountability, school leaders recognize that standardized assessment accountability measurements are positive and increasingly accurate when summer learning is factored into final calculations.

**Intersessions provide instructional intervention.**

Many districts and individual schools have found advantages in using the breaks between grading periods to offer excellent opportunities to support and enrich struggling learners (Gerard, 2007). Summer months and intersession periods provide the ideal time to pilot new approaches that look and feel different than those encountered during the school year (Smink, 2012). Multiple intersession periods provide students with more opportunities for remediation and enrichment, compared to the traditional calendar's typical summer school period (Dixon, 2011).

One type of a balanced calendar includes a model whereby after 45 days of instruction, students are provided a 15 day break. During that time, two or three week intersession periods, either optional or required as varied by districts, are planned for students who need remediation or enrichment. These intersession periods are planned after each 45 day instructional block, commonly in October, January, March and July. Summer vacation is limited to five weeks, rather than the traditional calendar that offers10- 12 weeks of vacation (Schulte, 2009). Rather than a single summer school program lasting three or four weeks, students on a balanced calendar model may gain up to an additional twelve weeks of instruction during intersession periods. This increase in instructional intervention represents an additional year of added instructional time for every three years a student is enrolled in a school utilizing a single track calendar model (Fairchild & Boulay, 2002; Schulte, 2009).

Research indicates that all students lose skills in mathematics during the summer, and that summer learning loss disproportionately affects low income students (Cooper et al. 1996; Fairchild & Boulay, 2002; Farbman, 2012). Most concerning is that summer learning loss is cumulative, and contributes substantially to the achievement gap between high and low income students (Alexander et al. 2007). Efforts to close this gap during the regular school year alone may not be successful (McCombs et al, 2012). While changing the calendar year can provide many benefits, the importance of the intersession period cannot be overstated. The additional instructional period between grading terms provides the difference between success and failure for many students, particularly those from low income families (Abakwue, 2011).

Boston Public Schools has developed “Acceleration Academies” at nine schools identified as “turnaround schools” for students to receive additional math and reading instruction. More than 1200 students in grades three through eight participated in week-long focused on reading and math. Teachers that have demonstrated high levels of effectiveness were purposefully recruited to lead these academies. Students gained an equivalent of a month’s worth of instruction in a single week, which otherwise would have simply been a vacation period (Farbman, 2012).

In January of 2011, Cardinal Roger Mahoney announced that all elementary schools in the Archdiocese of Los Angeles would implement a 200-day school year by the year 2012- 2013 (Sabatino et al. 2013). Three elementary school principals began a pilot of this program in 2011. A study was conducted to qualitatively discover the decision making process by the archdiocesan policymakers, the reactions from parents and stakeholders, and the rationale employed to make such a calendar adjustment (Sabatino et al. 2013). During community meetings and parent engagement venues, parents reflected that in the past, they felt the need to keep their child connected to school programs through books or summer camp programs. Now that the school year traversed into the summer months, the parents felt confident that the school system would be able to fill the need for educational opportunities in the summer, and parents felt less pressure in the summer to provide opportunities for their children in other settings (Sabatino et al. 2013). Although the Archdiocese of Los Angeles did not implement a balanced calendar as defined by NAYRE, the effect of a 200-day school year reduces the lengthy summer break found in traditional calendar models. A further study as to whether a decrease in summer fade was noticed after implementation of the new extended calendar would further supplement the existing literature.

In North Carolina, year round programs offer some form of remediation or enrichment opportunities during the intersession periods, while 57% of programs have mandatory remediation for students who are struggling academically (McMillen, 2001). Baltimore City Public School students introduced new summer programs in 2010, with a focus on STEM. Student success has allowed funding to continue, as 70% of students experienced no measurable summer learning loss, and 23% moved from basic to advanced levels of mathematics achievement.

Unfortunately, only 21% of students who are eligible for free and reduced lunch programs during the regular school year are able to participate in summer nutrition programs. Studies also show that crimes committed by young people occur at substantially higher rates when unsupervised during the months of the year when schools are closed. They are also at higher risks for drug and alcohol use (Fairchild & Boulay, 2002). Keeping school open during the summer months would reduce the large stretches of time when students do not have supervision, structure and access to a reliable source of breakfast and lunch programs. Fairfax County, Virginia’s Timber Lane Elementary implemented intersessions periods with a class of kindergarten students in 2003. Six years later, Principal Diane Connolly stated in 2009 that her students gained thirty additional weeks of instruction during their time at Timer Lane. She emphasized the power of adding almost an additional year of instruction to the career of the elementary students (Schulte, 2009).

The Elevate Math Program was implemented in six school districts in California’s Silicon Valley in the summer of 2014. Of the 496 students that participated in the study, 57% were eligible for free and reduced lunch (Snipes, Huang, Jaquet & Finkelstein, 2016). They spent nineteen days for four hours per day in blended learning classrooms, utilizing Khan Academy, a nationally known web-based program that individualizes student learning based on measured strengths and weaknesses, as well as Common Core based instructional modules. At the conclusion of the program, researchers concluded that statistically significant gains were made in algebra content and readiness for the upcoming year. Researchers also claim that 37% of the observed gains were directly to the avoidance of summer learning loss, which would have occurred if the summer program were not available (Snipes et al. 2016).

Summer learning loss is often the primary reason for adopting a balanced calendar model in an effort to bolster student achievement. When students are away from school for three months, they become less proficient in the material they learned in the preceding nine months. The largest difference in use of time over the summer between high and low income students was found to be the number of hours of television viewing. Low income students watch two hours more television per day as do their higher income peers (Gershenson, 2013). Classroom teachers often begin the year with several weeks of review in an effort to combat summer learning loss. Advocates for a balanced calendar contend that shorter, more frequent breaks and intervention periods effectively combat summer learning loss (Abakwue, 2011).

There are of course barriers to intersession periods, which are largely expansions of school time, either through more hours per day or more days per year. Farbman (2012) outlined these challenges as primarily being “limited financial resources by local and state governments, the infringement of additional school time of families and commitments such as athletics or employment, and ‘inertia factor’ of large institutions and their reliance on tradition and consistency” (p. 8).

**Theoretical Framework.**

The theoretical framework for this study is Organizational Theory. Originating from 19th Century observations of industrial and commercial organizations, Max Weber was the primary contributor to this body of work (Bush, 2015). Organizational theory is a theory for understanding, and a significant difference exists between organizational and management theory, which is an applied theory with a limited application (Hoyle & McMahon, 1986). Hoyle and McMahaon (1986) also states that organizational theory enhances the understanding of leadership and management of schools. School leaders need an understanding of organizational theory to guide and support their professional service (Bush, 2015). Since organizational theory originated in the industrial areas of the 19th Century and traditional school calendar models also originated from the same historical period in an effort to organize the education of children, organizational theory seems appropriate for this study.

Leadership development is often studied through the lens of organizational theory, allowing leaders to develop a “compass” to guide decision making (Brazer, Kruse & Conley, 2014). The framework encourages individual leaders to develop a perspective originating from the complex organization, a school district for example, rather than from a single point of view. Policymakers and school leaders understand both opportunities and limitations of a particular organization, as well as develop strategies to implement change (Brazer et al. 2014). Maintaining the focus of school leadership and organizational change is often constrained by the realization of external forces must be confronted and overcome in order for change to become reality (Brazer et al. 2014).

School leaders considering alternatives to the traditional school calendar are making organizational decisions to improve performance. However, Weber (1952) describes the process of achieving organizational change as the "iron cage" in which humanity has imprisoned itself (p. 181-182). DiMaggio and Powell (1983) expand further upon the idea of the iron cage, contending that the constraining process known as isomorphism creates an inevitable push towards homogeneity in established organizations. Through a variety of applications, with public schools used as a primary example, disparate organizations soon succumb to powerful forces that lead them towards organizational similarity within an established field (DiMaggio & Powell, 1983). Furthermore, many attempts to institute change by organizational leaders, after a certain level of structure is attained in the professional field, the cumulative effect of individual change is to decrease the extent of variety within the field (DiMaggio & Powell, 1983). This researcher is curious as to whether the institution of the traditional 180-day calendar model is a result of the concept of isomorphism, or the tendency for organizations to homogenize over time. If this is the case, it would supply evidence as to why the model has endured for so long, and illustrate the challenges school leaders and policy makers face while instituting organizational changes, such as a balanced calendar model, in a field as established as public education.

Bush (2015) also states that organizational theorists have responded to contextual variables by developing the notion of contingent leadership that suggests that leaders respond to unique circumstances or problems by adapting their behavior. As modern school leaders adapt to serving student populations with increasing diversity and poverty, adapting traditional practices to combat summer fade and socio-economic achievement gaps will require changes in traditional practices.

Within the post-positivism framework exists the philosophy of critical realism. Founded by Roy Bhaskar, an English philosopher who was prominent in the 1970's, critical realism "provides a philosophical grounding for science as well as an alternative to positivism"

(Alvesson, 2009, p. 40). Positivism, which has fallen out of favor since the middle part of the 20th Century, relies on empiricism to predict a reality that exists and requires understanding (Trochim, 2006). A critical realist recognizes a reality independent from our thinking to be studied and understood; however, the critical realist also recognizes that observation is fallible. Consequently, all theory that rests on observation is revisable due to inherent flaws in data and analysis. A critical realist attempts to understand reality, even though one recognizes this as an impossible task. In order to better understand reality, a post-positivism critical realist uses triangulation that calls for multiple sources, all of which have a component of error, to best approximate an understanding of a studied mechanism (Trochim, 2006). "It is not possible to reduce the world to observable objects and facts, critical realists argue" (Alvesson, 2009, p. 40).

**Conclusion.**

The United States has changed dramatically since the early 19th century. Students today must compete globally rather than locally for economic gain. Pederson (2012) states:

> Since very few American students today have the same farming obligations as their predecessors from over a century ago and most buildings constructed in the past 20 years are equipped with the necessary climate control, the original obstacles for year-round education seem to have been removed (p. 56).

Several reviews of existing literature have been conducted on the topic of public schools operating on a year round calendar, with the general consensus being that the student achievement outcome is positive when compared to schools operating on traditional calendars (Cooper et al. 1996; Alexander et al. 2007; Pedersen, 2012). However, these studies were broader in scope, and were not limited to mathematics achievement, middle school students, and single track calendar models. Therefore, the guiding questions of this study remain unanswered.

1. How does the adoption of traditional and balanced school calendar models influence mathematics achievement for the general population of students within a middle school?

2. How does to the adoption of traditional and balanced school calendar models influence mathematics achievement for the population of students identified as eligible for free and reduced lunch within a middle school?

This literature review provides a broader understanding of the impact of a balanced calendar model on student academic achievement. In addition, the reviewed literature related to students with low socioeconomic backgrounds being most susceptible to summer fade supports the second research question. U.S. student mathematical achievement must increase in the immediate future, and abbreviated school calendars and long traditional summer breaks do not positively impact the goal of global competitiveness (Dessoff, 2011, Winter, 2005).

This research project began with the simple observation from the researcher, while serving as either an administrator or teacher during traditional summer school sessions for a number of years, that students at risk of retention are more commonly from lower income backgrounds and are more ethnically diverse than the general student population. Additionally, many of the same students often attend summer school multiple years. Do we expect three weeks of summer school to repair the academic weaknesses of these students? Is there another academic model from which these students would benefit more so than the traditional calendar model used today?

The review of the literature provided an historical background of the current calendar model, and provided a litany of alternate ideas and programs throughout the country. Additionally, the literature seems to support the concept that some students, particularly from low income backgrounds, are both academically harmed from the long summer vacation, and benefit from an increase in both duration and frequency offered by intersession periods. As urban school system populations grow more diverse and increasingly disadvantaged, the need for additional research regarding alternatives to a three-week summer school program increases. Several reviews of existing literature have been conducted on the topic of public schools operating a year round calendar, with the general consensus being that the student achievement outcome is positive when compared to schools operating on traditional calendars. However, these studies were broader in scope, and were not limited to mathematics achievement, middle school students, and single track calendar models. Additionally, teacher and student attitudes are more positive and parents are more satisfied with the year round program (McMillen, 2001).

If policy makers are serious about global competitiveness and developing future American innovation and modernization, mathematics students from the United States must be able to compete with international students, many of whom already outperform American students, while simultaneously studying more days per year than current U.S. students. For example, Japanese students who have completed twelfth grade have attended school an equivalent of three additional years compared to students in this country (Ballinger, 2006). American students traditionally go to school fewer days than their international counterparts, while concurrently not attending school for 10- 12 weeks during the summer, adhering to both agrarian and family vacation traditions. In the age of globalization, we can no longer yield to outdated traditions if American students hope to both compete and lead the world on the global stage. U.S. student mathematical achievement must increase in the immediate future, and abbreviated school calendars and long traditional summer breaks do not positively impact the goal of global competitiveness (Dessoff, 2011, Winter, 2005).

Researchers have long known that the traditional school calendar does not correlate with student learning patterns. The long summer break interferes with retention of material, particularly for low-income students whose families cannot afford summer enrichment programs (Metzker, 2002). Over a century of research has provided evidence that summer fade, for many children in the United States, is a national phenomenon that no one seems to want to address (Pederson, 2011). Fairchild and Boulay (2002) state that while no single cause fully accounts for the persistence in achievement gaps, overlooking evidence about summer learning loss represents a significant missed opportunity to address a key aspect in the growth of achievement gaps between students after they begin school (p. 9).

On a foundational level, if communities agree that a middle school aged child should be attending school, then making the conscious choice to cancel school for a ten-week period every summer should be based on sound research, not on outdated agrarian traditions. Additionally, with longitudinal research concluding that the achievement gap both grows and compounds, and is directly linked to a lack of summer educational opportunities for low-income students (Alexander et al. 2007), then the continued tradition of extended summer vacations becomes difficult to justify.

One of the most significant hurdles to the clarity of researcher's conclusions is that many studies of the past often confused and combined the modified calendars designed to create intersession periods, with the multi-track year round schools that attempt to alleviate overcrowding (Schulte, 2009). Michael Evans, chief communications officer for Wake County Public School System in North Carolina, states that year round schools are not outperforming those on a traditional calendar, states (Dessoff, 2011). In Wake County, of the 163 schools, 49 schools operate on a multi-track scheduling system since the early 1990s. In 2011, five of the schools shifted from multi-track to single track as enrollment stabilized and overcrowding subsided.

Opponents of the balanced calendar model utilized such data to argue that year round school does not positively impact student achievement. Such data are largely collected by studies focused on multi-track schools, or studies that do not distinguish between multi-track and single track models (Dessoff, 2011).

Policymakers are unlikely to support widespread calendar modifications without a solid body of evidence that it will be beneficial for all students (Winter, 2005). Concrete evidence does not exist that simply rearranging the instructional time alone increases student achievement; however, through innovative intersession instructional programs, achievement results have been shown to increase. Such intersession periods are only able to exist when the calendar is arranged on a balanced, rather than traditional model (Dixon, 2011).

However, as Ballinger adamantly contends in 1988, what meta-message are we providing to our students about the value of learning when we formally announce that instruction is over in June and will not commence again until September? We cannot shut off the faucet of learning for two months every year and expect to have enough learners achieving at high levels (Gershenson, 2013). Nearly thirty years later, the point is magnified when the global economy is considered, as the nation needs to produce as many learners achieving at the highest levels as possible in order for the United States to maintain global competitiveness (Donohue & Miller, 2008). Other industrialized nations, many of which require students to attend school up to 25- 30% longer per year perform better than American students (Dessoff, 2011). As Secretary Duncan contended, in order to be competitive in the 21st Century, school days need to be more evenly distributed throughout the year, longer hours spent at school per day and more school days added per year.

Adjusting the calendar to accommodate intersessions periods is ultimately a small first step in the movement to transform our public education system from the 1850s to the present day.

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# CHAPTER 2

# THE INFLUENCE OF TRADITIONAL VS. BALANCED SCHOOL CALENDARS ON MIDDLE SCHOOL STUDENTS' MATHEMATICS ACHIEVEMENT

The purpose of this quantitative research study was to determine how the distribution of school days influenced middle school students' mathematics achievement by examining traditional and balanced school calendars. This study selected ten middle schools in the State of Michigan that followed a *balanced calendar,* and ten middle schools in Michigan that followed a *traditional calendar*. Although many calendar models exist, the most common model of a balanced school year is an academic term comprised of 45 days of school followed by a 15-day break, commonly with intersession time built into the three-week period between academic grading terms. This model also allows for a four or five-week summer break, which is considerably shorter than the ten or twelve weeks of vacation provided by the traditional calendar (Winter, 2005).

Using a matched subject design (Rosenbaum & Rubin, 1985; Stuart & Rubin, 2007; Young, 2011) schools were paired together that had similar total student populations, ethnicity demographics, and the percentage of students eligible for free and reduced lunch in order to minimize the impact of variables other than the calendar models. Since each of the selected schools were public middle schools in Michigan, curriculum standards were identical in all schools, as the State of Michigan adopted the Common Core State Standards (CCSS) in 2010, according to the Michigan Department of Education website. The Michigan Student Test of Educational Progress (M-STEP) serves as the end of grade standardized assessment. These standardized test results in the area of mathematics for students in sixth, seventh and eighth grades were analyzed to determine the impact of calendar models on student achievement.

This dissertation endeavors to determine the influence of school calendars on middle school mathematics achievement. In this study, the impact on middle school mathematics achievement by adopting a traditional 180-day school calendar is compared to the impact of using a balanced calendar model, which arranges 45 days of instruction, followed by 15 days of vacation. Intersession periods are scheduled during the breaks to remediate or enrich students by providing additional instructional time. As a critical realist, this researcher recognizes the inherent possibility of error within the data and the resulting analysis. Determining the reality of the mechanism of school calendar models as they influence student achievement in mathematics requires multiple studies through multiple approaches. This study is but one piece of the puzzle to help build a greater understanding of student achievement for policymakers.

The following research questions will guide this study:

1. How does the adoption of traditional and balanced school calendar models influence mathematics achievement for the general population of students within a middle school?
2. How does to the adoption of traditional and balanced school calendar models influence mathematics achievement for the population of students identified as eligible for free and reduced lunch within a middle school?

The research methodology outlined in this study provides policymakers and educational leaders with additional statistical information and insights through quantitative data analysis as they explore alternative calendar options for public school districts that they represent across the country.

**Methodology**

Donald Rubin, a statistics professor from Harvard University, pioneered the quantitative research tool known as *matched pair design*. One such arrangement of matched pair design exists “in which all of the outcome data is already available, and the goal of the matching is to reduce bias in the estimation of the treatment effect” (Stuart, 2010, p. 2). This situation directly applies to the conditions of this study. Matched pair design attempts to select the control groups for research so that as many background similarities between the control and the variable groups exist, with the exception of the covariate, or the primary mechanism of study (Rosenbaum & Rubin, 1985). “The appeal of matching lies in the simplicity of the concept and the intuitive idea that a tight matching should work well whether the relation between y and x is linear or curved” (Rubin, 2006, p. 57). A matched subject design controls preexisting variables that are closely related to the dependent variable that the study is designed to evaluate (Tavakoli, 2013). “Matching methods constitute a growing collection of techniques that attempt to replicate, as closely as possible, the ideal of randomized experiments when using observational data” (Stuart & Rubin, 2007, p. 155).

Random assignments are often not appropriate in educational studies due to ethical or practical constraints. It would not be appropriate nor practical for district leaders to assign middle school students to schools using different calendar models solely for the purpose of research and statistical data collection. A district’s adoption of an alternative calendar must be based on empirical data that has been previously collected and peer reviewed, rather than adopting a calendar for the purposes of conducting research. Consequently, a primary objective and advantage of an observational study, specifically matched pair design, is to control the biasing effects of confounding variables (Rubin, 2006). As a result, the matched pair design model is appropriate for this study.

Rubin & Thomas (2000) also contend that matched pair design methodology is a useful tool to reduce the influence of variables that are not directly being studied, but the method does have limitations. The practice of pairing involves the finding of a match for each experimental subject (Rubin, 2006). Pairing is appropriate and effective when the control population does not have the same mean (Rubin, 2006). In this study, each balanced calendar middle school was matched with a traditional calendar middle school as closely as possible, in terms of demographic and socio-economic data. “In matched sampling, the samples are drawn from the populations in such a way that the distributions of the confounding variables are similar in some respects in the samples” (Rubin, 2006, p. 31). However, an observational researcher may misidentify which variables have the greatest influence on the study, and therefore may match data sets inappropriately. In this study, it is likely that that no two middle schools are entirely identical, and therefore the researcher in good faith made choices to match data sources, resulting in compromises and possible inaccuracies.

> One of the most common criticisms of the conclusions drawn from an observational study is that they are erroneous because the investigator failed to adjust or match for another confounding variable that affects y. He may have been unaware of it, failed to measure it, or guessed that its effect would be negligible. Even under simple models, however, investigation of the effects of such a variable on the initial bias and of the performance of the regression and matching leads to no crisp conclusion that either rebuts or confirms this criticism in any generality (Rubin, 2006, p. 44).

Although matched pair design methodology has disadvantages, it is useful in order to limit the influence of variables that naturally exist, but are not the primary focus of the researcher.

There have been eleven quasi-experimental research studies in recent years designed to compare student achievement differences between extended time and traditional calendar schools. Five of these studies utilized matched pair design, namely Brown, 1998; Farbman & Kaplan, 2005; Frazier & Morrison, 1998; McDonald, Ross, Abney, & Zoblostsky, 2008 and Ross et al., 2007 (Patall, Cooper & Allen, 2010).

Using a match pair design, McDonald et al. (2008) conducted a study of the effectiveness of the Knowledge is Power Program (KIPP) and the impact of a extended school year. The study matched students who were in KIPP with students who were not in KIPP, while maintaining geographic and demographic similarity. The KIPP study compared student groups using their reading and mathematics achievement scores resulting from the Tennessee Comprehensive Assessment Program Achievement Test (TCAP/AT). The study concluded that the KIPP program students performed positively compared to their control group peers, in a statistically significant positive outcome when comparing 5$^{th}$ grade mathematics students.

James Pedersen (2012) used a matched pair design to compare the academic performance of high school students who were from either a traditional or balanced calendar school in California, Illinois, and Texas. No statistically significant differences in achievement were determined. Additionally, Andrea Winkelmann (2010) of Loyola University conducted a similar research study using 39 elementary schools on a traditional calendar in Chicago and matched them with 39 schools on a balanced calendar model. The researcher compared third grade reading and math achievement results and concluded that the balanced calendar model had a positive effect on student achievement.

A study conducted by Guill, Ludtke and Kollar (2017) used propensity score matched pair design using four different matching algorithms to evaluate the influence on school tracking with academic achievement on the Grundintelligenztest Skala 2 in the German school system. Due to the categorical nature of the variables in the study, both the Fisher exact test and regression analysis were used to conduct the statistical analysis of the data. The study concluded that those students placed in higher level tracks gained greater gains in achievement when compared to students on the remaining tracks. The study recommends that more, if not all students be given access to the benefits of the higher level tracks in the German school system.

**Sampling subjects, methods and procedures.**

The data for this study were retrieved from several school districts in Michigan that have adopted balanced calendar models at the middle school level. Twenty middle schools were chosen: ten utilizing the traditional model and ten utilizing the balanced model. The twenty middle schools involved in the study serve a combined total of 9,182 students in grades six, seven and eight. Data regarding these middle schools was examined using the Michigan Department of Education website, www.mischooldata.org. Each middle school with a balanced calendar model was paired with a middle school using a traditional calendar model. These schools were selected based on their (a) student population size, (b) demographic information and (c) percentage of student eligible for free and reduced lunch. Schools that did not have a mirroring school with the opposite calendar model were not included in the study. The goal of the research study was to find ten pairs of schools to analyze. The ten middle schools listed below all utilize a balanced school calendar:

a) Baldwin Jr. High, Baldwin Community Schools

b) Milton E. Tucker Middle School, Beecher Community School District

c) Croswell- Lexington Middle School, Croswell Community Schools

d) Davison Middle School, Davison Community Schools

e) Imlay City Middle School, Imlay City Schools

f) Roland-Warner Middle School, Lapeer Community Schools

g) Zemmer Middle School, Lapeer Community Schools

h) Madison Middle School, Madison School District

i) Pontiac Middle School, Pontiac City School District

j) Ypsilanti Middle School, Ypsilanti Community Schools

Table 1

*Matched Pairs: School Demographic Comparison*

| School | Calendar | Count | 6th Grade | 7th Grade | 8th Grade | F/R % | Asian | Black | Hispanic | White |
|---|---|---|---|---|---|---|---|---|---|---|
| Kosciuszko | Traditional | 315.0 | 0.0 | 169.0 | 146.0 | 94.4% | 35.9% | 22.2% | 40.3% | 0.0% |
| Baldwin | Balanced | 77.0 | 0.0 | 39.0 | 38.0 | 92.5% | 0.0% | 26.0% | 57.1% | 5.2% |
| Muskegon | Traditional | 548.0 | 0.0 | 289.0 | 259.0 | 89.4% | 0.2% | 61.9% | 19.9% | 12.6% |
| Ypsilanti | Balanced | 469.0 | 153.0 | 146.0 | 170.0 | 86.4% | 0.4% | 70.4% | 18.1% | 6.4% |
| Tomlinson | Traditional | 230.0 | 2.0 | 125.0 | 103.0 | 86.4% | 0.9% | 87.4% | 9.6% | 2.2% |
| Milton Tucker | Balanced | 269.0 | 85.0 | 58.0 | 54.0 | 85.1% | 0.0% | 87.3% | 5.1% | 3.0% |
| Linden Grove | Traditional | 745.0 | 261.0 | 256.0 | 228.0 | 68.0% | 1.3% | 47.8% | 33.7% | 10.1% |
| Pontiac | Balanced | 898.0 | 0.0 | 254.0 | 311.0 | 74.0% | 5.0% | 52.9% | 7.4% | 33.8% |
| Sturgis | Traditional | 718.0 | 252.0 | 239.0 | 227.0 | 63.5% | 1.3% | 2.2% | 57.1% | 36.8% |
| Madison | Balanced | 369.0 | 130.0 | 123.0 | 116.0 | 62.4% | 0.8% | 6.0% | 60.4% | 30.9% |
| Mill Creek | Traditional | 432.0 | 135.0 | 154.0 | 143.0 | 53.2% | 0.9% | 6.5% | 66.9% | 19.9% |
| Imlay City | Balanced | 484.0 | 151.0 | 158.0 | 175.0 | 57.0% | 0.8% | 0.8% | 72.5% | 25.0% |
| L.E. White | Traditional | 617.0 | 207.0 | 195.0 | 215.0 | 49.5% | 0.8% | 1.9% | 89.5% | 5.2% |
| Croswell | Balanced | 692.0 | 168.0 | 160.0 | 183.0 | 48.9% | 0.2% | 0.4% | 95.1% | 3.5% |
| Greenville | Traditional | 834.0 | 296.0 | 275.0 | 236.0 | 46.3% | 1.0% | 1.2% | 90.0% | 5.4% |
| Rolland | Balanced | 822.0 | 390.0 | 432.0 | 0.0 | 48.9% | 0.9% | 0.6% | 92.7% | 2.4% |
| Lee | Traditional | 422.0 | 133.0 | 153.0 | 136.0 | 47.4% | 0.1% | 7.1% | 7.6% | 82.7% |
| Zenner | Balanced | 385.0 | 0.0 | 0.0 | 385.0 | 47.3% | 0.5% | 0.5% | 3.4% | 92.7% |
| Lakeshore | Traditional | 920.0 | 0.0 | 472.0 | 448.0 | 31.8% | 2.0% | 1.3% | 88.9% | 5.0% |
| Davison | Balanced | 844 | 0.0 | 423.0 | 420.0 | 35.2% | 0.9% | 2.0% | 88.2% | 4.3% |

Table 1 illustrates the matched pairs of schools chosen by the researcher based on the identified criteria. Although no two schools are identical nor are likely to be so, ten pairs were chosen after carefully reviewing data from the State of Michigan, which included 594 middle schools with fifty students or more that served sixth, seventh and/or eighth grade students. Ten schools using balanced calendars were matched with ten schools using traditional calendars. The criteria for the *matching* process included student enrollment, ethnicity demographics, and percentage of students eligible for free and reduced lunch.

The student achievement results, publically available on the Michigan Department of Education website, were collected and analyzed for each school in the study. The Michigan Student Test of Educational Progress (M-STEP) uses four categories to report student progress: (a) not proficient, (b) partially proficient, (c) proficient, and (d) advanced. Students meeting the partially proficient standard or above are considered to have passed the assessment. The total percentage of students falling into the top three categories is considered the passing rate. The passing rates on the M-STEP mathematics assessment for all students who attend the identified schools comprising the matched pairs in grade levels six, seven and eight were collected at the conclusion of the 2015- 2016 school year. Additionally, passing rates on the M-STEP for students qualifying for free and reduced lunch were collected and analyzed separately. Passing rates for the total population of each grade level, as well as passing rates limited to students from low socio-economic backgrounds eligible for free and reduced lunch for each of the three grades levels in the area of mathematics were collected and recorded in Table 2.

Table 2

*Passing Rates on the M-Step Assessment for the Matched Paired Schools*

| School | Calendar | Count | Passing Rate 6 All | Passing Rate 7 All | Passing Rate 8 All | Passing Rate 6 F/R | Passing Rate 7 F/R | Passing Rate 8 F/R |
|---|---|---|---|---|---|---|---|---|
| Kosciuszko | Traditional | 315.0 | n/a | 40.5% | 34.9% | n/a | 41.7% | 36.6% |
| Baldwin | Balanced | 77.0 | n/a | 42.4% | 27.6 | n/a | 40.0% | 27.6% |
| Muskegon | Traditional | 548.0 | n/a | 35.5% | 22.9% | n/a | 36.3% | 22.7% |
| Ypsilanti | Balanced | 469.0 | 38.9% | 28.2% | 22.7% | 37.4% | 25.2% | 22.9% |
| Tomlinson | Traditional | 230.0 | n/a | 27.7% | 22.7% | n/a | 35.5% | 17.9% |
| Milton Tucker | Balanced | 269.0 | 33.8% | 33.3% | 13.5% | 32.3% | 34.8% | 13.0% |
| Linden Grove | Traditional | 745.0 | 49.8% | 46.5% | 48.2% | 36.7% | 37.9% | 37.9% |
| Pontiac | Balanced | 898.0 | n/a | 22.8% | 15.7% | n/a | 21.4% | 15.8% |
| Sturgis | Traditional | 718.0 | 65.7% | 58.3% | 54.2% | 61.0% | 50.9% | 47.0% |
| Madison | Balanced | 369.0 | 77.8% | 71.7% | 70.5% | 71.9% | 67.1% | 66.7% |
| Mill Creek | Traditional | 432.0 | 66.2% | 75.8% | 54.9% | 56.2% | 67.1% | 41.5% |
| Imlay City | Balanced | 484.0 | 59.6% | 63.6% | 46.2% | 50.0% | 51.6% | 42.2% |
| L.E. White | Traditional | 617.0 | 52.3% | 55.9% | 58.4% | 42.7% | 40.9% | 47.2% |
| Croswell | Balanced | 692.0 | 72.1% | 70.3% | 65.2% | 66.2% | 64.2% | 58.3% |
| Greenville | Traditional | 834.0 | 62.9% | 61.9% | 56.3% | 51.7% | 51.3% | 39.8% |
| Rolland | Balanced | 822.0 | 53.3% | 59.9% | n/a | 38.3% | 53.6% | n/a |
| Lee | Traditional | 422.0 | 41.6% | 45.8% | 51.8% | 40.6% | 43.4% | 51.9% |
| Zenner | Balanced | 385.0 | n/a | n/a | 45.0% | n/a | n/a | 40.1% |
| Lakeshore | Traditional | 920.0 | n/a | 83.6% | 74.2% | n/a | 63.9% | 57.5% |
| Davison | Balanced | 844 | n/a | 71.4% | 78.2% | n/a | 58.5% | 57.3% |

Since the study is comparing the passing rates, the statistical analysis focused on the categorical variables of passing versus not passing the M-STEP mathematics assessment. The number of students who passed the assessment, regardless of score or level, was compared to the number of students that did not pass the assessment in each school included in the study. A Chi-Square test of significance was used to compare these two categorical variables, *passing* and *not passing*. The Fischer exact test was also utilized (Stuart, 2010; Onchiri, 2013) since these two tests are appropriate for distributions that do not have a normal distribution, also known as non-parametric.

Onchiri (2013) explains that the Chi-Square technique determines whether two characteristics are related or independent. It is used to estimate the likelihood that a variable other than chance influences the observed relationship. “Chi-Square is not a measure of degree of relationship or the form of relationship between two attributes but it is simply a technique of judging the significance of such association or relationship between two attributes” (Onchiri, 2013, p. 1237).

These calculations were used to test the null hypothesis. The *null hypothesis* of this study predicts that the difference between the passing rates from traditional and balanced calendar models will be zero, or a value of no statistical significance for each grade level: results that “fail to reject the null hypothesis.” The *alternative hypothesis* predicts that the difference between passing rates will be a value significantly different than zero for each grade level. This process was followed for both the total population of students in grade levels six, seven and eight in the identified schools, as well as the limited population of only students eligible for free and reduced lunch for each grade level in the identified schools. The Chi-Square and Fisher Exact test calculations were made in the six categories of assessment data collected from the identified matched pair middle schools in the study. In addition, the Cramer V and Odds Ratio calculations are included in the tables located in the appendix. These values indicate the level of association or effect size for the Chi-Square statistic.

These six categories are listed as:

a) sixth grade mathematics assessment passing rates, all students

b) sixth grade mathematics assessment passing rates, F/R lunch students only

c) seventh grade mathematics assessment passing rates, all students

d) seventh grade mathematics assessment passing rates, F/R lunch students only

e) eighth grade mathematics assessment passing rates, all students

f) eighth grade mathematics assessment passing rates, F/R lunch students only

**Results**

The M-STEP mathematics assessment results for the matched paired middle schools is illustrated in Table 1. Mean passing rates were calculated for the total number of students in each of the six categories included in the study that attend the schools identified in the matcher pair design process. The reader will notice that the mean passing rates in the six categories show no significant difference between traditional and balanced calendar models. In all six comparisons of mean passing score, the scores were either identical, or the traditional calendar mean scores were slightly higher. Such a comparison of mean passing scores results in no evidence to support that balanced calendars positively influence mathematics achievement amongst the students attending the schools included in the study. The median is the standard reporting tool for non-normal distributions. However, the data available on the Michigan DOE website do not include median passing rates, and therefore mean passing rates was used as the reporting tool for this descriptive statistics summary.

**Sixth grade mathematics achievement analysis: All students.**

Of the ten matched pairs of schools, only four of the pairs contain mathematics assessment data for sixth grade students. Many schools in Michigan tend to serve sixth grade students as part of the elementary school model. Schools that exist in this structure were not included in the study, as an elementary school organization would be considered an additional variable not accounted for in the matched pairing process.

Table 3

*Mean Passing Rates for the Matched Pairs on the M-STEP Mathematics Assessment*

| | Traditional Calendar | Balanced Calendar |
|---|---|---|
| 6th grade, all students | *549/ 890 (62%)* | *520/ 839 (62%)* |
| 7th grade, all students | *1255/2174 (58%)* | *997/1793 (56%)* |
| 8th grade, all students | *793/1905 (51%)* | *890/1853 (48%)* |
| 6th grade, F/R Lunch only | *250/471 (53%)* | *235/440 (53%)* |
| 7th grade, F/R Lunch only | *598/1308 (46%)* | *452/1005 (45%)* |
| 8th grade, F/R Lunch only | *443/1147 (39%)* | *386/1050 (37%)* |

The statistical analysis of mathematics assessment data for the four matched pairs is illustrated in Tables 4 - 7 (See Appendix). Of the four pairs of schools analyzed for mathematics assessment data for all sixth grade students, two of the pairs resulted in a statistically significant results that the balanced calendar model influences sixth grade mathematics passing rates with a positive influence when compared to the traditional calendar model. Contrastingly, the analysis of one of the pairs resulted in a statistically significant results that the balanced calendar model influences sixth grade mathematics passing rates with a negative influence. The analysis for the remaining matched pair showed no significant influence upon passing rates from the implemented calendar model.

**Sixth grade mathematics achievement analysis: F/R lunch students only.**

The statistical analysis of mathematics assessment data limited to only sixth grade students eligible for free and reduced lunch for the four matched pairs is illustrated in Tables 8-11. Of the four pairs of schools analyzed for mathematics assessment data limited to only sixth grade students eligible for free and reduced lunch, one of the pairs resulted in a statistically significant results that the balanced calendar model influences mathematics assessment data with a positive influence when compared to the traditional calendar model. Contrastingly, the analysis of one of the pairs resulted in a statistically significant results that the balanced calendar model influences sixth grade mathematics passing rates with a negative influence. The analysis for the remaining two matched pairs showed no significant influence upon passing rates from the implemented calendar model.

**Seventh grade mathematics achievement analysis: All students.**

Nine of the ten of the identified matched pairs include schools that have assessment data available for the seventh grade students. Seventh grade students to not typically attend elementary school, nor do they attend high school, and as a result, nine of the schools identified for this study serve seventh grade students. The exception was Zemmer Middle School, which serves $8^{th}$ & $9^{th}$ grade students at that particular campus within the Lapeer Community Schools district. The statistical analysis of mathematics assessment data for the nine matched pairs is illustrated in Tables 12- 20. Of the nine pairs of schools analyzed, two of the pairs resulted in a statistically significant results that balanced calendar schools influence $7^{th}$ grade mathematics passing rates with a positive influence. Contrastingly, the analysis of three of the pairs resulted in a statistically significant results that balanced calendar schools influence $7^{th}$ grade mathematics passing rates with a negative influence. The analysis for the four remaining matched pairs showed no significant influence.

**Seventh grade mathematics achievement analysis: F/R lunch students only.**

The statistical analysis of mathematics assessment data limited to only seventh grade students eligible for free and reduced lunch for the nine matched pairs is illustrated in Tables 21-29. Of the nine pairs of schools analyzed for mathematics assessment data limited to only seventh grade students eligible for free and reduced lunch, two of the pairs resulted in a statistically significant results that balanced calendar model influences mathematics assessment data with a positive influence when compared to the traditional calendar model. Contrastingly, the analysis of three of the pairs resulted in a statistically significant results that the balanced calendar model influences seventh grade mathematics passing rates with a negative influence. The analysis for the remaining four matched pairs showed no significant influence upon passing rates from the implemented calendar model.

**Eighth grade mathematics achievement analysis: All students.**

Nine of the ten of the identified matched pair schools have assessment data available for the eighth grade students. The exception was Roland- Warner Middle School, which serves $6^{th}$ & $7^{th}$ grade students at that particular campus within the Lapeer Community Schools district. The statistical analysis of mathematics assessment data for the nine matched pairs is illustrated in Tables 30-38. Of the nine pairs of schools analyzed, only one of the pairs resulted in a statistically significant results that balanced calendar schools influence eighth grade mathematics passing rates with a positive influence. Contrastingly, the analysis of one of the pairs resulted in a statistically significant results that balanced calendar schools influence eighth grade mathematics passing rates with a negative influence. The analysis for the seven remaining matched pairs showed no significant influence.

**Eighth grade mathematics achievement analysis: F/R lunch students only.**

The statistical analysis of mathematics assessment data limited to only eighth grade students eligible for free and reduced lunch for the nine matched pairs is illustrated in Tables 39-47. Of the nine pairs of schools analyzed for mathematics assessment data limited to only eighth grade students eligible for free and reduced lunch, two of the pairs resulted in a statistically significant results that balanced calendar model influences mathematics assessment data with a positive influence when compared to the traditional calendar model. Contrastingly, the analysis of one of the pairs resulted in a statistically significant results that the balanced calendar model influences sixth grade mathematics passing rates with a negative influence. The analysis for the remaining seven matched pairs showed no significant influence upon passing rates from the implemented calendar model.

## Discussion

A total of 44 statistical tests using Chi-Square and Fisher Exact were conducted on the matched pair schools in the six categories included in the study: 6$^{th}$ grade total results, 7$^{th}$ grade total results, 8$^{th}$ grade total results, results limited to only 6$^{th}$ grade students eligible for free and reduced lunch, results limited to only 7$^{th}$ grade students eligible for free and reduced lunch and results limited to only 8$^{th}$ grade students eligible for free and reduced lunch. These calculations are illustrated in Tables 4- 47 in the appendix. Of the combined total of 44 tests, only nine matched pairs resulted in significantly significant results that would indicate that balanced calendar schools influence mathematics achievement in a positive manner. Twenty- five of the 44 statistical analysis tests showed no significant influence on mathematics achievement by the implemented calendar model. Ten matched pairs resulted in significant results that would indicate that balanced calendar schools influence mathematics achievement in a negative manner. Although several past studies (Alexander et al. 2007; Cooper et al. 1996) indicate that students of lower socio economic backgrounds experience higher levels of summer fade during lengthy summer vacations, this research study does not provide additional evidence that students eligible for free and reduced lunch benefited from the implementation of balanced calendars, which included shorter summer vacations. That is, these students did not differ from the general population of middle school students, who attended the schools identified in the matched pairs.

These results would indicate that there is a lack of evidence in the collected data and in the resulting analysis for the researcher to claim that balanced calendars positively influence middle school achievement data in a significant manner, neither for the total student population nor for students eligible for free and reduced lunch. As a result, the researcher fails to reject the *null hypothesis* of this study, and concludes that the difference between the passing rates from traditional and balanced calendar models is a value of no statistical significance for each of the six categories included in the study: 6$^{th}$ grade total results, 7$^{th}$ grade total results, 8$^{th}$ grade total results, results limited to only 6$^{th}$ grade students eligible for free and reduced lunch, results limited to only 7$^{th}$ grade students eligible for free and reduced lunch and results limited to only 8$^{th}$ grade students eligible for free and reduced lunch.

**Significance of the Study**

As a growing number of school districts explore strategies to improve student achievement in mathematics, some schools have adopted year round calendar models (Pedersen, 2012). Studies limited to middle school mathematics achievement within single track schools operating balanced calendars are rare, and as a result, this study sheds additional information into the body of research of this topic.

**Theoretical Implications.**

The theoretical implications for this study emphasize that organizational practices are but one variable in the quest to increase mathematics achievement in the United States. This study concludes that the single variable of adopting a balanced calendar model alone does not result in increased middle school mathematics achievement, as many other variables also factor into achievement results. Although school organization is a critical component to educational leadership, this study found no evidence that calendar adoption alone influence middle school mathematics student achievement.

The theoretical framework for this study is Organizational Theory. Originating from 19th Century observations of industrial and commercial organizations, Max Weber was the primary contributor to this body of work (Bush, 2015). "Organizational theory is a theory for understanding, and a broad distinction exists between organizational and management theory, which is a practical theory with a narrower focus." (Hoyle, 1986, p.1). Hoyle (1986) also states that organizational theory enhances the understanding of leadership and management of schools. "Principals need an appreciation of organizational theory to inform and underpin their professional service (Bush, 2015, p. 41). Since organizational theory originated in the industrial areas of the 19th Century and traditional school calendar models also originated from the same historical period in an effort to organize the education of children, organizational theory seems appropriate for this study.

School leaders considering alternatives to the traditional school calendar are making organizational decisions to improve performance, which is parallel to efforts that industrial leaders undertook to make organizational changes to improve manufacturing performance in the late 1800s. Bush (2015) also states that organizational theorists have responded to contextual variables by developing the notion of contingent leadership that suggests that leaders respond to unique circumstances or problems by adapting their behavior. As modern school leaders adapt to serving student populations with increasing diversity and poverty, adapting traditional practices to combat summer fade and socio-economic achievement gaps will require changes in traditional practices.

Within the post-positivism framework exists the philosophy of critical realism. Founded by Roy Bhaskar, an English philosopher who was prominent in the 1970's, critical realism "provides a philosophical grounding for science as well as an alternative to positivism" (Alvesson, 2009, p. 40). A critical realist recognizes a reality independent from our thinking to be studied and understood; however, the critical realist also recognizes that observation is fallible. Consequently, all theory that rests on observation is revisable due to inherent flaws in data and analysis. A critical realist attempts to understand reality, even though one recognizes this as an impossible task. As a critical realist, the researchers fails to reject the null hypothesis of this study and find no significant difference in mathematics achievement results from students that attend traditional calendar models and those that attend schools that have implemented balanced calendar models. In this study, twenty middle school student populations were matched and analyzed by a total of 44 statistical tests using Chi-Square and Fisher exact. A post-positivism critical realist uses multiple observations and analyses to best approximate a representation of an investigated relationship, which was done so in this study (Trochim, 2006). "It is not possible to reduce the world to observable objects and facts, critical realists argue" (Alvesson, 2009, p. 40). However, as observation is fallible and depends on inherently flawed data and analysis, the researcher contends that future studies and research about the influence of school calendar models will further build a collective body of knowledge to provide an increasingly clearer understanding of summer fade and the influence of balanced calendars on student achievement.

**Practical Implications.**

As a result of the failure to reject the null hypothesis of the study and that evidence was not found to support the premise that middle schools that have adopted balanced calendars achieve higher levels of mathematics achievement at a statistically significant level, practical implications of this study are limited to the need for additional research to be conducted on the influence of calendar adoption on student achievement.

However, in the accompanying literature review, a number of programs from around the country are highlighted that support anecdotally that students, particularly from low income backgrounds, achieve at higher levels when additional instructional opportunities are provided through intersession periods. Lengthy summers without instruction result in summer fade, as studied by Cooper et al (1996) and Alexander et al. (2007) and have a negative cumulative effect of decreased achievement as students progress from year to year. Educators must combat summer fade with increases in instructional opportunities either during intersession periods or by decreasing the vast length of time during the summer without formal education. Regardless of whether a district adopts a balanced or traditional calendar, supplementing the standard 180- day school year with additional opportunities for formal education is critical, particularly for students from low income families. Student support programs, as outlined in the literature review, exist through public and private partnerships and are increasing in prevalence. Districts are increasingly cognizant of the effects of a twelve- week long summer without offering instructional support, and are finding creative ways and innovative programs to offset the damaging implications of summer fade.

**Policy Implications.**

This dissertation offers policymakers a greater understanding of the influence of shifting from a traditional calendar to a balanced calendar by making the school year type (traditional or balanced) the variable of interest. This study provides future policymakers with data, results and conclusions that may influence the decision- making process as districts consider calendar modifications. Policymakers are unlikely to support widespread calendar reforms without a solid body of evidence that it will be beneficial for all students (Winter, 2005). As a result, suggesting that current evidence supports the implementation of modified calendars is inappropriate (Cooper, Valentine, Charlton & Melson, 2003). Concrete evidence simply does not exist that shows that the act of rearranging the instructional time alone increases student achievement; however, through innovative intersession instructional programs, achievement results have been shown to increase (Graves, 2011). Such intersession periods are only able to exist when the calendar is arranged on a balanced, rather than traditional model (Dixon, 2011).

## Limitations

This scope of this study is limited in a number of aspects. The sample size of ten pairs of schools is relatively small, and as a result, further research is needed to confirm whether these findings can be applied to larger samples of schools. Additionally, the study was limited to middle school students and mathematics performance. Often districts or clusters within districts adopt a single calendar, and therefore further analysis would be necessary to determine if adopting a balanced calendar for a middle school is appropriate for the neighboring elementary and high schools that also serve that community. Furthermore, since this study was limited to mathematics data, further research is necessary to determine whether achievement data in other content areas are impacted by transitioning from a traditional to a balanced calendar model.

A further limitation is the selection of the schools, and the matched pairing of the schools. While no two schools are completely identical, the researcher attempted to match school demographic data as closely as possible. However, small differences exist in the schools beyond calendar adoption, and as a result, limit the findings of this study. The student achievement data was collected from the Michigan State Department of Education website, which is publically available. The results of this research study depend on the accuracy of the data listed on these websites. Any inaccuracies in data reporting may result in inaccurate conclusions. Variables such as length and tenure of faculty experience at each school, and the climate rating at each school were not included in this study, and may be found in future studies to impact achievement. Additionally, Stuart (2010) contends that even since the earliest work in matched pair designs dating back to the 1940's, the field continues to both expand in use and increase in complexity, and yet "no single source of information for researchers interested in an overview of methods and techniques is available, nor a summary of advice for applied researchers interested in implementing these methods" (p. 1).

An additional limitation of the research study relates to the dichotomous nature of the data, as organized by either the percentage of students passing or failing the end of year standardized assessment. The Michigan Student Test of Educational Progress (M-STEP) uses four categories to report student progress: (a) not proficient, (b) partially proficient, (c) proficient, and (d) advanced. Students are considered to have not passed the assessment if they achieve in the "not proficient" category. The study does not consider whether students may have moved from one passing level of achievement to a higher level of achievement as a result of the influence of balanced calendars. Although no significant difference was found in the passing and failing rates for middle school students on the M-STEP mathematics assessment, the study was not designed to determine if a higher percentage of students within the passing categories achieved in the "proficient" and "advanced" levels of achievement. A future researcher may consider factoring in the four levels of achievement into the statistical analysis to determine if a positive influence exists for students enrolled at balanced calendar schools.

Nonoyama-Tarumi, Hughes, and Willms (2015) conducted a study of 45 nations that participate in the PISA assessment, focusing on the nations with lower socioeconomic resources to determine if the lack of school and national resources impact student mathematics achievement amongst fourth grade students. The study found that a strong relationship does not exist between test results and the quality of teaching during the school year. In fact, across multiple nations with lower socioeconomic means, parental education, parental occupation and home possessions each had a higher relative risk than school resources and teacher quality. Nonoyama-Tarumi et al. caution policymakers that conclude that schools have no influence on achievement, as positive effects exist at a lower rate than the other factors mentioned. As a result of this research study, this researcher considered the likely possibility that factors such as parental education levels and teacher quality may have a greater influence on mathematics achievement than does adopted calendar models. Therefore, these variables, not specifically accounted for in the employed matching paired process may impact the findings.

Additionally, the researcher may have inadvertently included bias without realization, in that after the process of reviewing the existing literature (Alexander et al. 2007; Cooper et al. 1996) that found evidence that lower income students are more susceptible to summer fade, one would therefore expect a shorter summer break to have a positive influence on these students from disadvantaged backgrounds. Additionally, the schools chosen for the study were chosen based on demographics data publically available through the Michigan DOE. The researcher has no connection or familiarity with the schools included in this study outside of demographic and achievement data collected as a part of the research study.

**Suggestions for Future Inquiry**

As concluded by Cooper et al. (2003), the clearest conclusion offered by the synthesis of research that they conducted is that a credible research study of the effects of a modified calendar has yet to be conducted. A decade later, Gershenson (2013) agreed that the existing literature has yet to address the “summer specific differences in time use by SES, despite the fact that such differences may contribute to summer learning loss” (p. 1221). The conclusions drawn from this research study must be placed in the context of the relatively small sample size of ten matched pairs of middle schools, all located in the State of Michigan. This study was limited to a single State in order for curriculum variations to be limited, so as not to involve another variable into the data analysis. A broader study involving an increased number of schools, a greater number of students and involving a more expansive portion of the country would be necessary to more effectively measure the influence of calendar models on mathematics achievement.

In addition, the quality of the implementation of the intersession programs at the ten middle schools selected for the study that have implemented balanced calendars was not investigated. Future researchers may consider a mixed- method approach to combine the quantitative nature of the analysis of student achievement, as well as the qualitative nature of visiting the programs and interacting with the involved school personnel to determine the fidelity in which the intersession periods are implemented and the instructional strategies being utilized. Future researchers may be able to provide broader context related to the experience that students receive during the intersession periods, and to provide insights as to whether these programs are thought to positively influence the student achievement outcomes.

A further suggestion for future study would be to design a study that looks at the achievement data for individual students rather than individual school building results. For example, a researcher could match students rather than entire schools by identifying individual results that meet identical demographic and achievement variables. In order for such a study to be relevant and meaningful, a significant number of individual students at balanced calendar schools would be matched with individuals at traditional calendar schools. This research study matched twenty school buildings into ten pairs, and accounted for over 9,000 students. Would the results of the study be similar if the 9,000 students were matched as individual students rather than entire school buildings? Without substantial evidence that such a positive influence exists, district policymakers and leaders are less likely to implement such a widespread adjustment of the academic calendar.

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# APPENDICIES

## CHI-SQUARE TESTS

Table 4

*Chi-Square Test of School Calendar Type (Sturgis Middle School "Traditional" vs. Madison Middle School "Balanced") on M-STEP Passing Rates for 6th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Sturgis Middle School (Sturgis Public Schools) | | BALANCED Madison Middle School (Madison School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 166 (66%) | 176 (70%) | 101 (78%) | 91 (70%) | 267 (70%) |
| FAIL | 86 (34%) | 76 (30%) | 29 (66%) | 39 (30%) | 115 (30%) |
| TOTAL | 252 (100%) | 252 (100%) | 130 (100%) | 130 (100%) | 382 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | | *df* |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 382 | 2 | 2 | | *1* |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 5.95 | 0.015* | 3.841 | yes | 0.125 | 0.547 |
| Max likelh | 6.13 | 0.013* | 3.841 | yes | 0.127 | 0.547 |

Note: Fisher Exact Test p-value 0.019*

*p < .05

Table 5

*Chi-Square Test of School Calendar Type (Mill Creek Middle School "Traditional" vs. Imlay City Middle School "Balanced") on M-STEP Passing Rates for 6th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Mill Creek Middle School (Comstock Park Public Schools) | | BALANCED Imlay City Middle School (Imlay City Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 89 (66%) | 85 (63%) | 90 (60%) | 95 (63%) | 179 (63%) |
| FAIL | 46 (34%) | 95 (37%) | 61 (40%) | 56 (37%) | 107 (37%) |
| TOTAL | 135 (100%) | 135 (100%) | 151 (100%) | 151 (100%) | 286 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 286 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 1.32 | 0.251 | 3.841 | no | 0.068 | 1.326 |
| Max likelh | 1.32 | 0.251 | 3.841 | no | 0.068 | 1.326 |

Note: Fisher Exact Test p-value 0.3298

*p < .05

Table 6

*Chi-Square Test of School Calendar Type (L. E. White Middle School "Traditional" vs. Croswell- Lexington Middle School "Balanced") on M-STEP Passing Rates for 6th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL L. E. White Middle School (Allegan Public Schools) | | BALANCED Croswell- Lexington Middle School (Croswell- Lexington Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 108 (52%) | 127 (61%) | 121 (72%) | 103 (61%) | 229 (61%) |
| FAIL | 99 (48%) | 80 (39%) | 47 (28%) | 65 (39%) | 146 (39%) |
| TOTAL | 207 (100%) | 207 (100%) | 168 (100%) | 168 (100%) | 375 (100%) |

Summary Data

| | | | | | | |
|---|---|---|---|---|---|---|
| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
| Summary | 0.05 | 375 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 15.329 | 0.00009* | 3.841 | yes | 0.202 | 0.424 |
| Max likelh | 15.570 | 0.00008* | 3.841 | yes | 0.204 | 0.424 |

Note: Fisher Exact Test p-value 0.0001*

*p < .05

Table 7

*Chi-Square Test of School Calendar Type (Greenville Middle School "Traditional" vs. Roland Warner Campus 6/7 "Balanced") on M-STEP Passing Rates for 6th Grade Mathematics.*

| | School Calendar Type | | | | | |
|---|---|---|---|---|---|---|
| | TRADITIONAL Greenville Middle School (Greenville Public Schools) | | BALANCED Roland Warner Campus 6/7 (Lapeer Community School District) | | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total | |
| PASS | 186 (63%) | 170 (57%) | 208 (53%) | 224 (57%) | 394 (57%) | |
| FAIL | 110 (37%) | 126 (43%) | 182 (47%) | 166 (43%) | 292 (43%) | |
| TOTAL | 296 (100%) | 296 (100%) | 390 (100%) | 390 (100%) | 686 (100%) | |
| | | | Summary Data | | | |
| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
| Summary | 0.05 | 686 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 6.40 | 0.0114* | 3.841 | yes | 0.096 | 1.488 |
| Max likelh | 6.43 | 0.011* | 3.841 | yes | 0.096 | 1.488 |

Note: Fisher Exact Test p-value 0.0158*

P < .05

Table 8

*Chi-Square Test of School Calendar Type (Sturgis Middle School "Traditional" vs. Madison Middle School "Balanced") on M-STEP Passing Rates for 6th Grade Mathematics, F/R Lunch students only.*

| | School Calendar Type | | | | | |
|---|---|---|---|---|---|---|
| | TRADITIONAL Sturgis Middle School (Sturgis Public Schools) | | BALANCED Madison Middle School (Madison School District) | | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total | |
| PASS | 98 (61%) | 103 (64%) | 58 (72%) | 52 (64%) | 156 (65%) | |
| FAIL | 62 (39%) | 57 (36%) | 23 (28%) | 29 (36%) | 85 (35%) | |
| TOTAL | 160 (100%) | 160 (100%) | 81 (100%) | 81 (100%) | 241 (100%) | |
| | | | Summary Data | | | |
| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
| Summary | 0.05 | 241 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 2.816 | 0.0933 | 3.841 | no | 0.1081 | 0.610 |
| Max likelh | 2.872 | 0.0901 | 3.841 | no | 0.1091 | 0.610 |

Note: Fisher Exact Test p-value 0.119

P < .05

Table 9

*Chi-Square Test of School Calendar Type (Mill Creek Middle School "Traditional" vs. Imlay City Middle School "Balanced") on M-STEP Passing Rates for 6th Grade Mathematics, F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Mill Creek Middle School (Comstock Park Public Schools) | | BALANCED Imlay City Middle School (Imlay City Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 38 (53%) | 40 (56%) | 49 (57%) | 48 (56%) | 87 (55%) |
| FAIL | 34 (47%) | 32 (44%) | 37 (43%) | 38 (44%) | 71 (45%) |
| TOTAL | 72 (100%) | 72 (100%) | 86 (100%) | 86 (100%) | 158 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 158 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 0.2411 | 0.6234 | 3.841 | no | 0.0391 | 0.854 |
| Max likelh | 0.2411 | 06234 | 3.841 | no | 0.0391 | 0.854 |

Note: Fisher Exact Test p-value 0.4258

P < .05

Table 10

*Chi-Square Test of School Calendar Type (L. E. White Middle School "Traditional" vs. Croswell- Lexington Middle School "Balanced") on M-STEP Passing Rates for 6th Grade Mathematics, F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL L. E. White Middle School (Allegan Public Schools) | | BALANCED Croswell- Lexington Middle School (Croswell- Lexington Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 44 (43%) | 55 (54%) | 54 (66%) | 44 (54%) | 98 (53%) |
| FAIL | 58 (57%) | 47 (46%) | 28 (34%) | 38 (46%) | 86 (47%) |
| TOTAL | 102 (100%) | 102 (100%) | 82 (100%) | 82 (100%) | 185 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 185 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 10.126 | 0.00146* | 3.841 | yes | 0.2342 | 0.3802 |
| Max likelh | 10.2514 | 0.00136* | 3.841 | yes | 0.2356 | 0.3802 |

Note: Fisher Exact Test p-value 0.0028*

P < .05

Table 11

*Chi-Square Test of School Calendar Type (Greenville Middle School "Traditional" vs. Roland Warner Campus 6/7 "Balanced") on M-STEP Passing Rates for 6th Grade Mathematics, F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Greenville Middle School (Greenville Public Schools) | | BALANCED Roland Warner Campus 6/7 (Lapeer Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 71 (52%) | 60 (44%) | 73 (38%) | 84 (44%) | 144 (44%) |
| FAIL | 66 (48%) | 77 (56%) | 118 (62%) | 107 (56%) | 184 (56%) |
| TOTAL | 137 (100%) | 137 (100%) | 191 (100%) | 191 (100%) | 328 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 328 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 5.8985 | 0.01515* | 3.841 | yes | 0.1342 | 1.7313 |
| Max likelh | 5.8975 | 0.01516* | 3.841 | yes | 0.1342 | 1.7313 |

Note: Fisher Exact Test p-value 0.0179*

P < .05

Table 12

*Chi-Square Test of School Calendar Type (Kosciuszko Middle School "Traditional" vs. Baldwin Junior High School "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Kosciuszko Middle School (Hamtramck Schools) | | BALANCED Baldwin Jr. High School (Baldwin Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 68 (41%) | 69 (41%) | 17 (72%) | 16 (41%) | 85 (41%) |
| FAIL | 101 (59%) | 100 (59%) | 22 (28%) | 23 (59%) | 123 (59%) |
| TOTAL | 169 (100%) | 169 (100%) | 39 (100%) | 39 (100%) | 208 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 208 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 0.0485 | 0.8256 | 3.841 | no | 0.0153 | 0.9237 |
| Max likelh | 0.0484 | 0.8256 | 3.841 | no | 0.0153 | 09237 |

Note: Fisher Exact Test p-value 0.7183

P < .05

Table 13

*Chi-Square Test of School Calendar Type (Muskegon Middle School "Traditional" vs. Ypsilanti Community Middle School "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Muskegon Middle School (Muskegon Public Schools) | | BALANCED Ypsilanti Community Middle School (Ypsilanti Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 103 (36%) | 96 (33%) | 41 (28%) | 48 (33%) | 144 (33%) |
| FAIL | 186 (64%) | 193 (67%) | 105 (72%) | 98 (67%) | 291 (67%) |
| TOTAL | 289 (100%) | 289 (100%) | 146 (100%) | 146 (100%) | 435 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 435 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 2.336 | 0.1264 | 3.841 | no | 0.0732 | 1.4011 |
| Max likelh | 2.369 | 0.1237 | 3.841 | no | 0.0738 | 1.4011 |

Note: Fisher Exact Test p-value 0.1598

P < .05

Table 14

*Chi-Square Test of School Calendar Type (Tomlinson Middle School "Traditional" vs. Milton E. Tucker Middle School "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Tomlinson Middle School (Westwood Community Schools) | | BALANCED Milton E. Tucker Middle School (Beecher Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 35 (28%) | 37 (30%) | 19 (33%) | 17 (29%) | 54 (30%) |
| FAIL | 90 (72%) | 88 (70%) | 39 (67%) | 41 (71%) | 129 (70%) |
| TOTAL | 125 (100%) | 125 (100%) | 58 (100%) | 58 (100%) | 183 (100%) |

Summary Data

| | | | | | | |
|---|---|---|---|---|---|---|
| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
| Summary | 0.05 | 183 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 0.5978 | 0.4394 | 3.841 | no | 0.0572 | 0.7674 |
| Max likelh | 0.5906 | 0.4422 | 3.841 | no | 0.0568 | 0.7674 |

Note: Fisher Exact Test p-value 0.4852

$P < .05$

Table 15

*Chi-Square Test of School Calendar Type (Sturgis Middle School "Traditional" vs. Madison Middle School "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Lindon Grove Middle School (Kalamazoo Public Schools) | | BALANCED Pontiac Middle School (Pontiac City School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 119 (47%) | 89 (35%) | 58 (23%) | 88 (35%) | 177 (35%) |
| FAIL | 137 (53%) | 167 (65%) | 196 (77%) | 166 (65%) | 333 (65%) |
| TOTAL | 256 (100%) | 256 (100%) | 254 (100%) | 81 (100%) | 510 (100%) |

Summary Data

| | | | | | | |
|---|---|---|---|---|---|---|
| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
| Summary | 0.05 | 510 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 31.7255 | 0.000* | 3.841 | yes | 0.2494 | 2.9491 |
| Max likelh | 32.226 | 0.000* | 3.841 | yes | 0.2518 | 2.9491 |

Note: Fisher Exact Test p-value 0.000*

P < .05

Table 16

*Chi-Square Test of School Calendar Type (Sturgis Middle School "Traditional" vs. Madison Middle School "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Sturgis Middle School (Sturgis Public Schools) | | BALANCED Madison Middle School (Madison School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 139 (58%) | 150 (63%) | 88 (72%) | 77 (63%) | 228 (63%) |
| FAIL | 100 (42%) | 89 (37%) | 35 (28%) | 46 (37%) | 134 (37%) |
| TOTAL | 239 (100%) | 239 (100%) | 123 (100%) | 123 (100%) | 362 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 123 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 6.1841 | 0.0128* | 3.841 | yes | 0.1307 | 0.5534 |
| Max likelh | 6.3175 | 0.0119* | 3.841 | yes | 0.1321 | 0.5534 |

Note: Fisher Exact Test p-value 0.0161*

P < .05

Table 17

*Chi-Square Test of School Calendar Type (Mill Creek Middle School "Traditional" vs. Imlay City Middle School "Balanced") on M-STEP Passing Rates for 7th Grade.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Mill Creek Middle School (Comstock Park Public Schools) | | BALANCED Imlay City Middle School (Imlay City Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 117 (76%) | 107 (69%) | 101 (57%) | 110 (70%) | 217 (70%) |
| FAIL | 37 (34%) | 47 (31%) | 57 (43%) | 48 (30%) | 95 (30%) |
| TOTAL | 154 (100%) | 154 (100%) | 158 (100%) | 158 (100%) | 312 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 312 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 5.4735 | 0.01930* | 3.841 | yes | 0.1324 | 1.7915 |
| Max likelh | 5.5071 | 0.01893* | 3.841 | yes | 0.1328 | 1.7915 |

Note: Fisher Exact Test p-value 0.0261*

P < .05

Table 18

*Chi-Square Test of School Calendar Type (L. E. White Middle School "Traditional" vs. Croswell- Lexington Middle School "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL<br>L. E. White Middle School<br>(Allegan Public Schools) | | BALANCED<br>Croswell- Lexington<br>Middle School<br>(Croswell- Lexington<br>Community School<br>District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 109<br>(56%) | 122<br>(63%) | 112<br>(70%) | 100<br>(63%) | 221<br>(62%) |
| FAIL | 86<br>(44%) | 73<br>(37%) | 48<br>(30%) | 60<br>(37%) | 134<br>(38%) |
| TOTAL | 195<br>(100%) | 195<br>(100%) | 160<br>(100%) | 160<br>(100%) | 355<br>(100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 355 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 7.7649 | 0.0053* | 3.841 | yes | 0.1478 | 0.5356 |
| Max likelh | 7.8241 | 0.0051* | 3.841 | yes | 0.1486 | 0.5356 |

Note: Fisher Exact Test p-value 0.0111*

P < .05

Table 19

*Chi-Square Test of School Calendar Type (Greenville Middle School "Traditional" vs. Roland Warner Campus 6/7 "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Greenville Middle School (Greenville Public Schools) | | BALANCED Roland Warner Campus 6/7 (Lapeer Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 170 (62%) | 167 (61%) | 259 (60%) | 262 (61%) | 429 (61%) |
| FAIL | 105 (38%) | 108 (39%) | 173 (40%) | 170 (39%) | 278 (39%) |
| TOTAL | 275 (100%) | 275 (100%) | 432 (100%) | 432 (100%) | 707 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 707 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 0.3009 | 0.5832 | 3.841 | no | 0.0206 | 1.0907 |
| Max likelh | 0.3013 | 0.5830 | 3.841 | no | 0.0206 | 1.0907 |

Note: Fisher Exact Test p-value 0.6363

P < .05

Table 20

*Chi-Square Test of School Calendar Type (Lakeshore Middle School "Traditional" vs. Davison Middle School "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Lakeshore Middle School (Grand Haven Area Public Schools) | | BALANCED Davison Middle School (Davison Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 395 (84%) | 367 (78%) | 302 (71%) | 329 (78%) | 696 (78%) |
| FAIL | 77 (16%) | 105 (22%) | 121 (29%) | 94 (22%) | 199 (22%) |
| TOTAL | 472 (100%) | 472 (100%) | 423 (100%) | 432 (100%) | 895 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 895 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 19.3308 | 0.00001* | 3.841 | yes | 0.1469 | 2.0446 |
| Max likelh | 19.3873 | 0.00001* | 3.841 | yes | 0.1471 | 2.0446 |

Note: Fisher Exact Test p-value 0.000*

P < .05

Table 21

*Chi-Square Test of School Calendar Type (Kosciuszko Middle School "Traditional" vs. Baldwin Junior High School "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics, F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Kosciuszko Middle School (Hamtramck Schools) | | BALANCED Baldwin Jr. High School (Baldwin Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 66 (42%) | 66 (41%) | 14 (72%) | 15 (41%) | 80 (41%) |
| FAIL | 93 (59%) | 94 (59%) | 22 (28%) | 21 (59%) | 115 (59%) |
| TOTAL | 160 (100%) | 160 (100%) | 36 (100%) | 36 (100%) | 195 (100%) |

Summary Data

| | | | | | | |
|---|---|---|---|---|---|---|
| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
| Summary | 0.05 | 195 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 0.0336 | 0.8543 | 3.841 | no | 0.0131 | 1.0714 |
| Max likelh | 0.0337 | 0.8541 | 3.841 | no | 0.0131 | 1.0714 |

Note: Fisher Exact Test p-value 0.8522

P < .05

Table 22

*Chi-Square Test of School Calendar Type (Muskegon Middle School "Traditional" vs. Ypsilanti Community Middle School "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics, F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Muskegon Middle School (Muskegon Public Schools) | | BALANCED Ypsilanti Community Middle School (Ypsilanti Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 94 (36%) | 85 (33%) | 32 (25%) | 41 (33%) | 126 (33%) |
| FAIL | 165 (64%) | 174 (67%) | 94 (75%) | 85 (67%) | 259 (67%) |
| TOTAL | 259 (100%) | 259 (100%) | 126 (100%) | 126 (100%) | 385 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 385 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 4.7463 | 0.0293* | 3.841 | yes | 0.1111 | 1.6910 |
| Max likelh | 4.8673 | 0.0273* | 3.841 | yes | 0.1125 | 1.6910 |

Note: Fisher Exact Test p-value 0.0375*

$P < .05$

Table 23

*Chi-Square Test of School Calendar Type (Tomlinson Middle School "Traditional" vs. Milton E. Tucker Middle School "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics, F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Tomlinson Middle School (Westwood Community Schools) | | BALANCED Milton E. Tucker Middle School (Beecher Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 38 (36%) | 38 (35%) | 17 (35%) | 17 (35%) | 56 (36%) |
| FAIL | 70 (64%) | 70 (65%) | 32 (65%) | 32 (65%) | 102 (64%) |
| TOTAL | 108 (100%) | 108 (100%) | 49 (100%) | 49 (100%) | 157 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 157 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 0.0082 | 0.9278 | 3.841 | no | 0.0072 | 1.0331 |
| Max likelh | 0.0082 | 0.9277 | 3.841 | no | 0.0072 | 1.0331 |

Note: Fisher Exact Test p-value 1.000

P < .05

Table 24

*Chi-Square Test of School Calendar Type (Sturgis Middle School "Traditional" vs. Madison Middle School "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Lindon Grove Middle School (Kalamazoo Public Schools) | | BALANCED Pontiac Middle School (Pontiac City School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 66 (38%) | 51 (35%) | 40 (23%) | 55 (35%) | 106 (29%) |
| FAIL | 108 (62%) | 123 (65%) | 148 (77%) | 133 (65%) | 256 (71%) |
| TOTAL | 174 (100%) | 174 (100%) | 188 (100%) | 188 (100%) | 362 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 362 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 11.9009 | 0.000561* | 3.841 | yes | 0.181306 | 2.244 |
| Max likelh | 11.9712 | 0.00054* | 3.841 | yes | 0.181841 | 2.244 |

Note: Fisher Exact Test p-value 0.000*

P < .05

Table 25

*Chi-Square Test of School Calendar Type (Sturgis Middle School "Traditional" vs. Madison Middle School "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Sturgis Middle School (Sturgis Public Schools) | | BALANCED Madison Middle School (Madison School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 77 (51%) | 85 (56%) | 52 (72%) | 43 (56%) | 129 (56%) |
| FAIL | 74 (49%) | 66 (44%) | 25 (28%) | 34 (44%) | 99 (44%) |
| TOTAL | 151 (100%) | 151 (100%) | 77 (100%) | 77 (100%) | 228 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 228 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 5.4392 | 0.0196* | 3.841 | yes | 0.1542 | 0.5081 |
| Max likelh | 5.5260 | 0.0187* | 3.841 | yes | 0.1555 | 0.5081 |

Note: Fisher Exact Test p-value 0.0243*

P < .05

Table 26

*Chi-Square Test of School Calendar Type (Mill Creek Middle School "Traditional" vs. Imlay City Middle School "Balanced") on M-STEP Passing Rates for 7th Grade F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Mill Creek Middle School (Comstock Park Public Schools) | | BALANCED Imlay City Middle School (Imlay City Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 55 (51%) | 48 (59%) | 47 (52%) | 53 (59%) | 102 (59%) |
| FAIL | 27 (49%) | 34 (41%) | 43 (48%) | 37 (41%) | 71 (41%) |
| TOTAL | 82 (100%) | 82 (100%) | 90 (100%) | 90 (100%) | 173 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 173 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 4.2503 | 0.0392* | 3.841 | yes | 0.1571 | 1.911 |
| Max likelh | 4.2786 | 0.0385* | 3.841 | yes | 0.1576 | 1.911 |

Note: Fisher Exact Test p-value 0.0869

$P < .05$

Table 27

*Chi-Square Test of School Calendar Type (L. E. White Middle School "Traditional" vs. Croswell- Lexington Middle School "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics, F/R Lunch students only.*

| | School Calendar Type | | | | | |
|---|---|---|---|---|---|---|
| | TRADITIONAL<br>L. E. White Middle School<br>(Allegan Public Schools) | | BALANCED<br>Croswell- Lexington Middle School (Croswell- Lexington Community School District) | | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total | |
| PASS | 40<br>(41%) | 50<br>(52%) | 50<br>(64%) | 40<br>(52%) | 90<br>(51%) | |
| FAIL | 57<br>(59%) | 47<br>(48%) | 28<br>(36%) | 38<br>(48%) | 85<br>(49%) | |
| TOTAL | 97<br>(100%) | 97<br>(100%) | 78<br>(100%) | 78<br>(100%) | 175<br>(100%) | |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 175 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 9.3813 | 0.00219* | 3.841 | yes | 0.2316 | 0.3860 |
| Max likelh | 9.4800 | 0.00207* | 3.841 | yes | 0.2329 | 0.3860 |

Note: Fisher Exact Test p-value 0.0023*

P < .05

Table 28

*Chi-Square Test of School Calendar Type (Greenville Middle School "Traditional" vs. Roland Warner Campus 6/7 "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics, F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Greenville Middle School (Greenville Public Schools) | | BALANCED Roland Warner Campus 6/7 (Lapeer Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 65 (51%) | 67 (53%) | 113 (54%) | 111 (53%) | 179 (53%) |
| FAIL | 62 (49%) | 60 (47%) | 98 (46%) | 100 (47%) | 160 (47%) |
| TOTAL | 127 (100%) | 127 (100%) | 211 (100%) | 211 (100%) | 339 (100%) |

Summary Data

| | | | | | | |
|---|---|---|---|---|---|---|
| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
| Summary | 0.05 | 339 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 0.1662 | 0.6834 | 3.841 | no | 0.0221 | 0.9124 |
| Max likelh | 0.1662 | 0.6834 | 3.841 | no | 0.0221 | 0.9124 |

Note: Fisher Exact Test p-value 0.7359

P < .05

Table 29

*Chi-Square Test of School Calendar Type (Lakeshore Middle School "Traditional" vs. Davison Middle School "Balanced") on M-STEP Passing Rates for 7th Grade Mathematics, F/R Lunch students only.*

| | School Calendar Type | | | | | |
|---|---|---|---|---|---|---|
| | TRADITIONAL Lakeshore Middle School (Grand Haven Area Public Schools) | | BALANCED Davison Middle School (Davison Community School District) | | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total | |
| PASS | 96 (64%) | 92 (61%) | 87 (59%) | 91 (61%) | 183 (61%) | |
| FAIL | 54 (36%) | 58 (39%) | 62 (41%) | 58 (39%) | 116 (39%) | |
| TOTAL | 150 (100%) | 150 (100%) | 149 (100%) | 149 (100%) | 299 (100%) | |
| | | | Summary Data | | | |
| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
| Summary | 0.05 | 299 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 0.9245 | 0.3362 | 3.841 | no | 0.0556 | 1.2567 |
| Max likelh | 0.9250 | 0.3361 | 3.841 | no | 0.0556 | 1.2567 |

Note: Fisher Exact Test p-value 0.4050

P < .05

Table 30

*Chi-Square Test of School Calendar Type (Kosciuszko Middle School "Traditional" vs. Baldwin Junior High School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Kosciuszko Middle School (Hamtramck Schools) | | BALANCED Baldwin Jr. High School (Baldwin Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 51 (35%) | 49 (34%) | 10 (28%) | 13 (34%) | 61 (33%) |
| FAIL | 95 (65%) | 97 (66%) | 28 (72%) | 25 (66%) | 123 (67%) |
| TOTAL | 146 (100%) | 146 (100%) | 38 (100%) | 38 (100%) | 184 (100%) |

Summary Data

| | | | | | | |
|---|---|---|---|---|---|---|
| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
| Summary | 0.05 | 184 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 0.7222 | 0.3953 | 3.841 | no | 0.0626 | 1.4062 |
| Max likelh | 0.7401 | 0.3896 | 3.841 | no | 0.0634 | 1.4062 |

Note: Fisher Exact Test p-value 0.3412

$P < .05$

Table 31

*Chi-Square Test of School Calendar Type (Muskegon Middle School "Traditional" vs. Ypsilanti Community Middle School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Muskegon Middle School (Muskegon Public Schools) | | BALANCED Ypsilanti Community Middle School (Ypsilanti Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 59 (23%) | 59 (23%) | 39 (28%) | 39 (23%) | 98 (23%) |
| FAIL | 200 (77%) | 199 (77%) | 131 (72%) | 131 (77%) | 331 (77%) |
| TOTAL | 259 (100%) | 259 (100%) | 170 (100%) | 170 (100%) | 429 (100%) |

Summary Data

| | | | | | | |
|---|---|---|---|---|---|---|
| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
| Summary | 0.05 | 429 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 0.0019 | 0.9649 | 3.841 | no | 0.0021 | 1.010 |
| Max likelh | 0.0019 | 0.9649 | 3.841 | no | 0.0021 | 1.010 |

Note: Fisher Exact Test p-value 0.9065

P < .05

Table 32

*Chi-Square Test of School Calendar Type (Tomlinson Middle School "Traditional" vs. Milton E. Tucker Middle School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics.*

| | School Calendar Type | | | | | |
|---|---|---|---|---|---|---|
| | TRADITIONAL Tomlinson Middle School (Westwood Community Schools) | | BALANCED Milton E. Tucker Middle School (Beecher Community School District) | | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total | |
| PASS | 23 (22%) | 20 (19%) | 7 (14%) | 10 (19%) | 30 (19%) | |
| FAIL | 80 (78%) | 83 (81%) | 47 (86%) | 44 (81%) | 127 (81%) | |
| TOTAL | 103 (100%) | 103 (100%) | 54 (100%) | 54 (100%) | 157 (100%) | |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 157 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 1.8262 | 0.1765 | 3.841 | no | 0.1078 | 1.8588 |
| Max likelh | 1.9136 | 0.1665 | 3.841 | no | 0.1104 | 1.8588 |

Note: Fisher Exact Test p-value 0.2010

P < .05

Table 33

*Chi-Square Test of School Calendar Type (Sturgis Middle School "Traditional" vs. Madison Middle School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Lindon Grove Middle School (Kalamazoo Public Schools) | | BALANCED Pontiac Middle School (Pontiac City School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 110 (48%) | 67 (29%) | 49 (16%) | 92 (30%) | 159 (30%) |
| FAIL | 118 (52%) | 161 (71%) | 262 (84%) | 219 (70%) | 380 (70%) |
| TOTAL | 228 (100%) | 228 (100%) | 311 (100%) | 311 (100%) | 539 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 539 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 66.8221 | 0.000* | 3.841 | yes | 0.3521 | 4.9893 |
| Max likelh | 67.1873 | 0.000* | 3.841 | yes | 0.3530 | 4.9893 |

Note: Fisher Exact Test p-value 0.000*

P < .05

Table 34

*Chi-Square Test of School Calendar Type (Sturgis Middle School "Traditional" vs. Madison Middle School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Sturgis Middle School (Sturgis Public Schools) | | BALANCED Madison Middle School (Madison School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 123 (54%) | 136 (60%) | 82 (71%) | 69 (60%) | 205 (60%) |
| FAIL | 104 (46%) | 91 (40%) | 34 (29%) | 47 (40%) | 138 (40%) |
| TOTAL | 227 (100%) | 227 (100%) | 116 (100%) | 116 (100%) | 343 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 343 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 8.4945 | 0.0035* | 3.841 | yes | 0.1573 | 0.4947 |
| Max likelh | 8.6816 | 0.0032* | 3.841 | yes | 0.1590 | 0.4947 |

Note: Fisher Exact Test p-value 0.0035*

P < .05

Table 35

*Chi-Square Test of School Calendar Type (Mill Creek Middle School "Traditional" vs. Imlay City Middle School "Balanced") on M-STEP Passing Rates for 8th Grade.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Mill Creek Middle School (Comstock Park Public Schools) | | BALANCED Imlay City Middle School (Imlay City Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 79 (55%) | 72 (50%) | 81 (46%) | 88 (50%) | 159 (50%) |
| FAIL | 64 (45%) | 71 (50%) | 94 (54%) | 87 (50%) | 159 (50%) |
| TOTAL | 143 (100%) | 143 (100%) | 175 (100%) | 175 (100%) | 318 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 318 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 2.3753 | 0.1232 | 3.841 | no | 0.0864 | 1.4167 |
| Max likelh | 2.3785 | 0.1230 | 3.841 | no | 0.0864 | 1.4167 |

Note: Fisher Exact Test p-value 0.1162

$P < .05$

Table 36

*Chi-Square Test of School Calendar Type (L. E. White Middle School "Traditional" vs. Croswell- Lexington Middle School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL L. E. White Middle School (Allegan Public Schools) | | BALANCED Croswell- Lexington Middle School (Croswell- Lexington Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 126 (58%) | 132 (61%) | 119 (65%) | 113 (61%) | 245 (61%) |
| FAIL | 89 (42%) | 83 (39%) | 64 (35%) | 70 (39%) | 153 (39%) |
| TOTAL | 215 (100%) | 215 (100%) | 183 (100%) | 183 (100%) | 398 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | | *df* | |
|---|---|---|---|---|---|---|---|
| Summary | 0.05 | 398 | 2 | 2 | | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | | Odds Ratio |
| Pearson's | 1.9561 | 0.1619 | 3.841 | no | 0.0701 | | 0.7478 |
| Max likelh | 1.9616 | 0.1613 | 3.841 | no | 0.0702 | | 0.7478 |

Note: Fisher Exact Test p-value 0.2149

P < .05

Table 37

*Chi-Square Test of School Calendar Type (Lee Middle School "Traditional" vs. Zemmer Middle School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics.*

| | School Calendar Type | | | | | |
|---|---|---|---|---|---|---|
| | TRADITIONAL Lee Middle School (Godfrey- Lee Public Schools) | | BALANCED Zemmer Middle School (Lapeer Community School District) | | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total | |
| PASS | 70 (52%) | 64 (47%) | 173 (45%) | 180 (47%) | 244 (47%) | |
| FAIL | 66 (48%) | 72 (53%) | 212 (55%) | 205 (53%) | 277 (53%) | |
| TOTAL | 136 (100%) | 136 (100%) | 385 (100%) | 385 (100%) | 521 (100%) | |
| | | | Summary Data | | | |
| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
| Summary | 0.05 | 521 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 1.8949 | 0.1686 | 3.841 | no | 0.0603 | 1.3162 |
| Max likelh | 1.8920 | 0.1689 | 3.841 | no | 0.0602 | 1.3162 |

Note: Fisher Exact Test p-value 0.2306

$P < .05$

Table 38

*Chi-Square Test of School Calendar Type (Lakeshore Middle School "Traditional" vs. Davison Middle School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Lakeshore Middle School (Grand Haven Area Public Schools) | | BALANCED Davison Middle School (Davison Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 332 (74%) | 341 (76%) | 329 (78%) | 321 (76%) | 662 (76%) |
| FAIL | 116 (26%) | 107 (24%) | 92 (22%) | 100 (24%) | 207 (24%) |
| TOTAL | 448 (100%) | 448 (100%) | 421 (100%) | 421 (100%) | 869 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 869 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 1.9564 | 0.1618 | 3.841 | no | 0.0474 | 0.7996 |
| Max likelh | 1.9606 | 0.1614 | 3.841 | no | 0.0474 | 0.7996 |

Note: Fisher Exact Test p-value 0.2026

P < .05

Table 39

*Chi-Square Test of School Calendar Type (Kosciuszko Middle School "Traditional" vs. Baldwin Junior High School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics, F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Kosciuszko Middle School (Hamtramck Schools) | | BALANCED Baldwin Jr. High School (Baldwin Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 50 (37%) | 48 (35%) | 10 (72%) | 12 (34%) | 60 (35%) |
| FAIL | 88 (63%) | 90 (65%) | 25 (28%) | 23 (66%) | 113 (65%) |
| TOTAL | 138 (100%) | 138 (100%) | 35 (100%) | 35 (100%) | 173 (100%) |

Summary Data

| | | | | | | |
|---|---|---|---|---|---|---|
| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
| Summary | 0.05 | 173 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 0.9932 | 0.3189 | 3.841 | no | 0.0757 | 1.5121 |
| Max likelh | 1.0217 | 0.3189 | 3.841 | no | 0.0768 | 1.5121 |

Note: Fisher Exact Test p-value 0.4316

P < .05

Table 40

*Chi-Square Test of School Calendar Type (Muskegon Middle School "Traditional" vs. Ypsilanti Community Middle School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics, F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Muskegon Middle School (Muskegon Public Schools) | | BALANCED Ypsilanti Community Middle School (Ypsilanti Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 53 (37%) | 53 (23%) | 34 (23%) | 33 (23%) | 86 (23%) |
| FAIL | 179 (63%) | 179 (77%) | 113 (77%) | 114 (77%) | 292 (77%) |
| TOTAL | 232 (100%) | 232 (100%) | 147 (100%) | 147 (100%) | 378 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 378 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 0.0015 | 0.9689 | 3.841 | no | 0.0019 | 0.9902 |
| Max likelh | 0.0015 | 0.9689 | 3.841 | no | 0.0019 | 0.9902 |

Note: Fisher Exact Test p-value 0.8998

P < .05

Table 41

*Chi-Square Test of School Calendar Type (Tomlinson Middle School "Traditional" vs. Milton E. Tucker Middle School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics, F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Tomlinson Middle School (Westwood Community Schools) | | BALANCED Milton E. Tucker Middle School (Beecher Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 16 (18%) | 14 (16%) | 6 (13%) | 8 (16%) | 22 (16%) |
| FAIL | 73 (82%) | 75 (84%) | 40 (87%) | 38 (84%) | 113 (84%) |
| TOTAL | 89 (100%) | 89 (100%) | 46 (100%) | 46 (100%) | 135 (100%) |

Summary Data

| | | | | | | |
|---|---|---|---|---|---|---|
| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
| Summary | 0.05 | 135 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 0.5242 | 0.4690 | 3.841 | no | 0.0623 | 1.4529 |
| Max likelh | 0.5400 | 0.4624 | 3.841 | no | 0.0632 | 1.4529 |

Note: Fisher Exact Test p-value 0.8018

P < .05

Table 42

*Chi-Square Test of School Calendar Type (Sturgis Middle School "Traditional" vs. Madison Middle School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Lindon Grove Middle School (Kalamazoo Public Schools) | | BALANCED Pontiac Middle School (Pontiac City School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 59 (38%) | 38 (25%) | 36 (23%) | 57 (25%) | 95 (25%) |
| FAIL | 96 (62%) | 117 (75%) | 194 (77%) | 173 (75%) | 290 (75%) |
| TOTAL | 155 (100%) | 155 (100%) | 230 (100%) | 230 (100%) | 385 (100%) |

Summary Data

| | | | | | | |
|---|---|---|---|---|---|---|
| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
| Summary | 0.05 | 385 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 24.4341 | 0.000* | 3.841 | yes | 0.2518 | 3.2619 |
| Max likelh | 24.1107 | 0.000* | 3.841 | yes | 0.2501 | 3.2619 |

Note: Fisher Exact Test p-value 0.000*

P < .05

Table 43

*Chi-Square Test of School Calendar Type (Sturgis Middle School "Traditional" vs. Madison Middle School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Sturgis Middle School (Sturgis Public Schools) | | BALANCED Madison Middle School (Madison School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 68 (47%) | 77 (53%) | 48 (67%) | 39 (53%) | 116 (53%) |
| FAIL | 76 (53%) | 67 (47%) | 24 (33%) | 33 (47%) | 100 (47%) |
| TOTAL | 144 (100%) | 144 (100%) | 72 (100%) | 72 (100%) | 217 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 217 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 7.4784 | 0.0062* | 3.841 | yes | 0.1858 | 0.4437 |
| Max likelh | 7.4784 | 0.0058* | 3.841 | yes | 0.1872 | 0.4437 |

Note: Fisher Exact Test p-value 0.009*

P < .05

Table 44

*Chi-Square Test of School Calendar Type (Mill Creek Middle School "Traditional" vs. Imlay City Middle School "Balanced") on M-STEP Passing Rates for 8th Grade F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Mill Creek Middle School (Comstock Park Public Schools) | | BALANCED Imlay City Middle School (Imlay City Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 32 (42%) | 32 (42%) | 42 (42%) | 42 (42%) | 74 (42%) |
| FAIL | 45 (58%) | 44 (58%) | 58 (58%) | 58 (58%) | 102 (58%) |
| TOTAL | 76 (100%) | 76 (100%) | 100 (100%) | 100 (100%) | 176 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 176 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 0.0085 | 0.9263 | 3.841 | no | 0.0069 | 0.9718 |
| Max likelh | 0.0085 | 0.9263 | 3.841 | no | 0.0069 | 0.9718 |

Note: Fisher Exact Test p-value 1.0

P < .05

Table 45

*Chi-Square Test of School Calendar Type (L. E. White Middle School "Traditional" vs. Croswell- Lexington Middle School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics, F/R Lunch students only*.

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL L. E. White Middle School (Allegan Public Schools) | | BALANCED Croswell- Lexington Middle School (Croswell- Lexington Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 50 (47%) | 55 (52%) | 52 (64%) | 47 (52%) | 102 (52%) |
| FAIL | 56 (53%) | 51 (48%) | 37 (36%) | 42 (48%) | 94 (48%) |
| TOTAL | 106 (100%) | 106 (100%) | 89 (100%) | 89 (100%) | 196 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | | *df* |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 196 | 2 | 2 | | *1* |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 2.3706 | 0.1236 | 3.841 | no | 0.1100 | 0.6412 |
| Max likelh | 2.3769 | 0.1231 | 3.841 | no | 0.1101 | 0.6412 |

Note: Fisher Exact Test p-value 0.1499

$P < .05$

Table 46

*Chi-Square Test of School Calendar Type (Lee Middle School "Traditional" vs. Zemmer Middle School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics, F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Lee Middle School (Godfrey- Lee Public Schools) | | BALANCED Zemmer Middle School (Lapeer Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 33 (52%) | 28 (44%) | 73 (40%) | 79 (43%) | 106 (43%) |
| FAIL | 31 (48%) | 36 (56%) | 109 (60%) | 103 (57%) | 140 (57%) |
| TOTAL | 64 (100%) | 64 (100%) | 182 (100%) | 182 (100%) | 246 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 246 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 2.6880 | 0.1011 | 3.841 | no | 0.1044 | 1.6098 |
| Max likelh | 2.6711 | 0.1021 | 3.841 | no | 0.1040 | 1.6098 |

Note: Fisher Exact Test p-value 0.1419

P < .05

Table 47

*Chi-Square Test of School Calendar Type (Lakeshore Middle School "Traditional" vs. Davison Middle School "Balanced") on M-STEP Passing Rates for 8th Grade Mathematics, F/R Lunch students only.*

| | School Calendar Type | | | | |
|---|---|---|---|---|---|
| | TRADITIONAL Lakeshore Middle School (Grand Haven Area Public Schools) | | BALANCED Davison Middle School (Davison Community School District) | | |
| Promotion Rate | Observed Students | Expected Students | Observed Students | Expected Students | Total |
| PASS | 82 (57%) | 82 (57%) | 85 (59%) | 85 (57%) | 167 (57%) |
| FAIL | 61 (43%) | 61 (43%) | 63 (41%) | 63 (43%) | 124 (43%) |
| TOTAL | 143 (100%) | 143 (100%) | 148 (100%) | 148 (100%) | 291 (100%) |

Summary Data

| Chi-Square | Alpha | Count | Rows | Columns | *df* | |
|---|---|---|---|---|---|---|
| Summary | 0.05 | 2291 | 2 | 2 | *1* | |
| Chi-Square | Chi-sqr | p-value | x-crit | Sig | Cramer V | Odds Ratio |
| Pearson's | 0.0009 | 0.9750 | 3.841 | no | 0.0018 | 1.0074 |
| Max likelh | 0.0009 | 0.9750 | 3.841 | no | 0.0018 | 1.0074 |

Note: Fisher Exact Test p-value 0.9055

P < .05