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The Difference in Academic Achievement for Students in the Healthy Fitness Zone Compared to the High Risk Zone for BMI and Aerobic Capacity

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THE DIFFERENCE IN ACADEMIC ACHIEVEMENT FOR STUDENTS IN THE HEALTHY FITNESS ZONE COMPARED TO THE HIGH RISK ZONE FOR BMI AND AEROBIC CAPACITY

by

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(Under the Direction of Kymberly Harris)

ABSTRACT

Childhood obesity rates have climbed significantly over the past 40 years. With that, there has also been an increase in the number of associated health concerns, such as diabetes, heart disease, and asthma, of many. Quite independently, there has also been an increase in the accountability placed on schools to improve their reading and math test scores. This has resulted in a decrease in physical activity times in schools in order to provide more class time for reading and math. This study's purpose has been to identify whether a difference exists in academic outcomes for students in the HFZ compared to those in the HRZ in order to support better decision-making for school leaders in regards to reducing physical activity opportunities, like PE and recess. Using matched data for 666 fifth grade students from a southeastern Georgia community, this researcher measured student BMI and aerobic capacity scores comparing **FITNESS**GRAM® with results for these children on the MAP reading and math assessments. When accounting for SES, students in the HFZ for BMI and aerobic capacity had higher mean scores on the MAP math test. Students who were in the HRZ for BMI and not economically disadvantaged had a higher mean score in reading than students in the HFZ. Likewise, students who were in the HRZ for aerobic capacity and economically disadvantaged had a higher mean score in reading than students in the HFZ. None of the results were statistically significant, and, therefore, no difference between physical fitness and academic achievement for students in the HFZ compared to HRZ could be identified.

INDEX WORDS: Physical fitness, Academic achievement, Obesity, Childhood obesity, FITNESSGRAM, BMI, Aerobic capacity, MAP test, 5th grade

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DEDICATION

I would like to dedicate this to my family and friends who have supported me in this process and to all those who work daily to improve the lives of children.

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CHAPTER 1

INTRODUCTION

Increasingly, Americans are becoming aware that obesity of epidemic propositions is a major national issue. During the past 30 years, as the U.S. population has increased (Mackum & Wilson, 2011), so too has the percentage of obese adults and children (Ogden & Carroll, 2010; Ogden, Carroll, Kit, & Flegal, 2014). In 1960, the percentage of obese Americans was 13.4%. By 2014, that percentage had climbed to 37.7%. In other words, one in every three Americans can today be classified as obese (Flegal, Kruszon-Moran, Carroll, Fryar, & Ogden, 2016). This has widespread implications for society. Among the most important are increased healthcare costs and mortality rates. (Masters et al., 2013). Unfortunately, this phenomenon affects people of all ages and across all states, and it affects them differentially. For example, in children, obesity can affect academic success rates, behavior, interpersonal relationships, and self-esteem (Cook, Li, & Heinrich, 2014). One of the states most adversely affected by the obesity phenomenon is Georgia. Trust for America's Health (TFAH) and the Robert Wood Johnson Foundation (RWJF) reported that Georgia's adult obesity rate was 30.7% and that, among Georgia's children and youth, the rate was 21.3% (TFAH, 2011).

As we consider the challenges created by a growing population and increasing obesity rates, we must consider what can be done to reverse this trend. What we do know about this issue is that maintaining a healthy diet and staying active are two factors that determine the overall health of a child. Clearly, schools are charged with the academic well-being, but some argue that developing well rounded, productive citizens is also the responsibility of educators. Recognizing that physical health is a component of this, we must examine how school or state policy influence activity levels of public school students. As the nation focuses on increasing academic achievement, improvements in academic performance have come at the expense of students' physical fitness.

As a result of the No Child Left Behind Act of 2001, greater emphasis has been placed on student academic achievement, and schools have cut physical education time to provide more time for content area instruction (Vail, 2006). To more fully understand the impact of fitness on academic achievement, this study will examine the relationship between physical fitness and academic achievement in fifth grade students in a school in the southeastern United States.

Background

Obesity is a health issue that negatively affects an individual's quality of life and may lead to serious health risks such as hypertension, heart disease, diabetes, stroke, and potential loss of life (Must, Spadano, Coakley, Field, Colditz, and Dietz, 1999; "Overweight and Obesity Statistics", 2012). Obesity results from a genetic predisposition, individual behavior, and the environment in which a person lives, all interacting together in a specific and complex way (Nguyen & El-Serag, 2010). In the United States, the obesity percentage of American adults grew from 23% between 1988 and 1994 to 34.9% in 2011-2012 (Ogden & Carroll, 2010; Ogden et al., 2014). The following sections of this paper examine literature on the epidemic, obesity in Georgia, factors influencing obesity, and activity in schools.

The Obesity Epidemic

National agencies and researchers have continuously reported statistics highlighting the increase in the percentages of obese Americans across all demographic categories. In children, there continues to be a climb in overweight and obesity rates. In 2009-2010, the percentage of obese children was 16.9%. Over a 10- year span, this percentage has increased from 14% among boys to 18.6% and from 13.8% among girls to 15%. According to the CDC's health movement, Healthy People 2010, the goal for children was a decrease to 5% (Ogden et al., 2012) Additional research suggests that this 5% goal is far from reality at this time. A meta-analysis performed by Johnson and Johnson (2015) found that rural children have a 26% greater chance of becoming obese than do their urban counterparts.

Wang and Beydoun (2007) found increases in obesity levels of children and youth. In their study they sorted by gender, race, age, socioeconomic status, and geographic region. Their data were gathered from a nationally representative sample using two surveys. The first survey was the National Health and Nutrition Examination Survey (NHANES), which is conducted by the National Center for Health Statistics; and the second was the Behavioral Risk Factor Surveillance System (BRFSS), supported by the Centers for Disease Control and Prevention. The researchers found that the number of children ages 6 to 11 with a body mass index (BMI) in the obese zone ($\geq$ 95%) increased from 4% in 1971-1974 to

18.8% in 2003-2004 (Wang & Beydoun, 2007). In 2010, Ogden and Carroll utilized data from the NHANES and found that by 2008, the percentage of obese children ages 6 to 11 had increased to 19.6. By 2014, that number had stabilized at 17.4% (Ogden et al., 2016).

Other studies were conducted using the same data from the NHANES survey. A study reported in the *Journal of the American Medical Association* analyzed the information using all children ages 2 to 19 and found that from 2003 to 2004, 17.1% of the children in the study were in the overweight category. This study also found that among adults older than 20, 32.2% were overweight (Ogden et al., 2009). Another study used the 2003 to 2004 NHANES data, but also included the 2005 to 2006 data. This study found that 14.4% of non-Hispanic White females, ages 6 to 11, were in the overweight category while 24% of non-Hispanic Black females and 19.7% of Mexican American females were overweight. In males, the data were closer between non-Hispanic Whites (15.5%) and Non-Hispanic Blacks (18.6%). However, 27.5% of Mexican American males were in the overweight category (Ogden, Carroll, & Flegal, 2008). This research suggests that the problem exists across age and ethnic backgrounds. Other researchers have examined the issue over time in specific states. One state where this continues to be a concerning local issue is Georgia.

Obesity in Georgia

The issue in Georgia comes into focus through the examination of reports over the past one-quarter of a century. According to the BRFSS, in 1990, there were 10 states with an obesity level less than 10%. Georgia's rate was between

10% and 14%. At that time, no state had an obesity level greater than 15%. In 2000, Georgia was one of 23 states with an obesity rate greater than 20% (Centers for Disease Control, 2010). Alarmingly, by 2004, all states were over 20% and Georgia was at 29.6% (CDC "Adult Obesity Facts", 2012). One-fourth of the population of Georgia had reported no physical activity in the month prior to the data being collected, and 43% of ninth and twelfth grade students stated that they watched three or more hours of television each day. Overall, obesity has reportedly cost the state of Georgia $2.1 billion and has caused a critical strain on the healthcare system (CDC, "Georgia", 2012). Also, according to the CDC, Churchill County (pseudonym) had an obesity rate of 29% based on the 2007 BRFSS (CDC, "Georgia", 2012). This rate is pertinent as Churchill County is the setting for this study. These reports suggest that the rate of obesity continues to increase and will remain an ongoing concern until some action is taken to address it. Obesity is the outcome of many underlying factors. To make decisions on how to address the problem, we need to understand these factors and devise plans to mitigate them.

Factors Influencing Obesity

According to a cohort study by Keyes, Utz, Robinson, and Li (2010), for as long as children have been exposed to media marketing, changes in physical activity, and specific food supplies, they have been obese. However, children are now in danger of lifetime obesity. In the age of technology, there are many activities that can involve that do not require any physical activity. Children have greater access to television, gaming systems, and computers that may possibly distract them from going outside or being involved in physical activity-oriented behaviors. The use of technology in the classroom and on homework assignments may also detracting from potential physical activity opportunities. While organizations have begun to attempt to increase the activity levels of children, these attempts have not always been successful. For example, the CDC funded a program focused on increasing the amount of physical activity in children (Duke et al., 2003). Study results found that a majority of children participating did not become involved in coordinated after school physical activities. Possible reasons for this lack of involvement were attributed to neighborhood safety (Boslaugh, Luke, Brownson, Naleid, & Kreuter, 2004; Duke et al., 2003; Franzini et al., 2009), poverty levels (Duke et al., 2003; Duncan, Duncan, Strycker, & Chaumeton, 2002), parents not having time to transport (Duke et al., 2003), and location of programs and facilities (Duke et al., 2003; Gordon-Larsen, Nelson, Page, & Popkin, 2006). While many variables have been associated with childhood obesity and the inability to participate after school, the level of physical activity in school is one area that schools can control given the amount of time they spend in school each year. Based on the results of previous studies that have identified certain barriers to physical activity opportunities for children, the school leader's role in ensuring that students have physical activity time is significant for those students who may not get it elsewhere. As such, researchers have begun examining physical activity and obesity.

Physical Activity in Schools and Achievement

Research on physical activity after school and during regular school hours is beginning to emerge. Belcher et al. (2010) used accelerometer technology to measure the amount of physical activity of school children occurring during the day. Using a sample of 3,106 children and youth similar to that of the NHANES sample, data showed that in children ages 6 to 11, the amount of physical activity for boys and girls was significantly different between the normal weight group (≤ 85% BMI) and the obese group (≥ 95% BMI). This study did not include any information gathered during the school day. Rather, all data on physical activity using the accelerometer were based on after school activities.

According to Lee, Burgeson, Fulton, and Spain (2007), the CDC conducted a study involving school personnel from around the country. Results showed that 38 states had set up goals and aims for physical education in schools. However, only six states required that students receive a fitness assessment. This potentially leaves a large gap between what is occurring and what should be occurring in schools relating to the activity level of students. Beyond the health concerns related to obesity, there may be academic reasons for increasing activity levels. Research suggests that increasing the levels of moderate to vigorous physical activity students that engage students will improve overall student physical fitness (Colquitt, Langdon, Hires, & Pritchard, 2011). Based on this, student fitness scores based on a common fitness assessment could identify those students not participating in an appropriate amount of physical activity.

Increased physical activity has been shown to have an impact on a child's overall health. Fernandes and Sturm (2011) found that schools with more opportunities for physical activity had improved BMI scores. Also, according to Strong et al. (2005), increase opportunity for physical activity has been shown to have a positive impact on certain mental health issues, including anxiety, depression, and concentration. Based on these studies, improvement in these areas could positively affect students' academic outcomes. Trudeau and Shephard (2008) found that increasing the amount of physical activity did not have a negative effect on academic performance. This is noteworthy because some may assume that less time spent on core content areas leads to a decrease in scores. Apparently, this is not the case, which calls into question why the amount of physical activity in Grades 1 through 5 has been cut, and why higher minority schools were providing fewer physical activity opportunities than their counterparts (Beaulieu, Butterfield, & Pratt, 2009).

Explicit connections have been made between the amount of physical activity provided by schools and academic results for students. Studies in Massachusetts (Tremarche, Robinson, & Graham, 2007), Texas (Feiden, 2011; Van Dusen et al., 2011), and Mississippi (Blom, Alvarez, Zhang, & Kolbo, 2011) found a positive correlation between a student's physical fitness scores and their state standardized test scores. Furthermore, a study in Florida (Hollar et al., 2010) and in California (Grissom, 2005) took a step further not only to show a positive correlation, but that the correlation exists regardless of economic status. Given these results, it seems encouraging to build on this research and further examine the relationship between BMI and academic achievement.

Summary

Outside of school, children live in a society that induces many more unhealthy eating habits than healthy ones. However, among all children, a requirement to attend school is a consistent link. By demonstrating that a healthier child will perform better academically, the school can achieve two positive results by increasing the amount of physical activity and improving overall student fitness. A review of the literature suggests that there is a disparity between the health of white children and minority children. This disparity also exists among standardized test data. Perhaps improving fitness opportunities in the school setting could be the avenue to improve academics for all children.

Problem Statement

A major challenge facing today’s children is the rise in childhood obesity. Georgia has one of the highest childhood obesity rates in the nation. Yet, the No Child Left Behind Act of 2001 has forced schools to reallocate time for recess and formal physical education classes to increase time in core academic courses such as mathematics and reading. The A+ Education Reform Act of 2000 (HB 1187) brought about increased school accountability for better test scores. Specifically, in Georgia, students in third grade must pass the year-end assessment in reading in order to be promoted to the fourth grade, while fifth grade students must pass both reading and math assessments. Meanwhile, research suggests that students participating in regular physical education time rather than additional instructional time in reading and mathematics have had as good or better results in their core academic areas. Also, minority students and students with low SES make up a large population of obese children. Data suggests that students from these two subgroups also struggle academically. Identifying the strength of the relationship between physical fitness and student achievement could provide more insight into making changes and reallocating time within the school to improve student health and achievement.

Research Questions

The overarching research question of the dissertation has been to ascertain whether and the extent to which a difference exists on MAP reading and mathematics achievement for students in the healthy fitness zone (HFZ) and the high risk zone (HRZ) for BMI and aerobic capacity on the **FITNESS**GRAM®?

The study will address the following research questions:

RQ 1. When SES is accounted for, what is the difference in academic achievement on the MAP reading test for students in the healthy fitness zone (HFZ) versus the high risk zone (HRZ) for BMI and aerobic capacity as measured by the **FITNESS**GRAM®?

RQ 2. When SES is accounted for, what is the difference in academic achievement on the MAP math test for students in the healthy fitness zone (HFZ) versus the high risk zone (HRZ) for BMI and aerobic capacity as measured by the **FITNESS**GRAM®?

Significance of Study

The study will be significant if it establishes a difference between physical fitness and academic achievement for students in the HFZ compared to those in the HRZ. Advanced knowledge of how these variables interact may provide new opportunities for improving child health, student achievement, and better decision-making in the schools regarding the overall health of the child. The results will help also guide action-based and longitudinal research topics in the areas of student fitness and academics. Results could potentially support policy changes at the state level requiring more physical activity in schools to improve student physical fitness. Schools will be able to provide interventions over a period of years to find alternate ways to improve academics other than increasing instructional time. Current and future educators may take a closer look at their own classroom structure and discover how to allow an increased percentage of time for physical activity breaks during the day. This study could also prove applicable to improving academic performance for students in low SES contexts.

Research Design

The purpose of this study is to gain greater understanding of the influence of physical fitness on a child's academic achievement while accounting for SES. Data for the study was previously archived fifth grade data (N=754) for students at Churchill County elementary schools from the spring of 2012. The student data included student fitness data and student academic achievement data. Fitness data derived from the **FITNESS**GRAM® assessment. Although **FITNESS**GRAM®

measures several aspects of student fitness, only BMI and aerobic fitness values were collected for the study.

BMI is measured with the following formula: BMI = weight (lbs.) x 703/height^2 (in). In fifth grade, the aerobic capacity of students is measured by using Performance Aerobic Cardiovascular Endurance Run (PACER). The PACER test consists of timed runs back and forth across a 20-meter area. When the student can no longer meet the time requirements, the time is marked and the test is discontinued.

The researcher culled academic achievement data from results from the students' Measures of Academic Progress (MAP) assessment. The Northwest Evaluation Association (NWEA) created the MAP assessment and all Churchill County students take this assessment each spring. The researcher used the pseudonym Churchill County herein to maintain the confidentiality of the district. Students in the county take subtests in mathematics, reading, language arts, and science. This study employed values only for mathematics and reading. Scores are raw scale scores that NWEA applies a percentile rank. The basis for the percentile rank is a nationwide set of norms that the assessment authors readjusted these norms every three years, and the percentile rank used was from the norm adjustment of 2011.

Student SES was based upon the child's free/reduced status. In Churchill County, whether a child is on free/reduced status is determined by the United States Department of Agriculture (USDA) formula. According to the USDA formula, any child receiving reduced lunch would have a household income no greater than 185% of the poverty level. Students receiving free lunch have an income no greater than 135% of the poverty level.

All fifth grade students at all elementary schools in Churchill County with valid scores for BMI and aerobic capacity on the **FITNESS**GRAM® and reading and mathematics on the MAP test were part of the study. By including all students, the sample was representative of other schools with similar demographics in the southeastern United States. Despite archival format, all data was collected manually for students.

The data was entered into a Microsoft Excel spreadsheet. After verifying their accuracy, all student names were erased to protect students' identities. The Statistical Package for Social Sciences Version 23 (SPSS) was then applied to the data to analyze using factorial ANOVA to compare outcomes due to the fact that categorical data is being used.

Limitations, Delimitations, and Assumptions

Delimitations include using fifth grade students in Churchill County as subjects. Also, this study will only be using reading and mathematics scores for the MAP test. On the **FITNESS**GRAM®, body mass indicator (BMI) and aerobic capacity will be used for the fitness components. Therefore, the findings in this study may not be generalizable to other school districts and other standardized test data.

Key Terms

Aerobic fitness. This term refers to a fitness measure that one calculates by using recorded times for running a mile, walking a mile, and the PACER test, which is a timed, segmented running test.

Body mass index (BMI). This is an obesity indicator based upon an individual's height and weight.

Measures of academic progress (MAP). The MAP is an adaptive assessment using state standards to identify norm ranking for students and to track growth. It was developed in 2000 by Northwest Evaluation Association, a not-for-profit organization.

Free/reduced status – This level is based on a nationally-adopted formula from the United States Department of Agriculture for schools participating in the school breakfast/lunch program. This formula tracks low-income families. It also is in the allocation of funds to Title I schools. In order to receive reduced lunch, a family income cannot exceed 185% of the national poverty rate. To receive free lunch, a family income cannot exceed 135% of the national poverty rate. In Georgia, a family of one whose income is less than $15,171per year qualifies for free lunch. For each additional family member, the income total increases by $5,278 per year. A family of 1 whose income falls between $15,172 and $21,590 qualifies for reduced lunch prices. For each additional family member, the income total increases by $7,511 per year. In total, 62.29% of the students in the state of Georgia receive free or reduced lunch (Georgia Department of Education, 2014).

Obese. This adjective identifies individuals whose BMI for a given age exceeds the 95^{th} percentile.

Overweight. This adjective identifies individuals whose BMI for a given age exceeds the 85^{th} percentile.

CHAPTER 2

REVIEW OF SELECTED LITERATURE

This chapter reviews the research on obesity and its effects on academic success rates for children. The review provides the rates of obesity among adults and children, academic issues that exist within schools, and student academic outcomes relative to their physical fitness levels. There are four sections in this review: obesity, obesity in Georgia, academics, and physical fitness, and academics. For the purposes of this review, the researcher used databases located in Georgia Southern University's online library system. The primary databases used were ERIC, EBSCO Host, PubMed, and ProQuest. Google Scholar was also used as a source for locating empirical research. The primary search terms used were "fitness and academics," "childhood obesity," "physical fitness and academic achievement," "aerobic exercise and cognition," and "obesity and schools." The research studies included publications for the years 1999 to 2017.

Historically, the data available from the past 30 years gives testimony for the growing problem of obesity in the United States. Quite apart from an increasing population, the percentage of obese adults and children has grown substantially. During this period, the population in the U.S. has grown from 226.5 million to 308.7 million (Mackum & Wilson, 2011). Researchers have also documented a growing percentage of obese Americans during this time (Ogden & Carroll, 2010; Ogden et al., 2012). In the United States, the obesity percentage of American adults grew from an average of 23% between 1988 and 1994 to 35.7% in 2009-2010 (Ogden & Carroll, 2010; Ogden et al., 2012). The CDC, using

NHANES data, reported that from 1988 to 1994 and 2007 to 2008, obesity rates increased in adults at all economic and education levels (Ogden, Lamb, Carroll, & Flegal, 2010).

Obesity is the result of a genetic predisposition, individual behavior, and the environment in which a person lives, all interacting together in a specific but complex way to produce an individual who behaves in a certain way. Of these, environmental factors has the most direct influence on obesity due to energy intake being greater than energy consumption in obese individuals (Nguyen & El-Serag, 2010). This imbalance in energy consumption can negatively affect an individual's quality of life and may lead to serious health risks—asthma, sleep apnea, hypertension, heart disease, diabetes, osteoarthritis, stroke, and premature mortality (Field, Coakley, & Must, 2001; Must, et al., 1999; "Overweight and Obesity Statistics", 2012).

According to a cohort study by Keyes et al. (2010), for as long as children have been exposed to media marketing, changes in physical activity, and specific food supplies, they have been obese. However, now they are not only obese, but in greater danger of lifetime obesity. Outside of certain medical conditions from birth, obesity in children is caused by taking in more energy through food and drink than is being burned off through activity. Some variables contributing to this are an increase in the number of activities that do not require being active like computer gaming, video gaming systems, television, other forms of technology, and fewer physical education classes at school. Whether a child lives in a safe neighborhood where they can play outside is a variable influencing a child's activity levels as well. (“What causes overweight and obesity?”, 2012).

Wang and Beydoun (2007) using data collected by the National Health and Nutrition Examination Survey (NHANES) and the Behavioral Risk Factor Surveillance System (BRFSS), found that the number of children ages 6 to 11 with a body mass index (BMI) in the obese zone (≥ 95%) increased from 4% in 1971-1974 to 18.8% in 2003-2004. Other studies were conducted using the same data found from the NHANES survey. Additionally, a study from the Journal of American Medical Association analyzed the information using all children ages 2-19 and found that in 2003 to 2004 this group had 17.1% in the overweight category (Ogden, et al., 2006).

In 2008, the BRFSS found that 37 states had obesity rates greater than 25%. Five of these states (West Virginia, Oklahoma, Alabama, Tennessee, and Mississippi) had a rate of over 30%. In 1990, all fifty states had an obesity rate of less than 15% (Nguyen & El-Serag, 2010). Ogden and Carroll (2010) utilized data from the NHANES that were collected by the National Center for Health Statistics. They found that obesity levels rose from 6.5% to 19.6% in children ages 6 to 11 from 1976 to 2008. There continues to be a climb in overweight and obesity rates among children. In 2009-2010, the total percentage of obese children was up to 16.9%. Over a 10- year span, this has increased from 14% among males to 18.6% and from 13.8% among females to 15%. According to the CDC’s initiative *Healthy People 2010*, the goal was to drop the rate to 5% for children (Ogden et al., 2012). In 1980, the obesity rate for children was at 5.5% (Nguyen & El-Serag, 2010).

The World Health Organization [WHO] (2000) now recognizes childhood obesity as a disease. In the age of technology, there are many activities that children can be involved in that do not require any physical activity. Children have greater access to television, gaming systems, and computers that may possibly distract them from going outside or being involved in physical behaviors. Belcher et al. (2010) used accelerometer technology to measure the amount of physical activity by school children occurring during the day. Using a sample of 3,106 children and youth similar to that of the NHANES sample, data showed that for children ages 6 to 11, the amount of physical activity for males and females was significantly different between the normal weight group (≤ 85% BMI) and the obese group (≥ 95% BMI). This study did not include any information gathered during the school day. Rather, all the data on physical activity using the accelerometer were based on afterschool activities. Wang and Beydoun (2007), using their 2003-2004 data, found the subgroups with the largest percentages of obesity were Mexican-American males (25.3%) and non-Hispanic Black females (26.5%). Another study used the 2003 to 2004 NHANES data but also included the 2005 to 2006 data. This study found that 14.4% of non-Hispanic White females, ages 6 to 11, were overweight, while 24% of non-Hispanic Black females and 19.7% of Mexican American females were overweight. In males, the data were closer between non-Hispanic Whites (15.5%) and non-Hispanic Blacks (18.6%). However, among Mexican American males, 27.5% were overweight (Ogden, Carroll, & Flegal, 2008).

Due to the continued growth in childhood obesity numbers, the CDC initiated the "Youth Media Campaign," which was a nationally-based program designed to increase the amount of physical activity in which children between the ages 9 and 13 participated (Duke, Huhman, & Heitzler, 2003). This longitudinal study that found that 61.5% of children 9 to 13 do not participate in any organized physical activity after school. Duke et al. (2003) also identified possible causes for the lack of involvement in physical activity after school. Possible causes included neighborhood safety, cost of programs, location of programs, and parents not having time to participate and support such programs. There were three groups that were identified as having less involvement in organized afterschool physical activity. Compared to non-Hispanic white children, Hispanic, non-Hispanic black, and children from low SES were all less likely to be involved in organized after school physical activities.

These findings are similar to an earlier study conducted by Duncan, Duncan, Strycker, and Chaumeton (2001), in which poverty levels and social cohesion exhibited a significant relationship to the amount of physical activity opportunities available and supported by the community. This study, which collected data from participants in 56 urban neighborhoods in the Pacific Northwest, further supports the idea that increasing physical activity opportunities in schools supports all students by being a common location. In a study of over 1,000 adults in the St. Louis area, results indicated similar findings. Black participants (46.6%) indicated that they found neighborhoods less safe than white participants (54.3%) (Boslaugh, Luke, Brownson, Naleid, & Kreuter, 2004).

Overall, the study indicated that whether a neighborhood is thought of as safe has a greater impact on willingness to be involved in physical activity opportunities rather than the number of physical activity facilities available.

Gordon-Larsen et al. (2006) studied a nationally representative sample of more than 20,000 children ages 7 to 12. The results of this study, using geographic mapping, was that low-income and high minority areas had fewer physical activity facilities in close proximity and that their BMI scores were higher than others who had facilities closer to them. Franzini (2009) surveyed, interviewed, and observed 650 5th grade students from Alabama, California, and Texas in 2003. They reported that having a positive neighborhood perception associated positively with physical activity and a negative association with childhood obesity. This same study also showed that the greatest influence on a positive neighborhood perception was neighborhood safety. Neighborhood social cohesion (members willing to work together) also had a strong influence on the amount of physical activity that occurred. As in other studies, Hispanic and Black children demonstrated lower levels of physical activity than other groups (Franzini et al., 2009). Overall, however, having a safe and cohesive neighborhood was an important factor in positively influencing childhood obesity, especially in high minority or low-income areas that may not have facilities available.

Experts anticipate that the economy will suffer heavy burdens in healthcare costs as the result of the obesity epidemic ("Economic costs related to overweight and obesity", 2008). Indirect costs reached $92 billion for obesity-related health care in 2002 (Finkelstein, Fiebelkorn, & Wang, 2004), and by 2008 were close to $147 billion for adults and children (Finkelstein, Trogdon, Cohen, & Dietz, 2009). Also, in 2008, Finkelstein and Trogdon found that for children ages 8 to 13, medical expenses were $220 more per year per child than the average as a result of the children being overweight.

Obesity is an epidemic that is impacting all groups of people. In American adults, the obesity rate grew from 23% in 1988 to 35.7% in 2010 (Ogden & Carroll, 2010; Ogden et al., 2012). In children, the rate has gone from 6.5% in 1976 to 19.6% in 2008 (Ogden & Carroll, 2010). Unsafe neighborhoods (Boslaugh et al., 2004), lack of facilities (Gordon-Larsen et al., 2006), and social cohesion (Franzini et al., 2009) are existing barriers that inhibit physical fitness opportunities. Healthcare costs associated with the obesity epidemic reached as high as $147 billion in 2008 (Finkelstein, Trogdon, Cohen, & Dietz, 2009). While this is a national issue, obesity has also been examined at the state level. One state where obesity rates are of great concern in Georgia.

Obesity in Georgia

Data about this growing problem in Georgia were reported in 2011 by TFAH and RWJF (2011). Their report stated that Georgia's adult obesity rate was 28.7% and that, among Georgia's children and youth, the rate was 21.3%. The TFAH-RWJF report ranked Georgia as the 17th most obese state and noted that as obesity rates have increased, so has the frequency of reported cases of diabetes and hypertension. Based on the 2011-2012 NHANES report, Ogden et al. (2014)

identified Georgia's childhood obesity rate at 16.5%, which ranks Georgia as the 16th most obese state.

According to the BRFSS, in 1990, there were 10 states with an obesity level less than 10%. Georgia's rate was between 10 and14%. At that time, no state had an obesity level greater than 15%. Ten years later, Georgia was one of 23 states with an obesity rate greater than 20% (CDC, "Georgia", 2010). Alarmingly, by 2010, all states were over 20% obesity and Georgia was at 29% (CDC, "Adult Obesity Facts", 2012). A contributing factor to this is that one-fourth of the population of Georgia had reported no physical activity in the previous month, and 43% of 9th through 12th grade students stated that they had watched three or more hours of television every day. In 2001, 77% of obese children were projected to remain obese as adults (Freedman, Khan, Dietz, Srinivasan, & Berenson, 2001). This figure is significant as it illustrates how the obesity epidemic targets children. Overall, by 2003, obesity had reportedly cost the state of Georgia $2.1 billion dollars. Also, according to the CDC's 2012 data, the entire county in this study had an obesity rate of 29%. From such data, it was inevitable that school leaders would come to understand the bearing of schools on children's health. All children are required to attend school, and they spend a considerable amount of time there. Therefore, as school leaders are accountable for how students spend their time in school, they are responsible also for the role they and their schools must play in childhood obesity. The next section presents a consideration of the role played by research in academics.

Academics

Given the high-stakes nature of statewide test results, school leaders focus their attention on programs and initiatives that have the greatest positive effects on student achievement. School leaders make decisions on issues like scheduling, class size, programs, teacher evaluation and retention, demographics, and academic achievement for all students. Given the extent of school leaders' responsibilities, they should have access to the most up-to-date and most relevant possible information as inputs to their decision-making processes. It is equally important, however, that leaders remain focused on the domain that they can control without distraction from the domain that they do not control. For example, factors such as economic status, race, gender, home environment, and neighborhood location, while important and relevant as educational inputs to educational outcomes, are not controllable variables for school leaders and their efforts to make changes in this domain are likely to suffer from diminishing returns. This section will look at those variables that school leaders are able to control.

The most highly valued decisions for school leaders are those that ultimately focus on positively affecting student achievement for all students. The No Child Left Behind Act (NCLB) of 2001 has led elementary schools to focus on providing students with learning time in the core content areas of reading, language arts, mathematics, science, and social studies. School schedules have shown a refocus maximizing instructional time for these areas, and, more specifically, for reading and mathematics. Au (2007) supported such innovation by discovering that high-stakes testing compelled schools to narrow their focus to the tested subjects to the diminishment of non-tested content areas. These high-stakes tests have also been used to identify whether schools are showing proficiency in reading and mathematics for all subgroups or face funding cuts for sub-proficient performance (Karp, 2006). Although dropout rates may have declined from 1972 to 2008 (Chapman, Laird, & Kewal Ramani, 2011), the academic gaps between low SES and black students compared to other groups have continued to grow (Rowan, Hall, & Haycock, 2010). Therefore, when making decisions, leaders must consider strategies that will assist schools in closing these gaps. However, it is also important that leaders understand that, to appropriately close an achievement gap, the lower performing group must grow at a greater rate than the higher performing group. Whether or not an achievement gap can be closed depends on school leaders providing supports to all students, with special consideration being given to lower or underperforming groups. According to Au (2007), as a result of high-stakes testing, classroom pedagogy has turned into a factory-like process of learning.

Providing students with an education that meets the requirements of standardized testing, but one that also provides students with the necessary skills to compete in a global economy has become critical (Au, 2008). This is supported by the more recent focus for schools to have students college and/or career ready. Conley (2012) defined college and career readiness as a student who “can qualify for and succeed in entry-level, credit-bearing college courses leading to a baccalaureate or certificate, or career pathway-oriented training programs without the need for remedial or developmental coursework"(p. 1) . In order to achieve this, students are not required to have the same level of proficiency, but they must have a common set of foundational critical thinking skills, content knowledge, and strategies for learning (Conley, 2012). Therefore, the purpose of education has as much to do with preparing students to be successful learners and contributors to society as it does having the students meet a target on a standardized test. Understanding the connections between a child's physical and mental health may shed more light on making decisions that will positively influence student achievement.

Children's cognitive development plays a significant role in their overall academic performance. The executive functions in the brain relate to a child's ability to understand knowledge application, use working memory, shift mental sets, and control impulsive behaviors, which enhance a children's ability to excel in their academics (St. Clair-Thompson & Gathercole, 2006). St. Clair-Thompson and Gathercole (2006) also found that children with higher levels of executive functioning performed better in academic core subjects of English and mathematics. Therefore, enhancing cognitive development in children, more specifically their executive functions, can have a positive impact on their academic success (Diamond, 2013). Studies have found that having better aerobic capacity can improve brain functioning and cognition (Hillman, Erickson, & Kramer, 2008). This research has provided evidence of the importance of school leaders realizing the significance of physical activity in cognitive development for children.

Specific studies focusing on different sections of the brain have found that children who are more physically fit have better relational memory performance (Chaddock et al., 2010), were more efficient at managing conflicting cues, and experienced less behavioral interference to cues that were misleading or irrelevant (Chaddock et al., 2010). Moreover, children with better aerobic fitness were found to outperform their less-fit peers when tasks involved different amounts of interference control (Hillman, Buck, Themanson, Pontifex, & Castelli, 2009). Other studies found that working memory, another component of executive functioning, improved as a child's aerobic fitness increased (Hillman, Castelli, & Buck, 2005; Hillman, Snook, & Jerome, 2002; Kamijo et al., 2011). These studies demonstrate how fitness supports cognition, but it is necessary to also understand how it all connects to academic achievement as well.

In a study utilizing cognitive assessments as well as an achievement test for reading, spelling, and mathematics, students participating in moderate to intense aerobic exercise prior to the assessments showed an increase in cognitive responses and reading achievement. While students' scores in mathematics and spelling did not show improvement, there was no negative impact of the exercise (Hillman et al., 2009). Another study involving three months of consistent aerobic exercise with overweight, sedentary children found improved performance by the children on cognitive assessments and mathematics achievement on the Woodcock-Johnson Test of Achievement III (Davis et al., 2011).

In summary, as a result of the emphasis on high-stakes testing, schools have focused a greater amount of attention on the core content areas. The increase in time scheduled in the areas of mathematics and reading has not decreased the achievement gap between certain subgroups (Rowan, Hall, & Haycock, 2010). Understanding the role of cognitive development and executive function in children may help identify alternatives for improving student achievement. St. Clair-Thompson and Gathercole (2006) found that children with higher levels of executive functioning performed better in academic core subjects such as English and mathematics. Several studies found that children with better physical fitness outperformed their peers on cognitive tasks and that aerobic capacity was a defining influence (Hillman et al., 2009, Hillman, Castelli, & Buck, 2005, Hillman, Snook, & Jerome, 2002, Kamijo et al., 2011). Furthermore, studies also showed the link between aerobic capacity, improved cognition, and improved academic achievement (Davis et al., 2011; Hillman et al., 2009). Research conducted in schools that focused on the connection of physical fitness, physical activity, and academic achievement will be presented in the next section.

Physical Fitness and Academics in Schools

Based on the results of previous studies that have identified certain barriers to physical activity opportunities for children (Boslaugh et al., 2004; Franzini et al., 2009; Gordon-Larsen et al., 2006), the school's role in addressing the importance of physical activity in a child's development is significant. In a study conducted every six years in which school personnel from all 50 states are interviewed, either by phone or through a mailed survey, Lee, Burgeson, Fulton, and Spain (2007) found that 76.5% of states had established goals, objectives, or desired results for physical education in the elementary school setting. However, only 80.4% of states required that physical education be taught in the elementary school and only 36% of states had established time requirements for physical education. Furthermore, according to this study, only 11.8% of states required a test and 35.3% recommended a test to determine students' fitness scores (Lee, et al., 2007).

In a study that collected data over a five-year period, Fernandes and Sturm (2011) found that schools that provided more opportunities for physical activity produced lower BMI scores for their students. The data were gathered through direct assessment of the children and questionnaires from the parents, teachers, and administrators. The child's BMI was the dependent variable and the variables for analysis were whether the child participated in PE and recess for the recommended number of times during the school week.

Furthermore, Strong, et al. (2005) reviewed over 850 articles and studies to identify correlations relating to physical fitness and physical activity on different behavior and health outcomes in children and adolescents between the ages of 6 and 18. Their findings indicated that physical activity had a strong positive influence on the reduction of anxiety and depression. In addition, a positive association between physical fitness/activity and academics existed. Other positive associations that were reported included memory, concentration, and classroom behavior, which are important factors in student achievement. After the panel's review, the panel determined that school children who participated in 60 minutes per day of moderate to vigorous physical activity would experience positive results with health and behavioral outcomes (Strong et al., 2005).

Researchers have made connections between the amount of physical activity provided and academic results of students. Trudeau and Shephard (2008), in a quasi-experimental study, analyzed previous studies conducted in different parts of the world regarding the influence of physical activity on academic results. Their findings indicated that overall student performance increased, but that the levels of significance varied. However, they did find that increasing the amount of physical activity in the school did not have a negative impact on the academic performance of students on achievement tests or in the classroom, but it did improve their overall fitness. Beaulieu, Butterfield, and Pratt (2009) studied the amount of physical activity opportunities available for school children. Using data from the National Center for Educational Statistics, they found that the amount of physical activity for children in Grades 1 through 5 had decreased, and schools with smaller populations were providing more opportunities than larger schools. In addition, schools with higher minority populations as well as schools with high free-reduced lunch counts were providing less physical activity opportunities than their counterparts. This is significant when considering that Ogden et al.'s (2008) research found that minority children had higher obesity rates and, more specifically, children in poverty and black children, were behind their student peers academically (Rowan, Hall, & Haycock, 2010). Further, in this researcher's view, research should continue to develop the body of information showing positive relationships between physical fitness and academic performance.

Grissom (2005) analyzed physical fitness across genders and SES in California. He used over 800,000 students in his sample from fifth, seventh, and ninth grade public schools. He analyzed his data to seek associations between the students' scores on the Stanford Achievement Test (9th edition) and **FITNESS**GRAM®. The results demonstrated that as a student's physical fitness scores went up, so did their academic achievement scores. ANOVA results showed that as physical fitness scores increased, achievement scores also increased with statistical significance. He also found this same result with students from low SES backgrounds; however, the increase was not as great as those from non-SES homes.

Tremarche, Robinson, and Graham (2007) conducted a study using 311 fourth grade students in two Massachusetts schools and found a strong correlation between the amount of physical activity provided and the students' achievement test results. School 1 provided 28 hours of physical activity per year and school 2 provided 56. After the Massachusetts standardized test was given, school 2 scored significantly higher than school 1 on the reading and language arts portion of the test. School 2 also outscored school 1 on the mathematics portion, but not with the same level of significance. However, the population of school 1 had 12% more minority students than school 2 (Tremarche, Robinson, & Graham, 2007).

In 2009, Chomitz compared students' scores on the Massachusetts Comprehensive Assessment System (MCAS) achievement tests in the areas of mathematics (1,103 fourth, sixth, and eighth grade students) and English (744 fourth and seventh grade students) with their fitness scores. Their fitness scores measured five different domains and were modified from the Amateur Athletic Union (AAU) standards and **FITNESS**GRAM® standards. The five fitness domains that were used included an endurance cardiovascular test, abdominal strength test, flexibility test, upper body strength test, and agility test. Using logistic regression analyses, the researchers were able to estimate that the chances of passing the mathematics MCAS increased by 38% with each fitness test passed and an estimated 24% on the English MCAS, when controlling for gender, ethnicity, weight status, grade, and SES (Chomitz et al., 2009). Other states found similar results.

In Florida, Hollar et al. (2010) completed a study in high minority and low SES schools to determine if instituting school health programs would improve student fitness. The results showed that student health improved as did state assessment results on the Florida Comprehensive Achievement Test (FCAT) in reading and mathematics. Overall, the study found that implementing obesity prevention programs can positively affect both fitness and achievement for low SES students that are at-risk for obesity and low academic achievement (Hollar et al., 2010).

A Mississippi study indicated a statistically significant positive correlation between students' **FITNESS**GRAM® results and their mathematics and language arts scores on the Mississippi Curriculum Test (MCT2). The results also showed that for every additional fitness zone achieved, the chance for high achievement in language arts and mathematics increased. These correlations remained significant when controlling for gender, race, and SES. This study also found a positive relationship between fitness and attendance rates, which contribute to academic success (Blom et al., 2011).

A 2011 Texas study involving over 250,000 students Grades 3 to 11 in 13 different school districts compared student data from the Texas Assessment of Knowledge and Skills (TAKS) and the **FITNESS**GRAM® assessment. Results showed, except for BMI, that fitness variables had a positive association with academic achievement with cardiovascular fitness having the greatest direct association. While the range of fitness outcomes did not vary much across the grade levels, the gap in academic achievement between the fit and unfit differed significantly (Van Dusen et al, 2011). Another study in Texas conducted by the Robert Wood Johnson Foundation found consistent correlations between fitness scores and academic achievement (Feiden, 2011).

A longitudinal study in California revealed that physical fitness was a better predictor of academic achievement than BMI alone. Students' SES was a defining variable for those students with poor physical fitness but high academic achievement. This study also found a greater relationship between fitness and academic achievement at the beginning of the study compared to changes in fitness or achievement over time (London & Castrechini, 2011). These results allude to the idea that improving fitness for fifth grade students who already struggle academically may not provide academic improvement aggressively enough to close the achievement gap between those struggling students and their peers.

Wittberg, Northrup, and Cottrell (2012) analyzed aerobic fitness and academic achievement in fifth grade students and then again, two years later, when they were seventh grade students. Their results indicated that students who were in the HFZ as fifth graders and remained there as seventh graders had significantly higher scores on the West Virginia Educational Standards Test (WESTEST) than students who were in the “needs improvement zone” for both years. A previous study using the WESTEST as the academic measure found that as fifth grade students achieved better results on the PACER test or mile run for **FITNESS**GRAM®, their academic results increased as well (Wittberg, Cottrell, Davis, & Northrup, 2010). Together these studies suggest that attending to children’s physical fitness at the start of their school career may have a greater influence on academic outcomes.

This review of literature suggests that improving student fitness may also improve student cognition which, in turn, improves student achievement. This supports the overall goals of schools to improve standardized test results, prepare students for college and/or careers, and close achievement gaps that exist. Moreover, the results suggest long-range economic savings in health care costs if schools provide opportunities to improve student fitness. Among all children, a requirement to attend school is a consistent link. By demonstrating that a healthier child will perform better academically, the school has two positive results that can be acquired by increasing the amount of physical activity: improving student achievement and improving overall student fitness.

CHAPTER 3

METHODOLOGY

This study investigates the connection BMI and aerobic capacity have with academic achievement in children. Understanding how these variables interact together based on the research questions may provide new opportunities for improving child health, student achievement, and better decision making by school leaders regarding the overall health of the child. The results, if persuasive, should help guide action-based, and longitudinal research topics in the areas of student fitness and academics. Schools may also be able to provide interventions over a period of years to find alternate ways to improve academics other than increasing instructional time. Current and future educators may take a closer look at their own classroom structure to allow for more physical activity breaks during the day to enable students to better perform. This study may support strategies to improve academic performance of students from low SES.

This chapter describes the procedures used to acquire data for the study and the methods employed in the analysis of that data. The following will be included: (a) research questions, (b) the methodology, (c) data selected for analysis, and (d) the procedures for collecting and analyzing the data.

Research Questions

The overarching research question of the dissertation has been to ascertain whether and the extent to which a difference exists on MAP reading and mathematics achievement for students in the healthy fitness zone (HFZ) and the high risk zone (HRZ) for BMI and aerobic capacity on the **FITNESS**GRAM®?

The following subquestions directed the study:

RQ 1. When SES is accounted for, what is the difference in academic achievement on the MAP reading test for students in the HFZ versus the HRZ for BMI and aerobic capacity as measured by the **FITNESS**GRAM®?

RQ 2. When SES is accounted for, what is the difference in academic achievement on the MAP math test for students in the HFZ versus the HRZ for BMI and aerobic capacity as measured by the **FITNESS**GRAM®?

Research Design

The study examined the difference in academic achievement for students in the HFZ compared to the HRZ while accounting for socio-economic status. The researcher employed archival data for this study. He collected the fitness and student academic achievement data from archives for fifth grade (n = 754) students in Churchill County (a pseudonym used to main district confidentiality) elementary schools as a standard part of the standard record-keeping process during the spring of the 2011-2012 school year. Fitness levels were measured utilizing the **FITNESS**GRAM® assessment

The **FITNESS**GRAM® assessment bases student scores on established health standards instead of just using national averages (Meredith & Welk, 1999). The **FITNESS**GRAM® measures several aspects of student fitness; this study, however, employed only BMI and aerobic fitness. (BMI for a human being is measured by using the following formula: BMI = weight (lbs.) x 703/height^2 (in), and the Cooper Institute has identified the healthy score ranges for children (Plowman & Meredith, 2014). The ranges for HFZ, NIZ, and HRZ for BMI and aerobic capacity are listed in Table 11 and 12 of the Appendix A. In fifth grade, the district measures students' aerobic capacity by using Performance Aerobic Cardiovascular Endurance Run (PACER). The PACER test consists of timed runs back and forth across a 20-meter area. When the student can no longer meet the time requirements the time is marked and they discontinue the test. PACER computes scores from results by taking into consideration the number of laps run and the student's BMI. The score itself represents the milliliters of oxygen used per kilogram per minute (Meredith & Welk, 1999). Any score 40.2 or above for 5th grade students age 10 or 11 is in the healthy fitness zone (HFZ). Likewise, any score less than or equal to 37.3 is in the high risk zone (HRZ). Table 1 and Table 2 in Appendix A outline the score ranges for aerobic capacity as the Cooper Institute defines it (Plowman & Meredith, 2014). In addition to fitness data, the researcher also analyzed academic achievement data from the 2011-2012 school year.

The researcher used the MAP assessment to measure academic achievement in mathematics and reading. Northwest Evaluation Association created the MAP assessment and the district gives the assessment to all Churchill County students each spring. This annual assessment includes sections on mathematics, reading, language arts, and science, and studies have demonstrated its validity and reliability (NWEA, 2004; Brown & Coughlin, 2007). This present study used only mathematics and reading results from the spring of the 2011-2012 school year. NWEA assigns percentile ranks based on nationwide norms to the raw numerical scores. The norms are adjusted every three years with the most recent adjustment having occurred in 2011. Although percentile ranks were categorical, they were more standardized and were of greater interpretive value than were raw scores.

The researcher used children's free/reduced status as the basis for determining SES. In Churchill County, whether a child was on free/reduced status was determined by the United States Department of Agriculture (USDA) formula. According to the USDA formula, any child receiving reduced lunch would have a household income no greater than 185% of the poverty level. Students receiving free lunch had an income no greater than 135% of the poverty level.

Population

The population of Churchill County in 2012 was 72,737 people. Of that, 34% were white males, 33% were white females 13.5% were black males and 14.5% were black females. The remaining 5% were comprised of all other demographic groups. Also, 31.4% of the population in Churchill County was living in poverty in 2012 (United States Census Bureau, 2014). However, for this study, the SES of the students was based on their free and reduced lunch status which was a different calculation from determining overall poverty. Within the Churchill County School System, 28.5% of the students were white males, 26.1% were white females, 18% were black males, and 17% were black females. Overall, 62% of the students were economically disadvantaged based on their free and reduced lunch status.

Sample and Sampling

The researcher selected the study's sample on the basis of two considerations. The first was the idea that childhood personality traits, self-control, and social-emotional functioning have all been found to be possible predictors for future adult behaviors including, crime, physical health, academic achievement, and wealth (Hampson, Goldberg, Vogt, & Dubanoski, 2007; Jones, Greenberg, & Crowley, 2015; Moffitt et al., 2011). Thus, using elementary students would allow for possible predictions for future behaviors. The second was that the **FITNESS**GRAM® user's manual stated that results for the PACER test for aerobic capacity were not reliable and valid under the age of ten. Therefore, to ensure that all participants were over the age of ten and to allow for some predictability for adult behavior, fifth grade students were used in this sample. For the purpose of this study, the sample consisted of all fifth grade students (n =781) from the nine elementary schools in Churchill County who had valid **FITNESS**GRAM® scores for BMI and aerobic capacity as well as scores for the mathematics and reading portions of the MAP test during the spring of 2012. After eliminating students with incomplete or invalid data, there were 666 fifth grade students remaining in the study. A school is designated by the federal government as Title I if a large portion of its population is economically disadvantaged according to its free and reduced lunch totals. Based on free and reduced lunch information, 484 students (72.5%) were economically disadvantaged. In terms of demographics, 26.8% were white males, 29.2% were white females, 18.9% were black males, 14.8% were black females, 4.4% were other males, and 5.7% were other females. Due to the fact that all other specific demographic groups were each less than 3% (n<20 students), they were listed under the “other” category. Finally, 50.2% were male and 49.8% were female. By including all students, the sample was representative of other schools with similar demographics in the southeastern United States.

Instrumentation

The student academic data was from the reading and mathematics portions of the MAP test, which the district administered to all students in second through tenth grades in Churchill County Schools during the 2011-2012 school year. The MAP test was an online assessment that the district administered in the fall and spring of each year. The purpose of the MAP test was to assess students’ content knowledge and their growth compared to peers. Students would receive a scale score that would then compute to a percentile rank based on national norms according to Northwest Evaluation Association guidance. A student in third grade could have the same scale score as a student in fifth grade. However, depending on the norms, the percentile rank for the third grader could be much higher than for the fifth grade student. Thus, it was important to use a percentile rank because such rankings were categorical and would give a clearer picture of how proficient children’s reading and mathematics scores were compared to their peers.

Student fitness data came from the aerobic capacity and BMI sections of the **FITNESS**GRAM® assessment from The Cooper Institute. The assessment measured aerobic capacity using the PACER test or by having students run the mile. For this study, the PACER test was used. Based on the outcomes of the PACER test, the research identified each child as being in the healthy fitness zone

(HFZ), the needs improvement zone (NIZ) or the high-risk zone (HRZ). Children's scores were the output of a calculation that used the number of PACER laps completed along with their age, gender, and BMI scores. Since the variable was one of three zones, school administrators labeled student records as "3" for HFZ, "2" for NIZ, or a "1" for HRZ.

Data Collection

After acquiring permission to compile the MAP assessment data from district personnel, the data analysis coordinator for the district helped this researcher gather the MAP data. The data included student names, economic status, race, gender, MAP reading percentile rank from spring 2012, and MAP mathematics percentile rank from spring 2012. The collection of fitness data required the permission of district personnel to access the state website containing district level fitness data by school. Student **FITNESS**GRAM® reports were printed by the researcher for each fifth grade student from the spring of 2012. The data was kept secure during the study and kept under lock while not in use. The data contained no student names, which preserved individual confidentiality. All data was destroyed by the researcher at the conclusion of the study.

Data Analysis

All archival data for individual students was extracted by the researcher and entered into a Microsoft Excel spreadsheet. After verifying accuracy, the researcher erased all student names to protect student identities, and entered into the *Statistical Package for Social Sciences* (version 23; SPSS) program for analysis. In SPSS, the SPSS analytical routine was a factorial ANOVA due to it being categorical in nature. Results were then analyzed by the researcher to discern how these results related to the research questions in order to determine the difference between physical fitness scores for students in the HFZ and HRZ compared to their academic achievement.

Summary

Using a sample of 666 fifth grade students from a rural county in Southeast Georgia, the researcher conducted a factorial ANOVA to determine the relationship between student fitness and academic achievement. He employed **FITNESS**GRAM® data to determine student fitness as measured by aerobic capacity and BM, and MAP test data to measure student achievement data in mathematics and reading. SPSS we the software of choice for the study's analytic computations.

CHAPTER 4

DATA ANALYSIS

Moving forward from the growing problem of childhood obesity in the United States, this study intended to analyze whether student fitness as measured by BMI and aerobic capacity was significantly related to academic performance as measured by MAP reading and math scores. BMI and aerobic capacity would be determined using **FITNESS**GRAM® as the assessment. This chapter discusses the analyses of the data, beginning with demographic information about the sample and going ahead with the data analysis that the researcher performed with respect to each research subquestion.

Demographics

After matching up **FITNESS**GRAM® results with MAP reading and math scores for 781 fifth grade students, there were 666 students who had data in all four categories. Of these students, 332 (49.8%) were female, 334 (50.2%) were male, and 405 (60.8%) were considered to be economically disadvantaged. Tables 1 and 2 show the between-subjects factors that were used in data analysis. Relating to BMI, 37.7% are in the HRZ, 11.6% are in the NIZ, and 50.7% are in the HFZ. For aerobic capacity, 14.6% are in the HRZ, 23.1% are in the NIZ, and 62.3% are in the HFZ.

Table 1

Between-subjects Factors (SES and BMI)

		Value Label	N
SES	1	Not economically disadvantaged	261
	2	Economically disadvantaged	405
BMI	1	High risk	251
	2	Needs improvement	77
	3	Healthy fitness zone	338

Table 2

Between-Subjects Factors (SES and AER)

		Value Label	N
SES	1	Not economically disadvantaged	261
	2	Economically disadvantaged	405
AER	1	High risk	97
	2	Needs improvement	154
	3	Healthy fitness zone	415

Research Questions

RQ 1

When SES is accounted for, what is the difference in academic achievement on the MAP reading test for students in the healthy fitness zone (HFZ) versus the high risk zone (HRZ) for BMI and aerobic capacity as measured by the **FITNESS**GRAM®? Table 3 presents the descriptive statistics for BMI and MAP reading mean scores when SES was accounted for.

Table 3

Descriptive Statistics for BMI and MAP Reading Mean Scores When Accounting for SES (Dependent Variable: Reading Percentile)

SES	BMI	Mean	Std. Dev.	N
Not economically disadvantaged	High risk	68.72	19.880	89
	Needs improvement	68.69	15.459	32
	Healthy fitness zone	67.09	22.892	140
	Total	67.84	21.049	261
Economically disadvantaged	High Risk	46.82	25.450	162
	Needs Improvement	46.73	24.566	45
	Healthy Fitness Zone	47.62	27.352	198
	Total	47.20	26.246	405
Total	High risk	54.59	25.815	251
	Needs improvement	55.86	23.780	77
	Healthy Fitness zone	55.69	27.309	338
	Total	55.29	26.332	666

The results in Table 3 show that the 89 students not economically disadvantaged and in the HRZ for BMI had a higher mean score for the MAP reading test than the 32 students in the NIZ by .03 points, and the 140 students in the HFZ by 1.63 points. However, in the economically disadvantaged group, the 198 students in the HFZ outperformed the 162 students in the HRZ by .8 points and the NIZ by .89 points. Students not economically disadvantaged and in the HFZ had a higher mean score on the MAP reading than the economically disadvantaged students in the HFZ by 19.47 points. Table 4 shows the significance levels for student BMI and reading.

Table 4

Tests of Between-Subjects Effects (BMI, Rdg, SES; dependent variable: Rdg percentile)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	67855.645[a]	5	13571.129	22.777	0
Intercept	1438364.044	1	1438364.044	2414.06	0
SES	48269.028	1	48269.028	81.012	0
BMI	25.264	2	12.632	0.021	0.979
SES * BMI	235.164	2	117.582	0.197	0.821
Error	393245.845	660	595.827		
Total	2497148	666			
Corrected Total	461101.489	665			

[a]R squared = .147 (Adjusted R squared = .141)

According to Table 4, when controlling for SES, there is no statistically significant difference between students' BMI scores on the **FITNESS**GRAM® and their MAP reading percentile. There is a significant difference between mean scores for students in the economically disadvantaged group and students not economically disadvantaged. Table 5 presents the descriptive statistics for aerobic capacity.

Table 5

Descriptive Statistics for Aerobic Capacity and Reading When Accounting for SES

SES	AER	Mean	Std. Deviation	N
Not economically disadvantaged	High risk	65.5	23.192	36
	Needs improvement	69.79	19.446	56
	Healthy fitness zone	67.7	21.152	169
	Total	67.84	21.049	261
Economically disadvantaged	High risk	49	24.631	61
	Needs improvement	43.16	26.349	98
	Healthy fitness zone	48.37	26.528	246
	Total	47.2	26.246	405
Total	High risk	55.12	25.288	97
	Needs improvement	52.84	27.225	154
	Healthy fitness zone	56.24	26.238	415
	Total	55.29	26.332	666

Students not economically disadvantaged and in the HFZ scored higher than those in the HRZ by 2.2 points. However, students not economically disadvantaged and in the NIZ for aerobic capacity had a higher mean score than those in the HFZ by 2.09 points. For the economically disadvantaged group, students in the HRZ for aerobic capacity outperformed the students in the NIZ by 5.84 points and outperformed students in the HFZ by .63 points. Like with math, there was a statistically significant difference between the means of students who are not economically disadvantaged (67.84) and those who are economically disadvantaged (47.20).

Table 6

Tests of Between-Subject Effects (AER, RDG, SES; Dependent Variable: Rdg Percentile)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected model	70158.991[a]	5	14031.798	23.689	0
Intercept	1435282.25	1	1435282.25	2423.08	0
SES	47444.157	1	47444.157	80.097	0
AER	265.892	2	132.946	0.224	0.799
SES * AER	1833.896	2	916.948	1.548	0.213
Error	390942.499	660	592.337		
Total	2497148	666			
Corrected Total	461101.489	665			

[a]R Squared = .152 (Adjusted R Squared - .146

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Table 6 shows that no statistically significant difference exists between students' scores on the MAP reading test and their score for aerobic capacity on the **FITNESS**GRAM® when SES is accounted for.

RQ 2

When SES is accounted for, what is the difference in academic achievement on the MAP math test for students in the healthy fitness zone (HFZ) versus the high risk zone (HRZ) for BMI and aerobic capacity as measured by the **FITNESS**GRAM®?

Table 7 presents the descriptive statistics for BMI and MAP reading mean scores when SES is accounted for.

Table 7

Descriptive Statistics for BMI and MAP Math Mean Scores When Accounting for SES (Dependent Variable: Math Percentile

SES	BMI	Mean	Std. Dev.	N
Not economically disadvantaged	High risk	68.88	20.433	89
	Needs improvement	74.03	22.279	32
	Healthy fitness zone	73.21	23.556	140
	Total	71.83	22.400	261
Economically disadvantaged	High risk	45.78	28.204	162
	Needs improvement	47.33	28.270	45
	Healthy fitness zone	48.49	29.164	198
	Total	47.28	28.643	405
Total	High risk	53.97	27.961	251
	Needs improvement	58.43	28.992	77
	Healthy fitness zone	58.73	29.576	338
	Total	56.9	28.957	666

As shown in Table 8, students not economically disadvantaged and in the HFZ (N = 140) had a higher mean than students in the HRZ (N = 89) by 4.33 points. Likewise, for the economically disadvantaged students in the HFZ (N = 198) scored 2.71 percentile points higher on average than the students in the HRZ (N = 162). Overall, those in the HFZ (N = 338) outperformed those in the HRZ (N = 251) by 4.76 points.

Table 8

Tests of Between-subjects Effects (BMI, Rdg, SES; Dependent Variable: Math Percentile)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	97549.178[a]	5	19509.836	27.989	0
Intercept	1540313.638	1	1540313.64	2209.75	0
SES	66835.342	1	66835.342	95.883	0
BMI	1784.408	2	892.204	1.28	0.279
SES * BMI	204.077	2	102.039	0.146	0.864
Error	460055.082	660	697.053		
Total	2713807	666			
Corrected Total	557604.26	665			

[a] R Squared = .175 (Adjusted R Squared = .169)

Table 9 shows that no significant difference exists between student scores on the MAP math test and BMI scores on **FITNESS**GRAM®.

Table 9

Descriptive Statistics for Aerobic Capacity and MAP Math Mean Scores When Accounting for SES (Dependent Variable: Math Percentile)

SES	AER	Mean	Std. Dev.	N
Not economically disadvantaged	High risk	67.22	18.885	36
	Needs improvement	71.00	22.471	56
	Healthy fitness zone	73.09	23.034	169
	Total	71.83	22.400	261
Economically disadvantaged	High risk	47.05	26.445	61
	Needs improvement	42.81	28.391	98
	Healthy fitness zone	49.11	29.173	246
	Total	47.28	28.643	405
Total	High risk	54.54	25.750	97
	Needs improvement	53.06	29.626	154
	Healthy fitness zone	58.88	29.292	415
	Total	56.90	28.957	666

According to Table 10, students who were classified as not economically disadvantaged did see a slight increase in the mean from 67.22 for those in the HRZ (N = 36) to 73.09 if they were in the HFZ for aerobic capacity (N = 169). Economically disadvantaged students' mean scores for MAP math increased by only 2.06 points when moving from the HRZ (N = 61) to the HFZ (N = 246) for aerobic capacity. Overall, for math and aerobic capacity, the students in the HFZ (N = 415) had a higher mean score by 4.34 points than the HRZ students (N = 97).

Table 10

Tests of Between-subjects Effects (AER, Math, SES; Dependent Variable: Math Percentile

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	99559.387[a]	5	19911.877	28.691	0
Intercept	1492388.01	1	1492388.01	2150.39	0
SES	63654.645	1	63654.645	91.72	0
AER	2489.83	2	1244.915	1.794	0.167
SES * AER	935.471	2	467.735	0.674	0.51
Error	458044.873	660	694.007		
Total	2713807	666			
Corrected Total	557604.26	665			

[a] R Squared = .179 (Adjusted R Squared = .172)

The results show that when accounting for SES, there is no statistically significant difference between students' means for the MAP math test and their corresponding score for aerobic capacity on the **FITNESS**GRAM®. Though not statistically significant, the strongest negative relationship existed between economically disadvantaged students in the NIZ having a mean score lower than those in the HFZ by 6.3 points. There is a statistically significant difference in student mean scores between the economically disadvantaged and not economically disadvantaged students.

Summary

Based on the results of this data analysis, there is no clear difference between children's BMI and aerobic capacity and their academic achievement on the MAP reading and math tests. After accounting for SES, the difference in mean scores on the MAP reading and math test were statistically significant ($p < .000$) between students who were economically disadvantaged and those who were not. The students who were not economically disadvantaged and in the HRZ for BMI did have a higher mean score than those students in the HFZ. Likewise, students who were economically disadvantaged and in the HRZ for aerobic capacity had a higher mean score than those students in the HFZ. In math, both economically disadvantaged and not economically disadvantaged students in the HFZ for BMI and aerobic capacity had higher mean scores than students in the HRZ. Furthermore, when not accounting for SES, all students in the HFZ had higher mean scores for reading and math than those in the HRZ. Chapter 5 presents further discussion of the results of this study.

CHAPTER 5

SUMMARY, FINDINGS, DISCUSSION, RECOMMENDATIONS, AND CONCLUSIONS

A building leader is responsible for ensuring an environment by which children can aspire to be the best version of themselves possible. This means that establishing an effective school culture is critical for the success of everyone in the building, including teachers, staff, administrators, and students. School culture is the beliefs, attitudes, norms, relationships, and values placed on students and student learning. There are student variables that are out of the scope of control of the school. These include, socio economic status (SES), single parent homes, smoking/drinking, diet, and home values. The most impacting of these is SES. It is the responsibility of leaders to recognize these variables and the weight they have, not use them as reasons for lack of success, and certainly not rely on them as a means for student academic growth. Leaders must choose to establish a school culture that focuses attention on the whole child and the variables that are controllable for teachers and staff who work with students. These include engagement, content, relationships, behavior, self-confidence, creative/critical thinking, and health and wellness opportunities.

Schools have become trapped into thinking standardized test scores are the goal and treating them with more time on task will resolve it. The doctor never designs a treatment that overlooks the patient. As leaders, we have to ensure that we are not overlooking our students or teachers in order to treat the low test score problem. The purpose of this study was to present data identifying a link between physical fitness and academic achievement in order to help school leaders find more student-centered ways to improve academic achievement that includes physical activity as opposed to cutting physical education courses in favor of lengthening reading and math classes. Although the results did not show a clear connection, it is still the responsibility of school leaders to understand what researchers have shown relating to this topic.

Findings

The results of this study did not show a clear connection between student physical fitness and academic achievement through the lens of MAP reading and math mean percentile ranks. However, the results confirmed previous research establishing SES as a significant variable in student academic performance. These results also do not negate results from previous research regarding the importance of student fitness on academic growth. While schools may be evaluated on their standardized test results from their students, school leaders must focus on providing a school environment that appropriately supports the teachers and students in order to meet their goals. Extending time in reading and math courses by cutting physical activity opportunities has yet to yield better results. It has only decreased opportunities for students to be active and healthier within schools.

Research has indicated that healthier students are more prepared to receive new content in the classroom setting. Student learning is heavily impacted by their cognitive abilities. These abilities include knowledge application, use of working memory, control impulsive behaviors, and interference control (Hillman, Buck, Themanson, Pontifex, & Castelli, 2009; St. Clair-Thompson & Gathercole, 2006). Therefore, establishing a link between physical fitness and cognition would support the idea of fitness being an important variable in student success. Hillman, Erickson, and Kramer (2008) found that students with better aerobic capacity had better cognitive functioning. Under the umbrella of cognitive functioning are three specific abilities that greatly influence a student's ability to engage in their learning. They are controlling impulsive behaviors, interference control, and working memory. The most visible of these to teachers is controlling impulsive behaviors. Impulsive behaviors in children may be blurting out in class, but may also be a student walking past another's desk, seeing something they like, and taking it. In more extreme cases, it might be a student accidentally bumping into another student who then turns and strikes them. All of these responses may still happen, but students having regular physical activity opportunities decreases stress associated with sitting in class for long periods of time. This, in turn, may slow the student's impulsive response time allowing them to show restraint. Interference control is a child's ability to block out unnecessary stimuli which supports better attention and concentration. The longer a child has to sit in class, the more difficult it can be for them to use interference control. Working memory relates to a student's ability to use information they are receiving during instruction and is affected by interference and impulse control. As a part of a child's cognitive abilities, it would be supportive of both student and teacher for this area to be improved. This research will help inform leaders of the link between student health and how it supports academic growth.

Research has also found that improved physical activity has a positive relationship with self-esteem (Tremblay, Inman, & Willms, 2000), behavior (Barros, Silver, & Stein, 2009; Mahar, et. al., 2006), and overall health (Basch, 2011). Students who receive physical activity, good nourishment, and plenty of rest are much more likely to perform in the classroom compared to a student who is lacking in one of those three areas (Basch, 2011). This is important to school leaders because those three areas are also ones that students from low SES homes struggle with. Although some of these variables, like SES and sleep, are out of the scope of control of leaders, they still impede a student's ability to learn and be successful.

For years, schools have been trying to improve reading and math scores by increasing time in reading and math courses. The time had to come from somewhere, so either the school day was lengthened, or time in the arts and physical education was decreased. In some cases it may have been taken away all together, but very little has changed. Until school leaders place value on improving student health through physical activity, the results will remain stagnant. Continuing to underperform in academic areas decreases student confidence (Gregory, Skiba, & Noguera, 2010), while increasing student health can increase confidence thus putting the student in a better mindset for success.

Discussion

At the conclusion of this study, there were several variables that may have influenced the outcomes found. Due to the size of the standard deviations, attending to outliers may have presented mean percentile ranks for reading and math that were more representative of the sample. Also, where BMI is based on a formula, the PACER test may rely on some student self-reporting due to a large number of students in physical education classes. Although the study was completed in one school district, the nine elementary schools each have their own characteristics including size, demographics, and location. Evaluating them as individual schools rather than as an overall group may have provided a more realistic picture of the issue. Furthermore, by using **FITNESS**GRAM® data, it was a single measure of fitness rather than evaluating physical activity opportunities which may show more day to day impact in the classroom setting. While these issues may or may not have influenced the outcomes of this study, the intention was to support school leaders in search of solutions supporting students who underperform academically. That being said, school leaders must continue to look at all the variables within the school's scope of control that enhance a student's ability to be college and/or career ready.

A student's ability to block out distractions, control behavioral impulses, and make use of their ability to recall information are each vital components necessary for success. They are also some of the excuses given as to why students are not performing up to their potential. Each of these is an important part of cognition. Student cognitive abilities greatly influence whether or not they will be able to meet grade level expectations. If this is true, should not school leaders be supporting interventions that may help build and develop better cognition among students, specifically low SES students? Providing students with physical activity opportunities that build their aerobic capacity has been shown to improve their cognitive functioning. In turn, not only might it support their ability to remain on-task in the classroom, healthier students tend to have higher levels of self-esteem and confidence with less anxiety. As a school leader, it is essential that the school culture be one that builds students up rather than stressing them to the point where their behavior begins to interfere. Maintaining student engagement is key to improving student achievement. This relies on leaders providing the structural support and teachers providing the engaging instruction. Students who are more active tend to have higher levels of engagement. Many times, a teacher's initial response to a child who has misbehaved is to take their recess away. Research shows that this is counterproductive to the overall goal of student academic improvement. Therefore, school leaders have to find ways to support teachers with student behavior in order to provide a structure that is not going to create more problems.

Recommendations

In order to establish and maintain a school culture that focuses on the growth and success of all, it starts with the leader. A school leader's attitudes, behaviors, and actions will determine whether or not a positive school culture exists. This means that everything within the structure has value and is important as evidenced by the way the leader carries themselves. Creating and implementing a wellness plan for students and for teachers must not be seen as something else they have to do. It must be seen as part of the school culture. Maintaining a positive attitude is critical to de-escalating stress levels in teachers and students. An effective leader must be willing to do anything that is required of others within the building. Not only does this include promoting and participating in any new health related initiatives, but also supporting all staff such as cafeteria and custodial workers. Lastly, the actions that are put in place will determine the success of any new initiative, specifically a wellness plan, and whether or not it is carried out effectively.

The first action is to establish the values that are most important for the success of everyone. What is it that makes the school special and gives it the identity that it should have? The values will inform the next step, which is establishing a mission and vision. The vision is the aspirations for all, and the mission is the day to day actions that help to arrive there. Both the mission and vision should be able to be carried out by upholding the values that were established. Thirdly, set priorities in order to carry out the mission daily. What are the most important skills/behaviors that students need in order to be successful. For this process, it will involve prioritizing student health practices based on the belief that they will support student growth and achievement. The leader must use the priorities to establish a school wide schedule that includes physical activity opportunities for all students while also meeting the requirements of content instruction. Finally, reward those who uphold the values. This sends a clear message that they are important.

Conclusion

One of the main responsibilities of school leaders is to establish and maintain a positive school culture that is focused on student engagement, growth, and academic achievement. This requires leaders to understand their student population and have a clear understanding of the variables they can and cannot control. While SES is not something a leader can control, it is a variable that may identify certain issues common among students from low SES homes such as, lower academic achievement, fewer support resources, and poor living conditions that may affect the overall health of the child.

This study was intended to provide useful information to school leaders to inform their decision making process. Although this study did not directly show a difference in MAP reading and math mean percentile ranks for students in the healthy fitness zone (HFZ) and those in the high risk zone (HRZ) for BMI and aerobic capacity as measured by **FITNESS**GRAM®, it did provide two points of data that should not be overlooked by school leaders. The first was the significant difference in mean percentile ranks for both reading and math between students who are economically disadvantaged and those who are not. The second was the high percentage of students in the study who were not in the HFZ for BMI (49.2%) and aerobic capacity (37.7%). While the summative data used in this study was inconclusive, the research showing the positive relationship between daily physical activity and student achievement should be looked into further.

The missing link to helping close the achievement gap may be school leaders placing a focus on student health and wellness. Daily physical activity has been shown to support cognitive growth and development, decrease stress levels, improve behaviors, and foster healthier children who are better prepared to be focused and attentive students in the classroom. Including health and wellness in school values, mission, vision, and school improvement plans is paramount for school leaders to enhance the school environment for all including teachers, staff, and students.

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APPENDIX A

Table 11

Girls FITNESSGRAM® Standards

FITNESSGRAM® Standards for Healthy Fitness Zone® (Female)							
Age	Aerobic Capacity			Body Mass Index			
	NI – High Risk	NI – Some Risk	HFZ	Very Lean	HFZ	Some Risk	NI – High Risk
5	Participation in test encouraged. Aerobic standards not recommended			≤13.5	13.6-16.7	16.8	≥17.3
6				≤13.4	13.5-17.0	17.1	≥17.7
7				≤13.4	13.5-17.5	17.6	≥18.3
8				≤13.5	13.6-18.2	18.3	≥19.1
9				≤13.7	13.8-18.9	19	≥20.0
10	≤37.3	37.4-40.1	≥40.2	≤14.0	14.1-19.5	19.6	≥21.0
11	≤37.3	37.4-40.1	≥40.2	≤14.4	14.5-20.4	20.5	≥21.9
12	≤37.0	37.1-40.0	≥40.1	≤14.8	14.9-21.2	21.3	≥22.9
13	≤36.6	36.7-39.6	≥39.7	≤15.3	15.4-22.0	22.1	≥23.8
14	≤36.3	36.4-39.3	≥39.4	≤15.8	15.9-22.8	22.9	≥24.6
15	≤36.0	36.1-39.0	≥39.1	≤16.3	16.4-23.5	23.6	≥25.4
16	≤35.8	35.9-38.8	≥38.9	≤16.8	16.9-24.1	24.2	≥26.1
17	≤35.7	35.8-38.7	≥38.8	≤17.2	17.3-24.6	24.7	≥26.7
>17	≤35.3	35.4-38.5	≥38.6	≤17.5	17.6-25.1	25.2	≥27.2

Table 12

Boys FITNESSGRAM® Standards

FITNESSGRAM® Standards for Healthy Fitness Zone® (Male)							
Age	Aerobic Capacity			Body Mass Index			
	NI – High Risk	NI – Some Risk	HFZ	Very Lean	HFZ	NI – Some Risk	NI – High Risk
5	Participation in test encouraged. Aerobic standards not recommended			≤13.8	13.9-16.7	16.8	≥17.5
6				≤13.7	13.8-16.9	17	≥17.8
7				≤13.7	13.8-17.3	17.4	≥18.3
8				≤13.8	13.9-17.8	17.9	≥19.0
9				≤14.0	14.1-18.5	18.6	≥19.9
10	≤37.3	37.4-40.1	≥40.2	≤14.2	14.3-18.9	19	≥20.8
11	≤37.3	37.4-40.1	≥40.2	≤14.5	14.6-19.7	19.8	≥21.8
12	≤37.6	37.7-40.2	≥40.3	≤15.0	15.1-20.5	20.6	≥22.7
13	≤38.6	38.7-41.0	≥41.1	≤15.4	15.5-21.3	21.4	≥23.6
14	≤39.6	39.7-42.4	≥42.5	≤16.0	16.1-22.1	22.2	≥24.5
15	≤40.6	40.7-43.5	≥43.6	≤16.5	16.6-22.9	23	≥25.3
16	≤41.0	41.1-44.0	≥44.1	≤17.1	17.2-23.7	23.8	≥26.0
17	≤41.2	41.3-44.1	≥44.2	≤17.7	17.8-24.4	24.5	≥26.7
>17	≤41.2	41.3-44.2	≥44.3	≤18.2	18.3-25.1	25.2	≥27.5

APPENDIX B

BULLOCH COUNTY SCHOOLS

150 WILLIAMS ROAD, SUITE A
STATESBORO, GA 30458

PHONE
912/212-8500

FAX
912/212-8529

INTERNET
www.bulloch.k12.ga.us

EMAIL
boe@bulloch.k12.ga.us

March 13, 2017

Nathan Pennington
Georgia Southern University

Re: Request to Conduct Research in Bulloch County Schools

Mr. Pennington,

Your request to conduct research titled "The relationship between physical fitness and student achievement" has been approved. Prior to conducting research in Bulloch County Schools, principals must be contacted and permission given. Within one month from completion of your study, please provide this office and participating principals with a summary of findings.

Sincerely,

Virginia Bennett, Ed.D
Executive Director of Academic Support
Bulloch County Schools

Brooklet Elementary School

600 West Lane St., Brooklet, Georgia 30415
Phone (912) 842-8300 Fax (912) 842-8319

Marlin Baker
Principal

Christy Inman
Assistant Principal

March 22, 2017

Nathan Pennington
Georgia Southern University

Re: Request to Conduct Research in Bulloch County Schools

Mr. Pennington,

I approve for Nathan Pennington to use MAP reading and math data, as well as, FITNESSGRAM BMI and aerobic capacity data from all 5th grade students enrolled at Brooklet Elementary School during the 2011-2012 school year. I am aware that this data will be used to inform the district as well as support his doctoral endeavors.

Sincerely,

Marlin Baker
Principal
Brooklet Elementary School

Julia P. Bryant Elementary School
421 WEST MAIN STREET, STATESBORO, GEORGIA 30458
PHONE: (912) 212-8680 FAX: (912) 212-8699

March 22, 2017

Nathan Pennington
Georgia Southern University

Re: Request to Conduct Research in Bulloch County Schools

Mr. Pennington,

I approve for Nathan Pennington to use MAP reading and math data, as well as, FITNESSGRAM BMI and aerobic capacity data from all 5th grade students enrolled at Julia P. Bryant Elementary School during the 2011-2012 school year. I am aware that this data will be used to inform the district as well as support his doctoral endeavors.

Sincerely,

Julie Blackmar
Principal
Julia P. Bryant Elementary School

Langston Chapel Elementary School

150 Langston Chapel Road, Statesboro, GA 30458

Phone: (912)212-8700 Fax: (912)212-8719

March 22, 2017

Nathan Pennington
Georgia Southern University

Re: Request to Conduct Research in Bulloch County Schools

Mr. Pennington,

I approve for Nathan Pennington to use MAP reading and math data, as well as, FITNESSGRAM BMI and aerobic capacity data from all 5th grade students enrolled at Langston Chapel Elementary School during the 2011-2012 school year. I am aware that this data will be used to inform the district as well as support his doctoral endeavors.

Sincerely,

Pam Goodman

Pam Goodman
Principal
Langston Chapel Elementary School

Mattie Lively Elementary School

Dr. Carolyn Vasilatos
Principal

Mrs. Hope Sumner
Assistant Principal

204 Debbie Drive
Statesboro, Georgia 30458

Phone: 912.212.8760
Facsimile: 912.212.8779

March 22, 2017

Nathan Pennington
Georgia Southern University

Re: Request to Conduct Research in Bulloch County Schools

Mr. Pennington,

I approve for Nathan Pennington to use MAP reading and math data, as well as, FITNESSGRAM BMI and aerobic capacity data from all 5th grade students enrolled at Mattie Lively Elementary School during the 2011-2012 school year. I am aware that this data will be used to inform the district as well as support his doctoral endeavors.

Sincerely,

C Vasilatos

Dr. Carolyn Vasilatos
Principal
Mattie Lively Elementary School

239 BEASLEY ROAD
STATESBORO, GA 30461

Jennifer Wade
Principal
jrwade@bullochschools.org

Debra Minick
Assistant Principal
dminick@bullochschools.org

PHONE
912-212-8780

FAX
912-212-8799

WEBSITE
http://mces.bulloch.k12.ga.us

March 22, 2017

Nathan Pennington
Georgia Southern University

Re: Request to Conduct Research in Bulloch County Schools

Mr. Pennington,

I approve for Nathan Pennington to use MAP reading and math data, as well as, FITNESSGRAM BMI and aerobic capacity data from all 5th grade students enrolled at Mill Creek Elementary School during the 2011-2012 school year. I am aware that this data will be used to inform the district as well as support his doctoral endeavors.

Sincerely,

Jennifer Wade

Jennifer Wade
Principal
Mill Creek Elementary School

Nevils Elementary School
8438 Nevils-Groveland Road
Statesboro, GA 30458
Office: 912-842-8320
Fax: 912-842-8339

Principal
Nate Pennington

Assistant Principal
Rob Lindsey

March 22, 2017

Nathan Pennington
Georgia Southern University

Re: Request to Conduct Research in Bulloch County Schools

Mr. Pennington.

I approve for Nathan Pennington to use MAP reading and math data, as well as. FITNESSGRAM BMI and aerobic capacity data from all 5th grade students enrolled at Nevils Elementary School during the 2011-2012 school year. I am aware that this data will be used to inform the district as well as support his doctoral endeavors.

Sincerely,

Nate Pennington
Principal
Nevils Elementary School

Dr. Laurie Mascolo
Principal

Portal Elementary School
328 Grady Street South
Portal, Georgia 30450
Phone (912) 842-8340 Fax (912) 842-6359

Farrah Reddick
Assistant Principal

March 22, 2017

To: Nathan Pennington
Georgia Southern University

Re: Request to Conduct Research in Bulloch County Schools

Mr. Pennington,

I approve for you, Nathan Pennington, to use MAP reading and math data, as well as, FITNESSGRAM BMI and aerobic capacity data from all 5th grade students enrolled at Portal Elementary School during the 2011-2012 school year. I am aware that this data will be used to inform the district as well as support your doctoral endeavors.

I will be very interested in your findings.

Sincerely,

Laurie Mascolo

Dr. Laurie Mascolo
Principal
Portal Elementary School

SALLIE ZETTEROWER
ELEMENTARY SCHOOL

"Bulloch County Schools: Creating Responsible Citizens for College and Careers"

Julie Mizell
Principal

March 22, 2017

Nathan Pennington
Georgia Southern University

Re: Request to Conduct Research in Bulloch County Schools

Mr. Pennington,

I approve for Nathan Pennington to use MAP reading and math data, as well as, FITNESSGRAM BMI and aerobic capacity data from all 5th grade students enrolled at Sallie Zetterower Elementary School during the 2011-2012 school year. I am aware that this data will be used to inform the district as well as support his doctoral endeavors.

Sincerely,

Julie Mizell

Julie Mizell
Principal
Sallie Zetterower Elementary School

1200 Cawana Road | Statesboro Georgia 30461 | *(o)* 912.212.8800 | *(f)* 912.212.8819

Stilson Elementary School
15569 Highway 119
Brooklet, Georgia 30415
Phone: 912-842-8480 Fax: 912-842-8490

March 22, 2017

Nathan Pennington
Georgia Southern University

Re: Request to Conduct Research in Bulloch County Schools

Mr. Pennington,

I approve for Nathan Pennington to use MAP reading and math data, as well as, FITNESSGRAM BMI and aerobic capacity data from all 5th grade students enrolled at Stilson Elementary School during the 2011-2012 school year. I am aware that this data will be used to inform the district as well as support his doctoral endeavors.

Sincerely,

Tanita McDowell
Principal
Stilson Elementary School