RELATIONSHIPS BETWEEN STUDENTS' FITNESS LEVELS AND ACADEMIC ACHIEVEMENT

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Relationships Between Students' Fitness Levels and Academic Achievement

by Theresa Linam Roberts

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Abstract

Theresa Linam Roberts. RELATIONSHIPS BETWEEN STUDENTS' FITNESS LEVELS AND ACADEMIC ACHIEVEMENT. (Under the direction of Dr. Randall Dunn) School of Education, August 2009.

This study compared fifth grade students' physical fitness levels to academic achievement based on the premise that health and physical fitness has an effect on one's ability to learn and achieve academically. Due to *No Child Left Behind* and the mounting pressures to reach *Adequate Yearly Progress*, many school officials view non-assessed activities like physical education and recess as unnecessary, consequently creating a case for the elimination of any subject that is not directly measured through standardized testing. Finding a link between fitness and academic achievement may cause educational leaders to reevaluate time spent during the school day. Data was collected for 113 students during the 2008-2009 school year by using the FitnessGram, STAR Reading and Math Percentiles, and Grade Point Averages (GPA's). Through multiple regression, the researcher found statistically significant relationships between physical fitness and two of the three measures used for academic achievement: STAR Math Percentiles ($p = 0.0063 < 0.05$; $R = 0.26 > 0.195$) and GPA's ($p = 0.0124 < 0.05$; $R = 0.23 > 0.195$). Therefore, the hypothesis was accepted, validating a link between fitness and academic achievement. This study does not prove causality; it is more probable that physical fitness and academic achievement influence each other in ways that are still vague.

Dedication

This study is dedicated to my Lord and Savior, Jesus Christ. Without His blessings and guidance, this project would not have been possible. The scripture I live my life by best sums it up: Philippians 4:13 – “I can do all things through Christ who strengthens me.” His strength gave me the fortitude and desire to push onward. He deserves all the Glory!

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Chapter One: The Problem

Introduction

Over the past decade, public education has been increasingly held accountable through measures of academic achievement such as standardized testing under the strict requirements of *No Child Left Behind Act* (NCLB, 2001). NCLB is a reauthorization of an amendment to the Elementary and Secondary Education Act of 1965. This legislation increases the pressures currently affecting educational leaders and the decisions they make. Pressure to improve standardized test scores has resulted in greater emphasis on academics at the expense of programs like physical education, for which there is little accountability required. Because of the burden of high-stakes testing, many schools are cutting back or even eliminating non-academic subjects in favor of teaching the subjects which are tested (American Association of School Administrators, 2006). Siegel (2006) stated that many school officials view non-assessed subjects as unnecessary, thus generating a case for the abolition of any subject that is not directly measured through standardized testing.

"At a time when schools are pressured to devote more time and resources to academics and less to physical education, Hillman, Buck, et al. (2008) indicate that programs that promote physical fitness not only improve physical health, but cognitive health and academic achievement as well" (Diamond, p. 4, 2009). In a report called *Physical Activity and Health* issued by the Surgeon General of the United States in 1996, the current consensus regarding the health benefits of regular physical activity was defined. It clearly stated that physical activity which improves physical fitness is needed

to maintain health and be productive. Lavin, Shapiro, and Weill (1992) found a common theme in their research: if children are healthy, they are in a better position to learn. Furthermore, Cooper and Taras (2003) proposed, "health and achievement go hand in hand" (p. 23). “Reducing time for physical education does not guarantee improvement in academic achievement. While increasing time for physical education does not negatively influence academic achievement, decreasing time will not ensure that students will do better either” (Smith & Lounsbery, 2009, p. 41). Eliminating physical education from our schools to make more time for academics may be detrimental and counterproductive.

Professionals in the health and educational fields have intuitively believed that physically active and fit students perform better in school. Some studies have proven that there is a positive relationship between physical fitness and academic achievement (California Department of Education [CDE], 2002; Castelli, Hillman, Buck, & Erwin, 2007; Chomitz, Slining, McGowan, Mitchell, Dawson, & Hacker, 2009; Grissom, 2005; Shephard, 1997; Vail, 2006). A positive relationship means that as one measure improves, so does the other. It does not infer causality, meaning that evidence does not support that by improving physical fitness, academic achievement will improve or vice versa. Some recent research shows that physical fitness of students is one of the most significant influences impacting learning and academic achievement. Grissom (2005) investigated the link between fitness levels of students and their Stanford Achievement Test scores and presented evidence of a positive correlation between students’ fitness scores and their achievement. Grissom speculated that fitness levels impacted a child’s health and thus promoted academic achievement. Studies such as Grissom’s provide substantiation of the importance of teaching non-academic subjects in the public school

curriculum (Siegel, 2006). Despite the positive associations found, not all research supports the positive relationship between physical fitness and academic achievement (Tremblay, Inman, & Williams, 2000; Martin & Chalmers, 2007), which warrants further examination between the two.

Statement of the Problem

Due to the extreme pressures of *No Child Left Behind* placed on school leaders and administrators to show that they are providing every student with an appropriate education through improved test scores, they are faced with a daunting task that limits decisions being made for students' well-being. Many believe the standards upheld by the *No Child Left Behind Act* are notably too narrow, leaving little wiggle room for non-academic subjects. "Surely, we should demand more from our schools than to educate people to be proficient in reading and mathematics" (Noddings, 2005). Education is about so much more than just academics, but unfortunately, educators are so focused on academic achievement that inadvertently the mind, body connection is forgotten.

Due to *No Child Left Behind* breathing down the necks of academic leaders, physical education and exercise may be suffering due to the ever-increasing pressures to reach *Adequate Yearly Progress* (AYP). This call for accountability mandated that many schools change their focus from educating children to ensuring that students pass a high-stakes standardized test each year to show improvement. According to the Secretary of Education, Rod Paige:

> *No Child Left Behind* (NCLB) puts the focus on academics—where it should be—however, I am disturbed by reports I hear about schools doing away with recess and physical education programs. NCLB certainly does not encourage these kinds

> of severe measures. Studies show that dedicating increased time to physical activity during the school day does not detract from academics; on the contrary, it in fact improves academic performance. Physical activity also increases adolescents' self-esteem as well as their physical and mental health. It's also just common sense: children can't learn when they are listless (U.S. Department of Education, 2004).

In addition, according to Smith and Lounsbery (2009), there are both physical, as well as social benefits of participation in physical activity. The physical benefits include improved physical fitness, decreased risk of chronic diseases, and improved health status. Improved relationships with parents, improved mood, increased involvement in extracurricular activities, decreased drug use, and increased self-esteem which may account for higher grade-point averages are among the social benefits found by Field, Diego, and Sanders (2001).

The Greeks, thousands of years ago, understood the importance of improving the mind, body, and spirit. Their philosophic approach, in relation to the mind-body connection must be explored more intensely to discover if there are true connections between physical fitness and academic achievement. Previous research has indicated that the physical benefits of exercise are excellent subjects for continuous investigation in research. Exercise is helpful in sustaining a healthy weight, optimizing physical fitness levels, and advancing a longer life span. According to some research it has been suggested that physical activity during childhood can aid growth and development and that it can be a predictor of adult physical activity levels (Boreham & Riddoch, 2001). Regular physical activity and fitness topped the list of recommendations needed for a

healthy lifestyle (Spain & Franks, 2001). Some research has even suggested that physical activity may improve classroom academic success (Coe, Pivarnik, Womack, Reeves, & Malina, 2006; Field, Diego, & Sanders, 2001; Grissom, 2005; Nelson & Gordon-Larsen, 2006). "Accordingly, the current data provide support for the notion of early physical activity intervention to promote aerobic fitness as a means of improving not only physical health but cognitive health as well" (Hiliman, Buck, Themanson, Pontifex, & Castelli, p. 127, 2009).

Physical Activity and Academic Performance

Over all, children spend less time in physical education classes and exercising than past generations (Rajic et al., 1997). According to the Surgeon General (2001), as cited by the Center for Disease Control (CDC), nearly half of Americans ages twelve to twenty-one are not regularly active. Of high school students, only 19 % are physically active in physical education classes for twenty minutes or more, five days a week. Because academic achievement and exercise may be related, it is possible that the lack of exercise impedes not only the health of the child, but ultimately the intellectual potential of the child too. According to Rajic et al. (1997), regular exercise can improve academic performance and an effort to participate in frequent physical activity should be made by students. The physically active student is more likely to be academically motivated, alert, and successful (Dwyer, Sallis, Blizzard, Lazarus, & Dean, 2001). The relationship that exists between physical activity and academic achievement has been the subject of both speculation and research. With this in mind, Linder (1999) demonstrated a positive relationship between physical activity and academic performance.

The mind and body require movement in order to stay alert and focused. Daily physical activity can help promote a sound mind and body. According to Active Living Research (2007), "fourteen published studies analyzing data from approximately 58,000 students between 1967 and 2006 have investigated the link between overall participation in physical activity and academic performance. Eleven of those studies found that regular participation in physical activity is associated with improved academic performance" (p. 2). As stated by Active Living Research (2007), eight health surveys involving population-representative samples of youth from the United States, United Kingdom, Hong Kong, and Australia noted statistically noteworthy affirmative correlations between academic performance and physical activity. Nevertheless, none of these studies assessed academic performance with standardized educational tests.

A national longitudinal study analyzed data collected from 11,957 adolescents across the United States to examine the relationship between physical activity and sedentary behavior patterns (Nelson & Gordon-Larsen, 2006). According to the findings of the Nelson and Gordon-Larsen study, adolescents who reported either participating in school activities, such as PE and team sports, or playing sports, were 20 percent more likely than their sedentary peers to earn an "A" in math or English.

Two other smaller studies also reported a positive correlation between physical activity and academic performance. In 2002-2003 study, using data collected from 214 sixth-grade students concerning the effect of physical education class enrollment and physical activity on academic achievement, academic achievement was not significantly related to physical education enrollment, but higher grades were associated with vigorous physical activity (Coe, Pivarnik, Womack, Reeves, & Malina, 2006). In a separate study,

eighty-nine high school seniors were administered a questionnaire that gathered information on their exercise habits, relationships with parents and peers, depressive tendencies, sports involvement, drug use, and academic performance. “Students with a high level of exercise had better relationships with their parents (including greater intimacy and more frequent touching), were less depressed, spent more time involved in sports, used drugs less frequently, and had higher grade point averages than did students with a low level of exercise” (Field, Diego, & Sanders, 2001, p. 105).

Research has also indicated that students who take part in daily physical education show better academic performance and attitudes toward school versus students who do not participate in daily physical education (Dwyer et al., 2001). Based on a recent literature review conducted by Smith and Lounsbery (2009), “When students receive daily quality physical education, the rate of learning per unit of time appears to increase” (p. 40). Also, by physically interacting with their environment, students miss fewer days of school because of illness and exhibit greater academic achievement because of the physical vitality gained in physical education (Irandoust & Karlsson, 2002).

Providing further evidence linking the mind and body, according to Sallis (et al., 1999), physical activity enhances academic performance by triggering physical changes in the brain. It is not too far of a stretch to say that physical activity stimulates the brain thereby promoting academic achievement. Not only does exercise boost blood flow to the brain, it also causes the discharge of certain hormones that could abet learning (Sallis et al., 1999). In a study performed by Davis (et al., 2007), the researchers performed brain scans and found that the children who were exercising seemed to have more neural activity in the frontal areas of their brains, an important area for planning and organizing,

problem solving, concentration, resisting impulses, and using strategies to achieve goals. The mind and body connection could possibly be a direct link to learning. The relationship between the two has fascinating implications for everyone involved in students' lives.

Purpose

Professional Significance of the Study

In the age of "No Child Left Behind," much emphasis is placed on academic achievement and test scores. Health issues and physical fitness are often overlooked or seen as a secondary priority, disconnected from achievement. In fact, research shows that the health and well-being of students is one of the most significant influences on learning and academic achievement. A study of middle school students undergoing school transitions found that students had better grades and school attendance when their health needs were met (Furstenberg, Cook, Eccles, Elder, & Sameroff, 1999). Good health is the foundation for success. Student health and physical fitness may possibly be the missing puzzle piece to academic success. According to U. S. Secretary of Education, Rod Paige (2004):

> When our children are unhealthy, they are not ready to learn. Millions of our K-12 students are out of shape; many are overweight or obese. And there are many reasons why: consumption of high-fat, high-calorie foods and drinks, consumption of soda, lack of physical exercise, and too much time playing video or computer games and watching television. We can change this, and we must. President Bush has directed that our schools work to make our children healthier through a new initiative, the 'Schools for a HealthierUS Challenge.' We can

> educate our children and keep them healthy. And it only takes the right incentives, some common sense and a resolute will to make this happen (Paige, 2004, para. 4,5).

In the past, little has been done to try to understand the influence of school health and physical education programs on academic achievement. No one had questioned whether classes in health education or physical education could improve academic outcomes. Through various studies, educators have learned that academic performance can improve if children eat a nutritional breakfast and if they are physically fit. Healthy eating patterns in childhood and adolescence promote optimal childhood health, growth, and intellectual development; prevent immediate health problems, such as iron deficiency anemia, obesity, eating disorders, and dental caries; and may prevent long-term health problems, such as coronary heart disease, cancer, and stroke. School health programs can help children and adolescents attain full educational potential and good health by providing them with the skills, social support, and environmental reinforcement they need to adopt long-term, healthy eating behaviors.

Health professionals and educators have long believed that a positive relationship exists between physical activity and academic performance (Sallis et al., 1999), but the existing empirical research on the relationship between physical fitness and academic performance is meager. However, one promising research study used as a basis for this study comes from the California Department of Education's annual physical fitness testing of all 5th, 7th and 9th grade students enrolled in California public schools (California Department of Education, 2002; National Association for Sport and Physical Education, 2005). The testing program, started in 1996, included over one million

students annually and used the FitnessGram Assessment Tool to measure physical fitness levels of students. Results were matched with Standardized Achievement Test (SAT 9) scores. Preliminary data showed that higher physical fitness levels of students were related to higher academic achievement (Grissom, 2005). A smaller study conducted by Castelli et al. (2007) found that "Associations were demonstrated in total academic achievement, mathematics achievement, and reading achievement, thus suggesting that aspects of physical fitness may be globally related to academic performance in preadolescents" (p. 239). Castelli's study compared Fitness Levels with students' math and reading scores on the Illinois Standard Achievement Test (Vail, 2006). Castelli's findings indicated that schools with higher fitness levels also had higher scores on the test, particularly in relation to math and aerobic fitness (Vail, 2006). A more recent study based on cross-sectional data gathered from a racially diverse urban school district demonstrated a significant positive relationship between fitness and Math and English academic achievement using the raw Massachusetts Comprehensive Assessment System scores or the categorical pass/fail variables (Chomitz, et al., 2009).

Schools are the perfect setting for physical activities, as children are at school for at least seven hours. "However, most public schools do not recognize the public health goal of promoting physical activity as appropriate to the school's educational mission and do not even offer physical activity programs" (Healthcare Georgia Foundation, 2005). Despite research linking physical fitness with academic achievement, many schools have reduced physical education opportunities and some have eliminated recess (Sallis et al., 1997). This decrease in physical activity has contributed to other health problems in students such as being overweight and obese.

Overweight and Obese Epidemic

Current research indicates a link between nutrition, physical activity and fitness, and learning. Research shows that the health and well-being of students is one of the most significant influences on learning and academic achievement; good health is the foundation for success. According to American Family Physicians, being overweight in childhood is an important public health issue because of its rapidly increasing prevalence and associated adverse medical and social cost. Overweight children struggle with barriers such as poor self-esteem, social discrimination, and depression, which factor in to student achievement.

Although the primary focus of this research is clearly to discuss the relationship between physical fitness and academic achievement, physical fitness by itself remains an important issue from both personal and public health perspectives. The momentum around overweight and obesity that exists in our society today leads to embracing physical fitness in students for reasons other than academic achievement. The downsizing of physical activity at schools comes at a time when national adolescent obesity rates are ascending, and are in fact considered to be at epidemic levels (Centers for Disease Control and Prevention, 2005). The percentage of children and adolescents who are overweight has more than tripled since 1980. Approximately 30.3 percent of children (ages 6-11) are overweight and 15.3 percent are obese. For adolescents (ages 12-19), 30.4 percent are overweight and 15.5 percent are obese (American Obesity Association, 2005). Obese children and adolescents now have diseases such as type 2 diabetes that in the past only occurred in adults. Overweight children tend to become overweight adults, putting

them at greater risk for heart disease, high blood pressure and stroke (Centers for Disease Control and Prevention, 2005).

The overweight or obese child who lives a sedentary life is a postcard of the health problems facing the youth of America today. Being physically inactive by watching television, playing video games, or succumbing to other technological advances increases the magnitude of the problem. This obese child can be viewed as the physical result of a complex social and educational problem which has joined in today's society to create a startlingly unhealthy climate for middle school-aged children (Satcher, 2005). Many educators would agree that "public school physical education programs are an effective and necessary way to promote youth physical activity" (Running & Fitnews, 2004, p. 1). In reality, problems have arisen which have not only hurt the quality of physical education being offered in schools, but in some cases have caused physical education programs to be eliminated entirely.

Children spend a major portion of their day in school. Because many of the lifestyle and behavior choices associated with being overweight develop during school-age years, a child's food intake and physical activity at school are important determinants of body weight. By providing meals, physical activity, and health education, school policies can help in the fight against childhood obesity and promote a healthy lifestyle thereby linking fitness and academic achievement.

Physical inactivity has contributed to this unparalleled epidemic of obesity, and the problem of physical inactivity is of particular concern in Tennessee. The Tennessee Youth Risk Behavior Survey (Tennessee Department of Education, 2007) shows that many students are not physically active: (1) 26.9 percent of females do not participate in

vigorous physical activity; (2) 56.9 percent of males do not engage in vigorous physical activity; (3) 39.2 percent of high school students do not attend physical education classes one or more times per week; (4) 38.3 percent watch three or more hours per day of television on an average school day; (5) 23.1 percent use a computer for something that is not school related three or more hours per day on an average school day; and (6) 25.5 percent of high school males and 34.7 percent of high school females describe themselves as slightly or very overweight. As Bradshaw et al. (2006) noted,

> More attention to physical education and physical activity is needed because of the rising obesity epidemic among youths in the United States and the dwindling of physical education programs in many areas of the country. If physical education were considered a core subject, it would help bring recognition the field and make the public realize its importance. With this recognition, schools would be more accountable. In addition, class sizes might be reduced so that all students could receive daily physical education, therefore, fitness levels would increase and lead to a healthier and more physically active population (p. 2).

Cardiovascular Disease

Our society is facing other health problems which have roots in and are linked to living a sedentary lifestyle. Increased physical activity has been related to an increased life expectancy and decreased risk of cardiovascular disease. According to Williams (2002),

> Coronary heart disease remains the leading cause of death in the United States, responsible for close to half a million deaths each year. During the past two decades, convincing evidence has emerged that links defined risk factors in adults

> with an accelerated atherosclerotic process. Pathological data have shown that atherosclerosis begins in childhood and that the extent of atherosclerotic change in children and young adults can be correlated with the presence of the same risk factors identified in adults. It thus seems eminently reasonable to initiate healthful lifestyle training in childhood to promote improved cardiovascular health in adult life (p. 143).

Cardiovascular disease is thought to originate in the childhood years and results in fatty substances in the arteries, which reduces blood flow and oxygen delivered to the heart (The President's Council on Physical Fitness and Sports, 1996). Risk factors associated with coronary heart diseases include high blood pressure/hypertension, diabetes, obesity, and physical inactivity. Physical activity that is performed regularly has positive health outcomes and can reduce the risk of developing a wide array of health illnesses. According to the Centers for Disease Control,

> … daily physical activity improves health in the following ways: reduces the risk of dying from heart disease, reduces the risk of dying prematurely, reduces the risk of developing diabetes, reduces the risk of developing high blood pressure, reduces the risk of developing colon cancer, reduces feelings of depression and anxiety, helps control weight, helps build and maintain healthy bones, joints, and muscles, and promotes psychological well-being. (1996, p.1)

Conclusion

Learning is not done in isolation; there are numerous factors and components that affect learning. Physical activity lends itself to physical fitness which is only one of the many factors that effect academic performance. Nevertheless, schools must recognize and

act on the direct connection between good health, physical fitness, and achievement. Together, schools and families can develop healthy students by articulating a common vision and supporting the health and well-being of students. As early as 1983, E. L. Boyer from the Carnegie Foundation for the Advancement of Teaching underscored the importance of such an approach by stating, "Clearly, no knowledge is more crucial than knowledge about health. Without it, no other life goal can be successfully achieved." This statement lays the foundation for further research in the relationship between fitness and academic achievement.

Change is desperately needed. According to Tennessee Coordinated School Health Director Connie Givens (2009),

> Tennessee ranks among the highest states in the nation for the incidence of heart disease, stroke and diabetes. Forty-one percent of students in the state's schools are overweight or obese. These adolescents have a 70 percent chance of becoming overweight adults who are subject to these life-threatening health conditions (Capitol Hill Week in Review, para. 14).

Considering the current state of affairs of our children, there is a mounting awareness that thorough research is needed to examine the relationship between physical fitness and academic achievement among school aged children. The educational system must begin to offer solutions to these health-related problems through physical education. This study aimed to find a connection between physical fitness and academic achievement, and report the findings. The linkage of physical fitness to academic achievement will help schools become more focused on the task at hand. This study contributes to the existing body of knowledge by assisting academic leaders and

administrators to make better decisions about physical fitness programs within the school day along with promoting daily physical education while improving academic achievement.

The purpose of this study was to determine fifth grade students' fitness levels using the FitnessGram Assessment Tool, and academic achievement using STAR Reading Percentiles, STAR Math Percentiles, and Grade Point Averages in order to compare physical fitness to academic achievement based on the premise that the health and physical fitness of the child has an effect on his or her ability to learn and to achieve academically. This study did not attempt to determine causality. The researcher sought to build on and add to the previous correlational research by documenting the strength and significance of the relationship between physical fitness and academic achievement. By using the *FitnessGram Assessment Tool*, fifth grade students from a rural East Tennessee Title I middle school were assessed on upper body strength and endurance, flexibility, abdominal strength and endurance, aerobic capacity and body composition in order to determine fitness levels. The research occurred during the first and second Semesters of the 2008–2009 school year.

Statement of Hypothesis

Study in this area was warranted because physical fitness is critically important for all students and because more research is needed in the comparison of physical fitness to academic achievement. It was hypothesized that:

- There will be a significant positive relationship between physical fitness levels based on the FitnessGram Physical Fitness Assessment Program

and academic achievement based on STAR Reading Percentiles, STAR Math Percentiles, and Grade Point Averages.

Statement of Null Hypothesis

- There will not be a significant positive relationship between physical fitness levels based on the FitnessGram Physical Fitness Assessment Program and academic achievement based on STAR Reading Percentiles, STAR Math Percentiles, and Grade Point Averages.

Research Objective

In addition to the hypotheses stated above, data was collected to compare gender, academic achievement, and FitnessGram fitness levels. These groups were compared statistically and results are reported.

Definitions of Key Terms

To make certain a clear understanding of terms is achieved and to provide consistency throughout this study, the following definitions are provided:

Aerobic Capacity (VO_2max). The maximum rate that oxygen can be taken up and utilized by the body during exercise (Welk & Meredith, 2008).

Back Saver Sit and Reach (BS). The assessment used to safely measure flexibility predominately of the hamstring muscles (Meredith & Welk, 2005).

Body Mass Index (BMI). BMI is a ratio of weight over height (Cooper Institute for Aerobics Research, 1992).

Cardiovascular Endurance. The body's ability to undergo vigorous exercise for a long period of time (Graham, Holt-Hale, & Parker, 2004).

Coronary Heart Disease (CHD). A disease of the blood vessels of the heart that causes heart attacks (Sandmaier, 1997).

Exercise. A subcategory of physical activity that is planned, structured, repetitive, and purposive in the sense that the improvement or maintenance of one or more components of physical fitness is the objective. "Exercise" and "exercise training" frequently are used interchangeably and generally refer to physical activity performed during leisure time with the primary purpose of improving or maintaining physical fitness, physical performance, or health (Center for Disease Control and Prevention, 2005).

FitnessGram. Comprehensive fitness program that emphasizes knowledge, motivation and assessment (Cooper Institute for Aerobics Research, 1992).

Flexibility. The range of motion in a joint (Hinson, 1995).

Health. A human condition with physical, social and psychological dimensions, each characterized on a continuum with positive and negative poles. Positive health is associated with a capacity to enjoy life and to withstand challenges; it is not merely the absence of disease. Negative health is associated with illness, and in the extreme, with premature death (Center for Disease Control and Prevention, 2005).

Healthy Fitness Zone (HFZ). These standards have been established to represent a level of fitness that offers some degree of protection against diseases that result from sedentary living (Cooper Institute, 1992).

Health Related Fitness/Fitness Levels. Fitness related to a person's risk for developing degenerative conditions and includes the following five components: body

composition, cardiovascular endurance, muscular endurance, muscular strength and flexibility (Hinson, 1995).

Moderate Physical Activity. Physical activity that uses 150 calories of energy per day (President's Council on Physical Fitness and Sports, 1996).

Muscular Endurance. A muscle's ability to produce power for a long period of time (Graham, Holt-Hale, & Parker, 1993).

Muscular Strength. The amount of power a muscle can produce (Graham, Holt/Hale, & Parker, 1993).

Needs Improvement. A level of fitness that the child should try to improve upon, but not failure (Cooper Institute, 1992).

Physical Activity. Any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level. Physical activity generally refers to the subset of physical activity that enhances health (Center for Disease Control and Prevention, 2005).

Physical Fitness. The condition of the body and its ability to perform activity (Hinson, 1995).

Sedentary. Not participating in any type of physical activity (Center for Disease Control and Prevention, 2005).

Overview of Methodology

Subjects

The population for this study consisted of 113 fifth grade students from a rural East Tennessee Title I middle school. The students' fitness levels were assessed using the FitnessGram Assessment Program to determine if the students were within the Healthy

Fitness Zone, or if they needed improvement. Academic data was determined by using STAR Reading Percentiles, STAR Math Percentiles, and Grade Point Averages. Demographic data, such as the students' gender was also obtained, and correlations between that variable and fitness level and academic achievement test results were evaluated.

Instruments

Information and data for the physical fitness portion of this study were collected through the FitnessGram assessment instrument during the first and second semesters of the 2008-2009 school year. The Cooper Institute for Aerobics Research developed the FitnessGram in 1982, and is located in Dallas, Texas, under the name of the Cooper Institute. The FitnessGram is endorsed by the American Alliance for Health, Physical Education, Recreation, and Dance (AAHPERD). The FitnessGram's primary goal is to assist students in grades 4-12 in establishing physical activity as part of their daily lives.

Some current research suggests that the higher the students' fitness levels, the better the classroom performance (Action for Healthy Kids, 2004). One valid assessment tool used to measure fitness levels is the FitnessGram Assessment Program (Cooper Institute, 1992). FitnessGram is a nationally recognized fitness assessment program that incorporates fitness assessments as one component of a fitness and physical education program. The FitnessGram tool is computerized and is a comprehensive criterion-referenced program designed for school-aged youth. There are several components of the FitnessGram including health-related fitness assessment, a software program to score the collected data, and educational materials to aid teachers and students. Performance is

classified as: (1) in the healthy fitness zone (HFZ) which means students met the fitness target or (2) needs improvement which means students failed to meet the target.

Students were assessed in five different areas of health related fitness, which included aerobic capacity, body composition, muscular strength, endurance, and flexibility. The category below the Healthy Fitness Zone (HFZ) is referred to as Needs Improvement Zone (NIZ) to indicate dimensions of fitness that may require special attention. While the effect of low fitness may not influence health until later in adulthood it is important to identify potential risks early on so that adjustments can be made to improve those levels. Therefore, the NIZ message should be used prescriptively to help children set goals or targets to improve their fitness. The wording used for this category does not imply "bad fitness" or "poor fitness" but rather areas in which the child should seek improvement (Cooper Institute for Aerobics Research, 1992). The FitnessGram results are not norm-referenced, so each student's results were not used to compare each other's fitness levels but instead to rate themselves by the health fitness standards prescribed.

Information and data collected for the academic portion of this study include students' STAR Reading and STAR Math Percentile Rankings assessed during the first semester of the 2008-2009 school year. Both STAR Math and STAR Reader are hosted by Renaissance Learning and are based in scientific research. According to Renaissance Learning,

> Eighty percent of the research on our products has been conducted independently or externally by university researchers, research firms, or school personnel. Study designs include experimental and quasi-experimental well as correlational, case

study, and psychometric (reliability and validity) research. Many have been published in peer review journals, and thus upheld to the highest scrutiny (2008). STAR Reading is a reliable and valid progress-monitoring assessment of general reading achievement and reading comprehension as is STAR Math regarding math achievement. STAR Reading provides norm-referenced reading scores for grades 1–12, criterion-referenced measures of students' instructional reading levels, and a way for teachers to track student growth throughout the year. Both STAR Reading and STAR Math use computer-adaptive technology to tailor each student's test based on responses to previous items. By administering test items that are closely matched to student achievement levels, STAR Reading and STAR Math reliability is enhanced. STAR Math provides accurate estimates of math ability for students in grades 1–12 relative to national norms, criterion-referenced diagnostic assessments of math skills development, and a way to track student growth throughout the year. Both programs have been deemed reliable and valid by The National Center for Student Progress Monitoring and The Southwest Educational Development Laboratory.

Grade Point Averages (GPA's) for the first semester of the 2008-2009 school year were also used for the academic data in this study. GPA's were calculated and used to determine academic achievement. The researcher was aware of the lack of internal reliability and validity provided for by GPA's due to various factors such as individual teacher's grading policies but chose to use it as an alternate form of academic achievement regardless.

Procedures

Parental consent was not necessary based on the school being involved in the Coordinated School Health Program and Fun and Fitness Program which already collected fitness information on the subjects. A letter (see Appendix A) was obtained from the principal confirming that there was no question about the legality of parental consent. The researcher met with the physical education teachers of the school and went through the purpose and administration of the FitnessGram assessment. She then helped them assess the students individually on the five components of fitness through the FitnessGram. Fifth Grade reading and math teachers administered the STAR Reading and STAR Math computer-assisted tests during the first semester of 2008-2009 school year. GPA's were calculated for the first semester and compiled with data from STAR Math and STAR Reading. The researcher gathered the percentile rankings of the students from STAR Reading, STAR Math, and GPA's and compared them with the results of the FitnessGram assessment fitness levels to determine whether or not a relationship exists between physical fitness and academic achievement.

Data Organization

Data were analyzed to assess if relationships existed among the FitnessGram Fitness Level Scores and academic achievement by comparing fitness levels to STAR Math Percentile Ranks, STAR Reading Percentile Ranks, Grade Point Averages, and gender. Data was entered into Microsoft Excel and then analyzed using the statistical program Analyse-it in order to determine if any relationships existed among the data.

Statistical Procedures

Multiple regression was used to examine the relationships among FitnessGram Fitness Level Scores, STAR Reading Percentile Ranks, STAR Math Percentile Ranks, GPA's, and Gender (Male vs. Female). Numerous regressions were conducted to determine the strength and direction of the relationship between physical fitness and academic achievement.

Applications/Significance of Study

Health professionals and educators have long believed that a positive relationship exists between physical activity and academic performance (Sallis et al., 1999). The physically active student is more likely to be academically motivated, alert, and successful (Dwyer, Sallis, Blizzard, Lazarus, & Dean, 2001). According to an extensive, recent literature review, cross-sectional observations showed a positive association between academic performance and physical activity, but physical fitness did not seem to show such an association at the present time (Trudeau & Shephard, 2008). Accordingly, the existing empirical research on the relationship between physical fitness and academic performance is meager. Currently, little research into the fitness levels of middle school students as associated with academic achievement has been located. The relationship between the two could have fascinating implications for schools and the educational community.

This study contributes to the existing body of knowledge by assisting academic leaders and administrators in making better decisions about physical fitness programs within the school day along with promoting daily physical education while improving

academic achievement. Information gained from the study should benefit educators by providing information about physical fitness as it relates to academic achievement.

Summary

The first chapter introduced the need to examine the importance of the relationship between physical fitness, using the FitnessGram, and academic achievement, using STAR Reading and STAR Math Percentiles and GPA's. The problem, purpose, hypothesis, research question, definitions of key terms, methodology, data organization, statistical procedures, and applications and significance of the study were also described in chapter one. The second chapter presents a review of the professional literature.

Chapter Two: Literature Review

Introduction

This comprehensive review of literature was conducted using various online and print resources. Chapter Two presents several important topics that relate directly to educational leaders, physical education programs, physical fitness and academic achievement. The organization of topics include childhood overweight and obesity, self-image, contributors to obesity, school-factors and impact, coordinated school health programs, schools and physical activity, physical fitness programs and schools, and physical fitness and the role of genetics.

Historical Background

Some thirty years ago, children would hike, play basketball, and leave the house to play – only coming back when dinner was ready. Now, in many communities, open spaces have been filled with residential or commercial developments, playgrounds have been closed due to fear of possible litigation, and the increasing threats to child safety have put an end to young people exploring to their heart's content. Also, in days gone by, dinner was cooked by Mom, not a fast food restaurant as is the case in so many households today. In the 21st century, children eat less nutritious food and exercise less. Unfortunately, the computer and television have become the best friends of too many of our children. The result is not only sociologically, academically, and physically significant; it can also be deadly.

Together, schools and families can develop healthy students by articulating a common vision and supporting the health and well-being of students. Good health and fitness is the foundation for success. Physical fitness may possibly be the missing puzzle piece to academic success. As early as 1983, E. L. Boyer from the Carnegie Foundation for the Advancement of Teaching underscored the importance of such an approach by stating, "Clearly, no knowledge is more crucial than knowledge about health. Without it, no other life goal can be successfully achieved." According to U. S. Secretary of Education, Rod Paige (2004):

> When our children are unhealthy, they are not ready to learn. Millions of our K-12 students are out of shape; many are overweight or obese. And there are many reasons why: consumption of high-fat, high-calorie foods and drinks, consumption of soda, lack of physical exercise, and too much time playing video or computer games and watching television. We can change this, and we must. President Bush has directed that our schools work to make our children healthier through a new initiative, the 'Schools for a HealthierUS Challenge.' We can educate our children and keep them healthy. And it only takes the right incentives, some common sense and a resolute will to make this happen (Paige, 2004, para. 4,5).

Through various studies, educators have learned that academic performance can improve if children eat a nutritional breakfast and if they are physically fit. Healthy eating patterns in childhood and adolescence promote optimal childhood health, growth, and intellectual development; prevent immediate health problems, such as iron deficiency anemia, obesity, eating disorders, and dental caries; and may prevent long-term health

problems, such as coronary heart disease, cancer, and stroke. School health programs can help children and adolescents attain full educational potential and good health by providing them with the skills, social support, and environmental reinforcement they need to adopt long-term, healthy eating behaviors.

Related Research

Childhood Overweight and Obesity

Today, obesity is one of the most urgent health concerns of our children. In the last 20 years, the proportion of overweight children between ages 6 and 19 has tripled, to nearly one in every three kids (Tyre, 2003). Many experts agree that obesity has its roots in childhood (Bouchard, 2000; Gutin & Barbeau, 2000; Murray, 2001). The number of overweight children in the United States has been on the rise since the early 1960's. During the 1960's, the National Health Examination Survey (NHES) confirmed that the percentage of children between 6 and 11 years old who were overweight was 4 percent, while the percentage among adolescents (12-19 years old) was 5 percent. By 2000, the number of overweight American youths in both age groups had dangerously increased to 15.3 percent and 15.5 percent respectively (American Obesity Association [AOA], 2002; CDC, 1999). "An estimated 17 percent of U.S. children are overweight, and policymakers are turning to schools to help students trim down and shape up" (Gill, 2007, para. 1). These statistics come 40 years after President Lyndon B. Johnson signed the Child Nutrition Act. According to Gill (2007), many children came to school hungry and went home unfed. The law recognized the connection between "nutrition and the capacity of children to develop and learn," and the government pledged to help states "through

grants-in-aid and other means, to meet more effectively the nutritional needs of our children" (Child Nutrition Act of 1966, Section 2).

According to Tyre (2003), fifteen percent of children in the United States, nine million kids, were seriously overweight, a rate that had tripled since 1970. By 2006, according to Active Living Research, more than one-third of children and teens, approximately 25 million kids, were overweight or obese. The explanation of this increase in body weight has been suggested to be due to a greater decrease in physical education at school, frequency of eating out, and consuming less than the recommended servings of fruits and vegetables per day. Children are moving on a fast track toward adult cripplers like heart disease, strokes, high blood pressure, cancer, and diabetes. Worrisome is the fact that obesity contributes to these health related issues. This exponential escalation of overweight children will continue to challenge society's healthcare system, because they will most likely become overweight or obese adults with future difficulties (Salbe & Ravussin, 2000). Education is desperately needed to counteract this problem.

Recent years have seen increased rates of obesity and related health risks for children. Being overweight has been identified as a significant risk factor for coronary heart disease and diabetes and is associated with other chronic diseases (Laing, 2002). Obesity is associated with significant health problems in the pediatric age group and is an important early risk factor for much of adult morbidity and mortality. Pediatricians are now treating chronic diseases, including type II diabetes mellitus, which were once the preserve of adult medicine (Sabin, 2002). Because of the escalating rate of type II diabetes mellitus among obese adolescents and because diabetes-related morbidities may

exacerbate if diagnosis is delayed the clinician should be alert to the possibility of type II diabetes mellitus in all obese adolescents (Krebs, 2003). Other health issues include high cholesterol, hypertension, hyperinsulinism, insulin resistance, impaired glucose tolerance, asthma, obstructive sleep apnea syndrome, menstrual irregularity and mental health problems.

Childhood obesity promises to contribute to lower adult quality of life and higher medical costs in the future. Researchers estimate the probability of childhood obesity persisting into adulthood to increase from approximately 20% at four years of age to approximately 80% by adolescence. "These kids could need coronary bypass in their 20's," says Kelly Brownell, director of the Yale University Center for Eating and Weight Disorders (Wallis, 2003, p. 68). Brownell (2004) states that this could be the first generation of American children to lead shorter lives than their parents. According to Salbe & Ravussin (2000), parental obesity more than doubles the risk for adult obesity in both obese and nonobese children. In addition, if both parents are obese, there is an 80 percent chance that their children will be obese (Anspaugh, Hamrick, & Rosato, 2003).

Self-Image

Not all of the problems related to being overweight are physical in nature though. Tyre (2003, p. 60) states, "In a recent study pediatricians reported that severely obese adolescents felt slightly more social isolation than teenage cancer patients undergoing chemotherapy." The most immediate consequence of being overweight as perceived by children themselves is social discrimination. This is associated with poor self-esteem and depression. If you relate this to academic learning in the classroom, there are bound to be consequences.

Krebs (2003) states that the psychological stress of social stigmatization forced on obese children may be just as detrimental as the medical morbidities. According to Irwin, Kerr, & Symons (2003), not only do the overweight and obese encounter physical health problems; they are also subject to an enormous amount of mental and emotional damage that society inflicts upon them. According to Cahnman (1968), obesity has been considered immoral and gluttonous in American society. In the United States, the obese are seen as contagious, and individuals believe that they could become contaminated by associating with an obese person (Cahnman, 1968). Many people enjoy fat jokes and the media's insulting portrayals of obese individuals. This prevailing attitude begins in childhood (Bell & Morgan, 2000; Gordon-Larsen, 2001), continues into young adulthood (Lewis et al., 1997; Perez-Lopez, Lewis, & Cash, 2001), and manifests itself in the societal psyche as these young citizens age (Crandall & Biernat, 1990). Irwin, Kerr, & Symons (2003, p. 2) state, "This deep rooted manifestation occurs because the established negative beliefs regarding the obese are entrenched in the principal settings in today's society."

As stated in earlier research, as overweight children get older, their self-esteem is more negatively affected. Although the self-esteem levels of overweight preschool children are similar to their nonobese peers (Kleges et al., 1992), the literature notes that the self-esteem scores of obese children drastically decrease between the ages of 9 to 11 in comparison to the scores of nonobese students (Pierce & Wardle, 1997). Overall, society's principal opinion about being overweight is that they are lazy, have no self-control, and will be unsuccessful or unhappy in life (Brownell & Fairburn, 1995). These public attitudes toward this demoralized group often end up as self-fulfilling prophecies

for the obese (Cahnman, 1968). Therefore, the cycle of discrimination persists and continues to confine the obese to negative expectations (Crandall, 1994).

Contributors to Obesity

Young persons' food choices are influenced by television advertisements for low-nutritive foods. Young people see about one food advertisement for every five minutes of Saturday morning children's shows. Most of the foods advertised during children's programming are high in fat, sugar, or sodium; practically no advertisements are for healthy foods such as fruits and vegetables. Studies have indicated that, compared with those who watch little television, children and adolescents who watch more television are more likely to have unhealthy eating habits and unhealthy conceptions about food, ask their parents to buy foods advertised on television, and eat more unhealthy food. Some studies of school age children have found that television watching is directly associated with obesity. Because children in the United States spend, on average, more than 20 hours a week watching television (more time over the course of the year than they are in school) school-based programs should help counter the effect of television watching on young peoples' eating habits.

In the past, parents and children routinely sat around the table in order to share nutritious, home-cooked meals. Today, few families prepare home-cooked meals or even eat together (Demas, 2003). Eating out at fast food restaurants is on the rise. According to Brownell (2004), the restaurant industry accounted for 46.1% of every food dollar in 1999 which was up from 25% in 1955. These days, young people are more on the go due to constant involvement in extracurricular activities such as sporting events, cheerleading, and socializing with friends. This on the go lifestyle and decreased parental supervision

can lead to children making poor food choices. Children who eat meals with their family consume more fruits and vegetables, fewer carbonated drinks, and less fat in food both at home and away from home (Dietz, 2001). Combining poor food choices with larger food portions is another contributing factor in the increase of childhood obesity. Fast food restaurants now have very large servings of soft drinks and French fries. Everyone has been asked if they would like to super-size their order. Approximately 30 percent of children eat fast food on a given day. One study suggests that children who ate fast food consumed an average of 187 calories a day more than those who did not (Bowman, 2004). In light of these findings, measures to limit marketing of fast food to children may be warranted.

Being overweight or obese is a major problem in school-age children, and sugar sweetened drinks have been blamed as one of its causes. Unfortunately, studies have not yet been able to tell whether soft drinks really do contribute to obesity or whether children who are obese simply drink a lot of these beverages. To learn more, researchers from Cornell University studied 30 children, ages 6 to 13 years, who were enrolled at a summer camp. They found that when children drank more than 12 ounces a day of soft drinks, those drinks took the place of milk in their diets. As a result, these children had lower daily intakes of protein, vitamin A, calcium, and other minerals. They also wound up consuming more calories overall. So the more these children consumed excessive amounts of soft drinks, the more they gained weight as reported in September 2003, *Child Health Alert*. According to Taylor (2003), the food industry pretends that the answer to kids' excessive soft-drink consumption is more physical activity. Of course that's important, but keep in mind that a 110-pound child would have to bike for 75

minutes to burn off just one 20-ounce Coke (Taylor, 2003). "The CDC claims the average daily consumption of soft drinks among young girls doubled from 1978 to 1998, while consumption of carbonated sodas nearly tripled among boys during the same 20-year span" (Gill, 2007, para. 4). As Coca-Cola boasts, "More than 1.3 billion times a day someone enjoys one of our beverages" (The Coca-Cola Company, n.d., para.2).

School Factors and Impact

Children spend a major portion of their day in school. "Because many of the lifestyle and behavior choices associated with obesity develop during school-age years, a child's food intake and physical activities at school are important determinants of body weight" (Carter, 2002, p. 1). By providing well-balanced meals, physical activity, and health education, school policies can help reduce the effects of childhood obesity. Schools play a significant factor in the lives of students. The renewed focus on adolescent eating habits arrived as districts participating in federally funded school-meals' programs were required to develop local wellness policies, stated Gill (2007). The Child Nutrition Reauthorization Act of 2004 required districts partaking in subsidized school breakfast and lunch programs to establish nutrition guidelines and physical activity goals by the end of the 2006-2007 school year (Gill, 2007, para. 7).

Today, as schools are being progressively further called upon to step in and address areas that were formerly considered to be off-limits; the present predicament that exists in children's well-being has high precedence. Children need nutrition education in order to help them develop lifelong, healthy eating patterns. Schools are ideal settings for nutrition education for several reasons:

- Schools can reach almost all children and adolescents.
- Schools provide opportunities to practice healthy eating.
- Schools can teach students how to resist social pressures. Eating is a socially learned behavior that is influenced by social pressures.
- Skilled personnel are available. After appropriate training, teachers can use their instructional skills and food service personnel can contribute their expertise to nutrition education programs.

School-based nutrition education is particularly important because today's children and adolescents frequently decide what to eat with little adult supervision. The increase in one-parent families or families having two working parents and the availability of convenience foods and fast-food restaurants inhibit parents' monitoring of their children's eating habits. Schools are a critical part of the social environment that shapes young peoples' eating behaviors and can therefore play a large role in helping improve their diet.

One area where schools have been able to make an impact is in the area of school meals. According to Demas (2003), many students rely on school meals, breakfast and lunch, for at least two-thirds of the calories which they consume each day. These meals are capable of having a major effect on their health and behavior. Cullen (2004) in a letter on pediatric obesity from the CDC and FDA states, " Among the students who were in fifth grade at the start of the study, high-fat vegetable consumption had increased the next year by 30% and milk use rose by 14%, while eating regular vegetables and sweetened drinks dropped by 10% and 12% respectively."

Ever since the time when the federal school lunch program began in 1946, it has served a dual purpose. That dual purpose was to feed the hungry children and to provide an outlet for surplus farm commodities. Until then, many students arrived at school with little or no breakfast and brought nothing with them to eat for lunch. Demas (2003, p. 55) states, "There have been numerous studies that correlate a nutritious breakfast with better performance in school, not only in terms of grades but also in terms of behavior. This is the primary reason why the U.S. Department of Agriculture, which is the organization that runs the school meals' program, has added breakfast programs in many schools." Unfortunately, there is a problem that arises because of the dual purpose of the school meals' program. While the surplus foods that are provided to schools help defray the costs of running the meals' programs, it is also true that many of the foods that are used for the program, such as processed cheese, are not the most nutritious ones that are available. As stated by Carter (2002), the prevalence of obesity among children from low-income families is higher than in other socioeconomic groups, so the provision of free or reduced meals through these programs may influence food intake among this group. According to Demas (2003), when you consider at least half of the 53 million students who eat lunch every day, which has been provided to schools by USDA, the enormity and the significance of school meal programs can begin to be appreciated.

It is critical that principals and teachers work with food-service personnel in order to make this connection part of the student's education. Demas (2003, p. 57) states, "Educators need to insist that the foods served in their schools are not simply those that mimic the fast-food culture. The school meals' program should be integrated with the academic curriculum and serve as a model of contemporary nutrition knowledge." The

lunch program must be educationally supported and coordinated with the academic curriculum. We owe it to our students to provide them with the educational tools that they need to make informed food choices so that they will be able to protect themselves against obesity and diet-related diseases. The school cafeteria can serve as a model for an integrated curriculum that consciously acknowledges the role which nutrition plays in health, learning, and behavior.

The components of the school curriculum need to work together rather than in isolation in order to best serve students. The Heart-Smart Program is an example of components of the school curriculum working together. The five modules of the Heart-Smart curriculum include: general health and physiology, nutrition, exercise, coping skills, and raising self-esteem (Davis et al., 2002). These lessons can be incorporated in all subject areas. The Centers for Disease Control and Prevention issued the following seven recommendations for insuring a quality school program that promotes livelong healthy eating: (1) Policy, (2) Curriculum, (3) Instruction, (4) Program Coordination, (5) Staff Training, (6) Family and Community Involvement and (7) Evaluation (2002). The school professionals need to model positive attitudes and behaviors toward their obese students, because they have an audience that is watching closely (Cardinal & Cardinal, 2001).

Despite the acknowledgement of the problem of obesity existing, it is far from being cured. The solution of this challenging and complex issue will require great efforts from all arenas of society. There are some school systems that have helped to move toward positive steps to find solutions to this problem. Obesity spurred Arkansas to something new: grade fitness. According to Wallis (2003, p.68), when Arkansas schools

opened in 2003, they were asked "to issue each student a health report card in the form of a body mass index, or BMI." As lawmakers initially envisioned the plan in April 2003, schools were to literally add a section to report card alongside the traditional assessments for this measure of a child's body mass. Wallis (2003, p.68) states, "feeding a child is arguably a parent's most elemental task, so the prospect of schools' intruding in such an intimate matter and issuing F-is-for-fat grades was mortifying to many." The original plan was modified after concerns were voiced in the community. Instead of putting the information on a grade card, health reports were mailed separately to parents, and families could even opt out of the program. As stated by Wallis (2003), Cambridge, Massachusetts, is the only community that has conducted a scientific study of the impact of the use of health report cards. The results, published in the September 2003 issue of Archives of Pediatrics and Adolescent Medicine, showed that parents of overweight students were significantly more likely to say they planned to seek medical help, increase physical activity and work on a diet plan for their children if they received a BMI report card. Whether parents actually take the actions they planned and whether kids actually benefit are the subjects of a future study.

Arkansas was the first state to embrace the health-report-card approach, but other states are exploring similar policies and other steps to control childhood obesity. The medical community has been sounding the alarm for several years. According to Wallis (2003), the American Academy of Pediatrics (A.A.P.) formally recommended in August of 2003, that doctors make BMI assessments a routine part of annual physicals. No one doubts that the pediatrician's office belongs on the front lines of confronting the epidemic, but not everyone agrees the school is the right place to fight this battle. Many

obesity experts argue that the cafeteria and gym are the spots where schools should focus their energies. “Are we offering enough P.E. classes? How do we get more nutritious lunch meals into schools? How do we promote a healthy, active lifestyle without stigmatizing overweight children?” asks Dr. Nancy Krebs, a University of Colorado pediatrician who helped draft the A.A.P.’s new weight-screening recommendation (Wallis, 2003, p. 68). Krebs suspects that the most valuable part of Arkansas’ anti-obesity campaign is not the health report card but a provision in the same law that forbids access to vending machines in elementary schools during school hours.

Coordinated School Health Program

“Coordinated School Health Programs (CSHP) provide policies, activities, and services in an organized manner to promote the health of school students and staff through: comprehensive school health education; family and community involvement; physical education; school counseling, psychological, and social services; school health services; school nutrition services; and school-site health promotion for staff and faculty” (Murray, Low, Hollis, Cross, & Davis, p. 590, 2007). Schools, without the support of the families and community cannot function alone in this mounting problem. “The CDC is promoting a Healthy Youth! Initiative with its Coordinated School Health Program. The underlying theme is cooperation” (Gill, 2007, para. 9). “Schools by themselves cannot, and should not be expected to, address the nation’s most serious health and social problems,” the CDC declares on its Web site. “Families, health care workers, the media, religious [and] community organizations that serve youth, and young people themselves also must be systematically involved” (CDC, 2005, para.1). According to Murray et al (2007, p. 589), “… school health programs hold promise for improving academic

outcomes for children." Coordinated School Health Programs can serve as a catalyst for healthier communities.

Education is a shared responsibility throughout every student's life. Comprehensive, well-planned partnerships between family, school and community result in higher student achievement and well-being. For example, partnerships improve communication, leading to reinforcement of consistent messages about health and safety. Linking the home, school and community dimensions of every student's life leads to better-coordinated services. Family involvement, research-based classroom instruction, positive school climate and access to health services are all vital to nurturing healthy, productive students. Family involvement is the common thread that weaves these services together. It is one key to student success.

Parents must take an active part in the health of their children. Teaching about proper nutrition and making good food choices are parental responsibilities that are frequently ignored. Parents often pass poor eating habits on to their children. A trip to the grocery store makes clear that eating healthy is more expensive than eating poorly. Fresh fruits and vegetables cost more than pre-packaged frozen foods and canned foods. Parents carry the burden of being good examples and providing opportunities for children to be more active. Communities have sports leagues where children can participate in a variety of sports and activities. Families can take walks in the evening or ride bikes, instead of spending time in front of the television, in order to increase physical activity. Physical activity should be planned in a child's routine on minimum of three times per week. Children cannot do this alone; therefore the yoke falls on the parents.

Opportunities for physical activity and nutritionally sound food choices are critical to the health, well-being, and education of today's children. According to Carter (2002), schools have the potential to influence students' beliefs and attitudes about nutrition and weight control. Several studies show that investing in children's physical health needs promotes learning over the school years (Mistry, Crosby, Huston, Casey, & Ripke, 2002) and has profound effects on school readiness and early learning. Doctors say that prevention, not treatment, is the key to unlocking this stronghold of obesity against our children. Children must learn to eat right and exercise while they are still young. Nutrition education could give students the tools they need to make healthy choices regarding eating and physical activity.

Schools and Physical Activity

Another area in which schools can fight the health battle is by providing programs that encourage physical activity. According to Carter (2002), these programs may create expectations for regular physical activity that may persist into adulthood. In order to increase physical activity among children, regardless of their athletic abilities, the CDC recommends daily physical education classes that emphasize health-related fitness activities over activities requiring specific athletic abilities. Carter (2002) stated that in 2001, only half of school students participated in physical education classes, and less than one third of students had physical education daily. The Surgeon General recommends children should engage in 60 minutes of moderate activity most days of the week, yet estimates show that only 3.8 percent of elementary schools, 7.9 percent of middle schools, and 2.1 percent of high schools provide daily physical education (Lee, Burgeson, Fulton, & Spain, 2007).

Evidence suggests that students in elementary school through high school achieve better academically when they are physically active. Studies have demonstrated that physical activity is connected to physiological aspects of cognitive functioning (Sallis et al., 1999; Shephard, 1997). Studies also suggest that learning complex movements stimulates the part of the brain used in problem solving and learning (Sallis et al., 1999). Other research suggests that physical exercise increases neural connections and cerebral blood flow (Jensen, 1998). Brain research has shown that the brain benefits from exercise, specifically aerobic exercise due to increased blood flow to the brain, which has several effects. The brain's energy and oxygen increases due to the blood vessels being stimulated to grow. Memory formation is aided because of this increased blood flow. Exercise also heightens production of the chemical brain-derived neurotrophic factor (BDNF) which is found in the hippocampus, an area which is directly used during the learning process. Some scientists believe BDNF acts like "Miracle-Gro" for the brain (Ratey & Hagerman, 2008).

In a recent study, "physical activity was positively related to school contentment and academic achievement" (Kristjánsson, Sigfúsdóttir, Allegrante, & Helgason, p. 69, 2009). Physical activity can also increase academic performance indirectly by improving emotional health, self-esteem, and alertness – all of which are related to improved academic performance (Tremblay, Inman, & Willms, 1998). Data from social surveys indicate that youths who engage in moderate to high levels of physical activity tend to perform better in school (Dwyer, Sallis, Blizzard, Lazarus, & Dean, 2001; Field, Diego, & Sanders, 2001; Pate, Heath, Dowda, & Trost, 1996). These studies provide evidence that schools which endeavor to amplify academic instructional time at the cost of

physical education time will experience reductions in student learning and academic performance.

Sacrificing physical education for academics does not improve academic performance according to several studies conducted over the years. Two sources (Symons & Cinelli, 1997; Sousa, 2001) have recognized that taking time out of the school day for physical education does not lead to reduced achievement scores. A study conducted using 214 sixth-grade students in Michigan found that students enrolled in PE had similar grades and standardized test scores as students who were not enrolled in PE, despite receiving 55 minutes less of daily classroom instruction time for academic subjects (Coe, Pivarnik, Womack, Reeves, & Malina, 2006). According to Sallis et al (1999), data from 759 fourth- and fifth-graders in California was analyzed and found that students' scores on standardized achievement tests were not adversely affected by an intensive PE program that doubled or tripled PE time. On several test scores, students with enhanced PE performed better than students in control groups (Sallis et al, 1999). In yet another study, 287 fourth- and fifth-grade students from British Columbia were evaluated to determine if introducing daily classroom physical activity sessions affected their academic performance. Students in the intervention group participated in daily 10-minute classroom activity sessions in addition to their regularly scheduled 80-minute PE class. Despite increasing in-school physical activity time by approximately 50 minutes per week, students receiving the extra physical activity time had similar standardized test scores for mathematics, reading and language arts as did students in the control group (Ahamed, MacDonald, Reed, Naylor, Liu-Ambrose, & McKay, 2007).

Classroom teachers can also aid in accommodating physical activity breaks throughout the day. Research shows that short activity breaks can improve students' concentration skills and classroom behavior. Research in Georgia studied the effects of an activity break on classroom behavior in a sample of 43 fourth-grade students. Students exhibited notably more on-task classroom behavior and considerably less fidgeting on days with a scheduled activity break than on non-activity days (Jarrett, Maxwell, Dickerson, Hoge, Davies, & Yetley, 1998). A 12-week research project conducted in eastern North Carolina evaluated the effects of providing elementary students with a daily 10-minute activity break. Among 243 students in kindergarten through fourth grade, a daily activity break increased on-task behavior significantly, by an average of 8 percent. Among the least on-task students, the activity breaks improved on-task behavior by 20 percent (Mahar, Murphy, Rowe, Golden, Shields, & Raedke, 2006). In a another study using 177 New Jersey elementary students, researchers compared concentration test scores after students finished either a classroom lesson or a 15-minute physical activity session. Fourth-grade students exhibited appreciably better concentration scores after finishing the physical activity. Among second- and third-grade students, the physical activity intervention was neither positive nor negative to test performance (McNaughten & Gabbard, 1993).

A learning readiness physical education program was started at Naperville Central High School in Illinois in 2004. Before attending a literacy support class, underperforming literacy students were offered an early morning physical education class. Students who participated in both the early morning physical education class and the literacy intervention class gained 1.34 years of growth on the reading standardized

test by the end of the semester. Those who did not participate in the physical education class prior to literacy instruction only showed improvement of 0.7 years. Due to the success of this program, the school followed this method for mathematics instruction which yielded even greater results. Students who exercised prior to the math intervention class showed an increase of 20.4 percent on their standardized algebra test score; those who did not exercise prior to class only showed a 3.87 percent improvement (Viadero, 2008).

Physical Fitness Programs and Schools

Physical educators are in a unique position to lead the way for children to become more productive and healthy. According to Irwin et al (2003, p. 27), "In order to create a more secure and successful physical education environment for the obese, the physical educator must become more compassionate and understanding, change the present curriculum if it is restrictive, individualize assessment, and model appropriate and healthy behaviors at all times." If physical educators hope to be successful, they must have strategies that will aid them in better reaching this special population. Irwin (2003, p. 24), et al, also states, "When introducing physical fitness information, it should be done using a health-related philosophy rather than using the traditional, competitive method that many physical education programs use." In addition to requiring physical education, other opportunities for schools to increase energy expenditures include encouraging physical activity during recess and providing after-school sports and health-related fitness programs.

Certain curricular changes need to be made in order to help fight for the health of our children. According to Irwin, Kerr, & Symons (2003) traditional emphasis on zero-

sum sport skills and strategies is outdated and harmful to the future well-being of all children. Due to the mounting number of overweight and obese children, it is obvious that physical education training needs to be modernized and tailored to suit this population. More wellness information should be integrated into the curriculum. Nutrition information about a proper diet can be introduced in health education and coordinated with physical education. In order for obese students to value an activity more, they need to feel comfortable participating in that particular activity (Irwin, Kerr & Symons, 2003). Educators need to encourage these students, not build more barriers.

Physical Fitness and the Role of Genetics

The physically active lifestyle is associated with low future mortality, but the causality between physical activity and health is not always clear (Leskinen, Waller, Mutikainen, Aaltonen, Ronkainen, Alén, et al., 2009). Several physical activity-related traits are influenced by genetic factors. In a review of literature conducted by Beunen and Thomis (1999), they found that activity as a temperamental trait was under genetic control and no evidence was found for shared environmental factors. "Children tend to be active partly because genetic factors underlie this engagement in more active lifestyles" (Beunen & Thomis, p. S62, 1999). "Some inherited biological characteristics may make it easier for some individuals to achieve high levels of physical activity or fitness and favor them with low morbidity or with longevity" (Leskinen, et al, p. 108, 2009).

"Physical fitness is a complex phenotype influenced by a myriad of environmental and genetic factors, and variation in human physical performance and athletic ability has long been recognized as having a strong heritable component" (MacArthur & North, p. 331, 2005). "Although genetics might not be the main

determinant of population differences in physical performance, evidence is accumulating to suggest an important role of genetics in individual differences in physical performance" (Pitsiladis & Scott, p. S16, 2005). Height, which is a highly heritable trait, has the potential to lead one to become a high jumper, volleyball player, or basketball player and is under a strong degree of genetic control. However, not all tall individuals will be successful in these events. The sequencing of the human genome could help in the identification of gene variants that make up successful athletes. The screening of these variants alone is unlikely to allow prediction of athletic performance however (MacArthur & North, 2005; Pitsiladis & Scott, 2005). "The overall genetic effect on elite performance might not be a simple sum of the individual gene variants, since environmental factors and genetic background are likely to be confounding factors" (Pitsiladis & Scott, p. S17. 2005).

Conclusion

Change is desperately needed if we are going to battle poor health that is plaguing not only our young people, but our society today. Our children are bombarded with television commercials, print ads, vending machine availability, and fast food. They eat for entertainment, because they are bored, or during special events. America has made eating a social event. Children are not as physically active as they once were. Physical education classes, as well as recess, are being cut to make time for academics in light of the requirements of NCLB. Coupling this with diets high in empty calories predisposes America's youth to being overweight and unhealthy.

Food availability contributes to children being overweight and unhealthy. Families often eat on the run. Food consumed at home is higher in empty calories and

easier to cook thanks to the emergence of new technology such as the microwave. Many families no longer sit down and eat meals together. Children regularly eat in the car or in front of a television. Scores of children spend the time they could be outside "playing", in front of the television aimlessly watching TV or playing video games. These factors combined contribute to the health problems confronting our children today.

What changes can be made in order to secure health and physical fitness in our children thereby promoting academic achievement? Education and a change in lifestyle are two ways to attack this mounting health problem. Schools have fed millions of students with little or no regard for the health of children. The school system set out to make sure students received sufficient or even extra calories, assuming that growing children would be physically active and need those calories to burn. Looking at statistics, such is not the case today. Schools need to analyze their nutrition programs to assure that low calorie, healthy meals are options available to all children. Schools can also guarantee that physical education programs are designed to help students become physically active and necessitate physical fitness. Health classes should also include nutritional information so children can be taught appropriate eating habits. Making drink and candy machines inaccessible at school should also limit the availability of junk food in schools. Healthy snacks and drinks should be substituted for junk food in machines, canteens, or concessions stands.

The educational system must begin to offer solutions to these health-related problems. The mind-body connection must be explored more intensely to discover if there are true connections between fitness levels and academic achievement. With regard to the abundance of current literature outlining the alarming number of children who are

overweight or at risk thereof, it is evident that educational leaders, parents, middle school teachers, school nutritionists, school nurses, physical education teachers, and school health officials can use predictive information from this study to improve the health and fitness levels of students while also promoting academic achievement and lifelong, healthy habits.

Chapter Three: Methods

Introduction

This study examined the fitness levels of fifth grade students to determine if they met the criteria of the Healthy Fitness Zone (HFZ) on the FitnessGram. The researcher also collected academic data through STAR Reading, STAR Math, and GPA's to see if there was any correlation between physical fitness levels and academic achievement. The purposes of Chapter III are to describe: (a) the sample population which was selected for this study; (b) the instruments that were administered for data collection; (c) the methods, materials and procedures that were utilized to implement and collect the data for the study; (d) and the selection and use of statistical procedures that were employed in the analysis of the collected data.

This study was quantitative in nature and there was no known previous research on fifth grade students and the Healthy Fitness Zone (HFZ) in the selected school. In an attempt to determine the relationship between fifth grade students' results on the FitnessGram and academic achievement, this research compared fifth graders' levels of fitness on the FitnessGram to STAR Reading Percentiles, STAR Math Percentiles, and GPA. All students were assessed during the first and second semesters of the 2008-2009 school year to determine their level of fitness as measured through the FitnessGram Assessment Tool. STAR Reading and STAR Math Percentiles, along with GPA's, were assessed and documented during the 2008-2009 school year with anonymity achieved through coding.

Research Design

The research design was a quantitative, nonexperimental, correlational study where no attempt was made to change behavior or conditions or to manipulate the variables. Correlational research seeks to examine the strength and direction of relationships among two or more variables where the extent of the relationship is expressed as a numeric index. The purpose of this study was to compare fifth grade students' physical fitness levels to academic achievement based on the premise that the health and physical fitness of the child has an effect on his or her ability to learn and to achieve academically. Data was collected by using the FitnessGram Assessment Tool, STAR Reading Percentiles, STAR Math Percentiles, and Grade Point Averages. This study examined if students are in the Healthy Fitness Zone (HFZ) or needs improvement zone of the FitnessGram Assessment tool along with examining the relationship between physical fitness and academic achievement. Additionally, the researcher examined the relationship between physical fitness level scores, academic achievement, and gender to determine if relationships among the three variables existed. The following questions were asked:

1. Is there a significant positive relationship between physical fitness levels based on the FitnessGram Physical Fitness Assessment Program and academic achievement based on STAR Reading Percentiles, STAR Math Percentiles and Grade Point Averages?
2. Does gender play a role in the relationship between physical fitness levels based on the FitnessGram Physical Fitness Assessment Program and academic

achievement based on STAR Reading Percentile, STAR Math Percentiles and Grade Point Averages?

Preliminary Procedures

Prior to the execution of this study, a thorough review of literature was conducted. The review of literature focused on Childhood Overweight and Obesity, Self-Image, Contributors to Obesity, School Factors and Impact, Coordinated School Health Program, Schools and Physical Activity, Physical Fitness Programs and Schools, and Physical Fitness and the Role of Genetics. Project approval for use of human subjects was issued by the University IRB procedure.

Selection of the Sample

The population for this study consisted of 113 fifth grade students from a rural East Tennessee Title I middle school. Parental consent was not necessary based on the school being involved in the Coordinated School Health Program and Fun and Fitness Program which already collected the needed fitness information on the subjects. A letter was obtained from the principal confirming that there was no question about the legality of parental consent.

A Title I middle school in rural East Tennessee was the school chosen to do this study. Subjects were selected from the fifth grade due to the researcher's ability to gather valid and reliable information. Being a fifth grade teacher at the school, she had the opportunity to seek permission to view academic, as well as health information on the students participating. She was able to use her plan time, which consists of a fifty minute time period daily, to help administer the FitnessGram Assessment to the fifth graders during physical education classes. Since the school's inception on February 22, 1998, it

has been Title I funded, with the majority of the students falling into the poverty level. The school had a staff of 43 certified faculty members (34 full-time faculty and 9 part-time faculty). A total of 60% of faculty members held advanced degrees, while all were Highly Qualified within their respective instructional areas. The selected school contained grades five through eight with a population of 501 students. Of those 501 students, 113 (65 males and 48 females) were fifth graders. Approximately 62% of these fifth graders qualified for a free or reduced lunch rate. Of those 113 students, 96 were Caucasian, 3 were African American, 1 student was Asian, and 3 were Hispanic. All 113 students were proficient in English. The attendance rate was fair at 93.7 percent within the population sample. The transfer rate for 2008-2009 was 34 percent with the withdrawal rate at 32 percent.

The vision of the school is to Raise the Bar of Excellence. This means creating a culture of continuous improvement with a focus on the needs of individual students. The view of instruction in the school is for curriculum to drive assessment, which will drive instruction, which will then move the organization to better performance. The school's mission statement is to envision a partnership dedicated to providing the paths that inspire lifelong learners to value human dignity, contribute to society, and strive for excellence.

Only one period of physical education class for fifth grade is held each day. As many variables as possible were able to be controlled due to this factor. Fifth grade physical education class was held each day from 12:30-1:20. The students had physical education on a seven week rotation, two or three days per week, over the course of the school year. It is important to note that some of the participating students did have recess

for thirty minutes per day, in which students walked, thereby contributing to the physical activity they received other than physical education classes. Fifth grade students were targeted because they were not permitted to participate in middle school athletics. Again, by trying to control as many extraneous variables as possible, fifth grade students were the only ones who were assessed.

The researcher met with the physical education teachers of the school and went through the purpose and administration of the FitnessGram assessment. She then helped them assess the students individually on the five components of fitness through the FitnessGram to determine if the students were within the Healthy Fitness Zone (HFZ), or if they needed improvement (NIZ). Academic data was determined by using STAR Reading Percentiles, STAR Math Percentiles, and Grade Point Averages. Fifth Grade reading and math teachers administered the STAR Reading and STAR Math computer-assisted tests during the first semester of 2008-2009 school year. GPA's were calculated for the first semester and compiled with data from STAR Math and STAR Reading. The researcher gathered the percentile rankings of the students from STAR Reading, STAR Math, and GPA's and compared them with the results of the FitnessGram assessment fitness levels to determine whether or not a relationship existed between physical fitness and academic achievement. Demographic data, such as the students' gender was also obtained, and correlations between that variable and fitness level test results was evaluated.

Instruments Used in Data Collection

Information and data for the physical fitness portion of this study was collected through the use of the FitnessGram Physical Fitness Assessment Program during the first

and second semesters of the 2008-2009 school year. The fitness of a child should not be based on how he/she compared to the performance of other children, instead it should be individualized and defined by clear health standards (Cooper Institute for Aerobics Research, 1992). The purpose of testing for fitness was not to see how well a child compared to another, but it is to see how physically fit the child was and what implications it made for his/her health. The goal of fitness is not only to be fit now but also in the future.

To attain this goal, the researcher used the FitnessGram as the program to be used as the evaluation and assessment tool for physical fitness. The FitnessGram was developed in 1982 by the Cooper Institute for Aerobics Research in Dallas, Texas and is endorsed by the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD). The primary goal of the FitnessGram is to assist students in grades 4 -12 in establishing physical activity as part of their daily lives. The FitnessGram is designed to assess students through the five areas of health related fitness: aerobic capacity, body composition, muscular strength, muscular endurance and flexibility.

Students were assessed in five different areas of health related fitness, which included aerobic capacity, body composition, muscular strength, endurance, and flexibility. The category below the Healthy Fitness Zone (HFZ) is referred to as Needs Improvement Zone (NIZ) to indicate dimensions of fitness that may require special attention. While the effect of low fitness may not influence health until later in adulthood it is important to identify potential risks early on so that adjustments can be made to improve those levels. Therefore, the NIZ message should be used prescriptively to help children set goals or targets to improve their fitness. The wording used for this category

does not imply “bad fitness” or “poor fitness” but rather areas in which the child should seek improvement (Cooper Institute for Aerobics Research, 1992). The FitnessGram results are not norm-referenced, so each student’s results were not used to compare each other’s fitness levels but instead to rate themselves by the health fitness standards prescribed.

Six Subtests of FitnessGram

Students were assessed in five different areas of health related fitness, which included aerobic capacity, body composition, muscular strength, endurance, and flexibility. The tests the researcher had the participants to perform were the one-mile run, body mass index, curl-up test, trunk lift, 90 degree push-up, and the back-saver and reach. The researcher chose these tests, because research has indicated that the majority of these tests are the most reliable (Cooper Institute, 2005). The assessments are not norm referenced; therefore, students were not compared to each other but instead to health fitness standards. These particular health standards, (HFZ), were carefully established for each age and gender to indicate good health and physical fitness. Either students fell within the Healthy Fitness Zone or the Needs Improvement Zone of the FitnessGram Test.

The FitnessGram standards are based on a foundation of fitness knowledge research conducted by the Cooper Aerobics Institute and supported by the Centers for Disease Control and Prevention. The Healthy Fitness Zone (HFZ) standards represent an acceptable level of fitness required to maintain an active and healthy lifestyle, as well as, a level of fitness that reduces preventable diseases resulting from a lack of physical exercise or sedentary lifestyle.

Aerobic Capacity

Aerobic capacity is a significant element of physical fitness because it reflects the overall capacity of the cardiovascular and respiratory systems and the capability to carry out extended strenuous exercise (Welk & Meredith, 2008). From a fitness viewpoint, good cardiorespiratory fitness has been shown to lessen the threat (in adults) of hypertension, coronary heart disease, obesity, diabetes, some forms of cancer, and other health problems (Blair, Kohl, Gordon, & Paffenbarger, 1992). Many terms have been used to depict physical fitness, such as cardiovascular fitness, cardiorespiratory fitness, cardiorespiratory endurance, aerobic fitness, and physical working capacity. Even though these expressions may be defined with insignificant deviation, they can all be measured indistinguishable with aerobic capacity. "Because the underlying functional capacity is the construct of most interest in relation to health, and because field tests are actually validated against VO_2max measured in the laboratory, the term aerobic capacity has been used in the FitnessGram materials" (Welk & Meredith, 2008).

The FitnessGram program allowed three different field tests of aerobic capacity: PACER, the one-mile run, and the walk test. Because all three tests gave estimates of VO_2max, direct comparisons could be made between the outcomes from the different tests. While all three tests had established strong reliability and validity against measured VO_2max, they differed in how and where they were administered.

The one-mile run was used to measure the student's aerobic capacity in this study. The reason the researcher chose this assessment is because it is very comparable to the PACER test, and the school that is being assessed used the one-mile run in their physical education programs already for criteria in meeting Fun and Fitness expectations. Cureton

and Warren (1990) evaluated the validity of the original FitnessGram one-mile run criterion-referenced standards using data on 578 children, 7-14 years of age. They found the standards were reasonably valid at classifying VO_2max. The percentage of children classified correctly averaged 85%. In general, for children 9 years of age (third grade) and older, the reliability is moderate or high, with reliability coefficients above .66 (Welk & Meredith, 2008).

Students performed the one-mile run on a flat surface. The school in this study used the gym area around the basketball court to administer the test. Also, because the class sizes were relatively small, (<25), this assessment allowed for all the students in the class to run at one time, while the two physical education teachers and the researcher used the FitnessGram one-mile run sheet to score them. The administration of the test under conditions of abnormally elevated temperature, humidity or wind was avoided, as those elements could have been dangerous or may have lead to an invalid measure of aerobic capacity. Those conditions were avoided, as the test was administered during April with an average temperature of 75 degrees Fahrenheit or below inside the gym. The student's score was recorded in minutes and seconds.

Body Composition – Body Mass Index

The incidence of overweight and obesity has increased considerably in recent years, and the trends are apparent in children as well as adults. Elevated levels of body fat are associated with increased risk of coronary heart disease, stroke, and diabetes. Although children are not commonly in jeopardy for heart disease or stroke, increases in blood pressure and cholesterol transpire in overweight and obese children. Like other

dimensions of fitness, body composition does affect health status and does get better with regular physical activity.

There were various methods available for estimating body composition: underwater/hydrostatic weighing, bioelectrical impedance, skinfold measures, and body mass index (BMI) that was based on height and weight. Each of these methods did involve some limitations leading to an overall measurement error of 2% to 3% for estimates on body fat. Nonetheless, skinfold estimates had a lower prediction error and provided a more direct estimate of body fatness; therefore, this was the recommended approach in FitnessGram (Lohman & Going, 1998). Although the skinfold method was preferred, due to the training involved in using the skinfold method and having to actually physically touch the student to perform the test, the researcher opted (at the request of the principal) to use BMI's as the body composition test.

Abdominal Strength and Endurance

Muscular fitness is viewed as important, because balanced, healthy functioning of the musculoskeletal system requires that muscles be able to exert force or torque (measured as strength), resist fatigue (measured as muscular endurance), and move freely through a full range of motion (measured as flexibility) (Welk & Meredith, 2008). The tracking of neuromuscular fitness has been shown to be moderately high from adolescence to young adulthood (Twisk, Kemper, & vanMechelen, 2000). For these reasons, strength, endurance, and flexibility are viewed as vital dimensions of health related fitness.

The researcher assessed abdominal strength and endurance with the curl-up (knees flexed and feet unanchored) because these basics have been shown to decrease movement of the fifth lumbar vertebra over the sacral vertebrae. This in turn minimizes the activation of the hip flexors, increases the activation of the external and internal obliques and transverse abdominals, and maximizes abdominal muscle activation of the lower and upper rectus abdominals relative to disc compression (load) when compared with a variety of sit-ups (Welk & Meredith, 2008). According to tests performed in the field, the reliability of the curl-up test is higher for college students than for younger children, but the values are satisfactory for this type of assessment. No matter which abdominal assessment is used, better values are consistently found for older students (high school and college), but even those for the younger students are commonly acceptable (Welk & Meredith, 2008). Additional research is required on elementary through high school age students of both sexes. Resolve of validity has been made vulnerable by the lack of an established criterion measure (Anderson, Zhang, Rudisill, & Gaa, 1997). Electromyographical documentation and anatomical analysis provide the primary support for the use of the curl-up test to decide abdominal strength and endurance.

Students worked with a partner during this test. One student performed the test while the other observed. The observing partner kept count and made sure the curl-up was being done properly. The objective of the curl-up test was to complete as many curl-ups as possible. The performing student lay on the mat with their knees bent at an angle of approximately 140 degrees, feet flat on the floor, legs slightly apart, and arms straight and parallel to the trunk with palms of hands resting on the mat. Their fingers were

stretched out and their head was in contact with the mat. It was imperative that their feet were extended as far from their buttocks as possible, while still flat on the floor. The closer their feet were to the buttocks, the harder the movement.

After the performing person was correctly positioned on the mat, his or her partner placed a measuring strip on the mat under their partner's legs so that their fingertips were resting on the nearest edge of the measuring strip. The observing partner then knelt down at the head of the performing partner to count curl-ups and watch for correct technique. The observing partner placed a piece of paper below the performer's head to make sure that they came all the way down and touch the paper with their head. The observer watched for the paper to crumple each time their performing partner touched it with his or her head. The performing partner completed one curl-up every three seconds or twenty every minute. Students were stopped after completing 75 curl-ups, when the second form correction was made, or when they could no longer continue the test.

It was of utmost significance that the curl-up was performed with the proper technique and that students were trained beforehand by the teacher. Scoring was determined by the number of curl-ups performed. Curl-ups were counted when the student's head returned to the mat. For simplicity in giving the test, it was acceptable to count the first incorrect curl-up. In conclusion, it was important the students were allowed some practice time with the curl-up so that proper technique could be practiced and understood.

Trunk Extensor Strength and Endurance

The trunk lift was administered because of its relationship to low back health, which includes proper vertebral alignment. It was important that attention be given to performance and proper technique of this assessment during this test so that injury did not occur. The trunk extensor was performed slowly and carefully. The maximum score on this test was 12 inches, although the average for 5th grade children was between 9 to 12 inches. It was not recommended to encourage hyperextension due to safety. Test-retest studies of the trunk extension test have reported high reliability among high school and college students; however, there are no data on the consistency of results for younger children (Johnson, Miller, & Liemohn, 1997). It should be noted though that the trunk lift was a mandatory test of the FitnessGram in order to gather fitness levels and that most school-aged children pass this test easily.

The objective of this test was to lift the upper body off the floor using the muscles in the back and hold the position to allow for the measurement. A gym mat and a ruler were the only materials needed to administer this test. The test was administered with the performing student lying facedown, with their toes pointed and their hands placed under their thighs. A coin or similar object was placed on the floor in line with the student's eyes. During movement, the student's focus remained on the coin. The performing student lifted their upper body off the floor, in a very slow and controlled manner, to a maximum height of twelve inches. The head maintained a neutral/straight alignment with the spine. The position was held long enough for the test administrator to place the measuring device on the floor and determine the distance to the performing student's chin. The performing student was allowed two trials and the highest score was recorded.

When scoring the student, the examiner could only give a maximum score of twelve inches, even if the student performed at a higher level. It is also important to note performing students stayed focused on the coin and tried not to rise higher than twelve inches. This is very important because the Healthy Fitness Zone does not measure anything higher than twelve inches and excessive arching of the back could cause compression of the spinal discs resulting in injury. Students were informed of this and every attempt was made to prevent injury to the child.

Upper Body Strength and Endurance

Strength and endurance of the muscles in the upper body are very important in daily life. The ninety degree push-up was the recommended test item for upper body strength and endurance of the FitnessGram. This push-up has been adapted from other assessments, such as the modified pull-up, pull-up, and flexed arm hang. It is important to note that although all of these items are intended to measure upper arm and shoulder girdle strength and endurance, they do not all involve the same muscle groups to the same extent, and handling body weight is more of a factor in some than others.

The ninety degree push-up to an elbow angle of ninety degrees was first taught by the teacher and practiced by the students to ensure appropriate technique. The test required little or no equipment, and multiple students were tested at one time. The ninety degree push-up has generally been shown to produce consistent scores, but reliability depends on how it is administered. Due to this factor, the physical education teachers or the researcher assessed each individual student.

The test objective was to perform as many ninety degree push ups as possible at a regular pace. Students should have been able to perform one push-up every three seconds for 20 push-ups every minute. The test ended when the second mistake (form correction) was made. A form correction would be stopping to rest or not maintaining a regular pace, not achieving a ninety degree angle with the elbow on each repetition, not maintaining correct body position with a straight back, or not extending arms fully. The score was the number of ninety degree push-ups performed correctly. For ease in administration, it was permissible to count the first incorrect push up.

Flexibility

Sustaining ample joint flexibility is essential to daily living and functional health. For most young people, decreased flexibility is not an issue. Due to this fact and that many students easily pass the flexibility test, it was optional. However, the researcher thought it would be best to assess students on the backsaver sit and reach test so that she could better understand their overall levels of fitness.

The back-saver sit and reach assessment is comparable to the traditional sit and reach test, except it is performed on one side at a time. By testing one leg at a time, a conclusion can be made regarding asymmetry in hamstring flexibility. This method also helps to avoid hyperextension of both knees. The backsaver sit and reach essentially measures the flexibility of the lower back and hamstrings.

Before the students were assessed, five minutes of rapid walking and stretching were performed. This allowed students to get blood flowing through the muscles so that they could avoid injury and stretch more easily. Reliability data spanning a period of fifty

years have shown that the sit and reach test is extremely consistent, having correlations of .93 to .99 (Gilbert & Plowman, 1993).

Academic Assessment Tools

Information and data collected for the academic portion of this study include students' STAR Reading and STAR Math Percentile Rankings taken during the first semester of the 2008-2009 school year. Both STAR programs are hosted by Renaissance Learning and are supported by reliable scientific research. According to Renaissance Learning,

> Eighty percent of the research on our products has been conducted independently or externally by university researchers, research firms, or school personnel. Study designs include experimental and quasi-experimental well as correlational, case study, and psychometric (reliability and validity) research. Many have been published in peer review journals, and thus upheld to the highest scrutiny (2008).

STAR Reading is a reliable and valid progress-monitoring assessment of general reading achievement and reading comprehension as is STAR Math regarding math achievement. STAR Reading provides norm-referenced reading scores for grades 1–12, criterion-referenced measures of students' instructional reading levels, and a way for teachers to track student growth throughout the year. Both STAR Reading and STAR Math use computer-adaptive technology to tailor each student's test based on responses to previous items. By administering test items that are closely matched to student achievement levels, STAR Reading and STAR Math reliability is enhanced. STAR Math provides accurate estimates of math ability for students in grades 1–12 relative to national norms, criterion-referenced diagnostic assessments of math skills development, and a way to track student

growth throughout the year. Both programs have been deemed reliable and valid by The National Center for Student Progress Monitoring and The Southwest Educational Development Laboratory.

STAR Reading

Reliability is the extent to which a test yields consistent results from one administration of the test to another. To be useful, tests must yield consistent results. During the STAR Reading norming in the spring of 1999, Renaissance Learning collected and analyzed four types of reliability data: split-half, generic, test-retest, and alternate-forms reliability. The final norming sample for STAR Reading 2.0 included a nationally representative mix of approximately 30,000 students from 269 schools. These schools represented 47 states across the United States.

Generic reliability estimates are another way of estimating internal consistency reliability, derived from individual estimates of measurement error. The generic reliability estimates for STAR Reading range from 0.89 to 0.92, and vary little from grade to grade. The split-half and generic reliability estimates are very similar in magnitude, and both coefficients were estimated to be 0.96 with all grades combined (+1.0 represents perfect reliability). These reliability estimates are very high for a test composed of only 25 items deeming it to be a reliable test to assess reading. (Renaissance Learning, 2007).

Test-retest reliability is determined by administering the test twice to the same students. The test-retest reliability estimate for all grades combined is 0.94. Reliability estimates by grade range from 0.79 to 0.91. The reliability estimates for STAR Reading compare favorably with the reliability estimates provided for other published reading

tests. Alternate-forms reliability estimates were calculated based on students' scores from STAR Reading 1.2 and STAR Reading 2.0 tests. The correlation was 0.95 for the 4,551 students who took both tests (Renaissance Learning, 2007).

The validity of an assessment is the degree to which it measures what it is intended to measure. Validity is often used to judge a test's usefulness. For STAR Reading to measure reading achievement, its scores should correlate highly with other measures of reading achievement. During the STAR Reading norming study, schools submitted their students' STAR Reading results along with data on how their students performed on other popular standardized tests. Usable scores were received for more than 10,000 students. According to Renaissance Learning, the within-grade average concurrent validity coefficient was .76 for grades 1 through 6. The other validity coefficient within-grade average was .73 for grades 1 through 6. The overall estimate of the validity of STAR Reading is .72, with a standard error of .005. The true validity is estimated to lie within the range of .71 to .73, with a 95 percent confidence level. The extent that the STAR Reading 2.x test correlates with these tests provides support for STAR Reading construct validity (Renaissance Learning, 2007).

STAR Math

STAR Math was normed in the spring of 2002. Renaissance Learning obtained a nationally representative sample by selecting school districts and schools based on their geographic location, per-grade district enrollment, and socioeconomic status. The final norming sample for STAR Math included approximately 29,200 students from 312 schools in 48 states. In the course of STAR Math norming, Renaissance Learning collected and analyzed three types of reliability data: split-half, generic, and alternate-

forms reliability. The split-half and generic coefficients are estimates of internal consistency reliability; the alternate-forms coefficients are estimates of the reliability of repeat administrations of STAR Math.

The generic reliability estimates range from 0.79 to 0.87, and vary little from grade to grade. The split-half and generic reliability estimates are very similar in magnitude, and the coefficients were estimated to be 0.94 and 0.95, respectively, for all grades combined (+1.0 represents perfect reliability). These reliability estimates are very high for a test composed of only 24 items. The alternate-forms reliability estimates for grades 1 through 12 are fairly high—ranging from 0.72 to 0.79 (Renaissance Learning, 2007). However, because split-half and generic reliability estimates are subject to fewer sources of measurement error than alternate-forms reliability, the split-half and generic reliability estimates are higher. These estimates compare favorably with the reliability estimates provided for other published math achievement tests.

To ensure validity, for STAR Math to measure math achievement, its scores should correlate highly with other measures of math achievement. During the STAR Math norming study, schools submitted their students' STAR Math results along with data on how their students performed on other popular standardized tests. Usable scores were received for more than 10,000 students. The within-grade average concurrent validity coefficients for grades 1–6 varied from 0.63–0.71, with an overall average of 0.67. The other validity coefficient within-grade averages varied from 0.56–0.70; the overall average was 0.63. Predictive validity coefficients ranged from 0.55–0.73 in grades 1–6 with an average of 0.67 (Renaissance Learning, 2007).

Grade Point Averages

Grade Point Averages (GPA's) for the first semester of the 2008-2009 school year were also used for the academic data in this study. GPA's were calculated by the researcher and used to determine academic achievement. Although the researcher acknowledges the lack of validity and reliability among GPA's due to uncontrollable variables such as teacher preference, grading practices, student intrinsic motivation, and parental involvement, she chose to collect the data as an alternate form of academic achievement under the guidance of several professors.

Procedures

The researcher obtained the physical fitness data by working with the certified physical education teachers to administer the FitnessGram Assessment. She viewed the FitnessGram DVD several times to assure proper technique while assessing the students and administering the tests. They viewed the DVD and helped distribute handouts that clearly explained how the assessments were to be given. It was determined that all of the fitness information being collected for the FitnessGram Assessment was already required for both the Coordinated School Health Program and the Fun and Fitness Program previously being performed by the school on the selected students.

A parental consent form was deemed unnecessary by both the school principal and the university's IRB. The students were assessed during their regular physical education time, and because all information was confidential and anonymous, both she and the university's IRB did not see the need for consent to be given. Students were given a code to use for the data collection and names were used.

The accumulated testing time was approximately 200 minutes over several class periods, and the assessments were given during regular physical education class; therefore, no other classes were disturbed, and the school day was unchanged. Physical education teachers at the school were trained on the use of the FitnessGram prior to conducting the assessments with their students. The researcher met with the teachers and demonstrated how the tests were to be conducted, and she helped in the testing of the students.

Fifth Grade reading and math teachers administered the STAR Reading and STAR Math computer-assisted tests during the first semester of the 2008-2009 school year, as was done every year. GPA's were calculated for the first semester and compiled with data from STAR Math and STAR Reading. The researcher gathered the percentile rankings of the students from STAR Reading and STAR Math, along with GPA's and compared them with the results of the FitnessGram assessment fitness levels so as to determine whether or not a relationship existed between physical fitness and academic achievement.

Data Analysis

Data was analyzed to assess if relationships existed among the FitnessGram Fitness Level Scores and academic achievement by comparing fitness levels to STAR Math Percentile Ranks, STAR Reading Percentile Ranks, Grade Point Averages, and gender. Data was entered into Microsoft Excel and then analyzed using the statistical program Analyse-it to determine if any relationships existed among the data. Multiple regression was used examine the relationships among FitnessGram Fitness Level Scores, STAR Reading Percentile Ranks, STAR Math Percentile Ranks, GPA's, and Gender

(Male vs. Female) with statistical significance at $p < 0.05$ and $R > 0.195$ values at a 95% Confidence Interval.

The physical fitness data was collected, placed into the FitnessGram software, and calculated to determine whether it was in the Healthy Fitness Zone or Needs Improvement Zone. The software calculated this automatically when the data was input by the researcher, and the data was be reported through percentages, means, medians, frequencies, and standard deviations. Students were also assigned a fitness score of 0-6 based on how many fitness tests they scored within the HFZ. By ranking students in this manner, it helped the researcher determine the degree of fitness for each student along with assigning a numerical rating for the quantitative study. The FitnessGram fitness level scores, along with academic percentiles for STAR Reading and STAR Math, GPA's and Gender were entered into Microsoft Excel and then analyzed using the statistical program Analyse-it running multiple regression. Finally, the data was displayed through narrative text, tables, and graphs.

Summary

This chapter has explained methods used for this quantitative study in the researcher's attempt to assess fifth grade students' fitness levels as compared to the HFZ, and academic achievement using STAR Reading and Math Percentiles along with GPA's in order to compare physical fitness to academic achievement based on the premise that the health and physical fitness of the child has an effect on his or her ability to learn and to achieve academically. Gender was also analyzed to determine if it played a role in the relationship between fitness and academic achievement. The next chapter presents the findings that were obtained from the methods used.

Chapter Four: Findings

Introduction

As stated in Chapter 1, the purpose of this study was to determine fifth grade students' fitness levels using the FitnessGram Assessment Tool, and academic achievement using STAR Reading Percentiles, STAR Math Percentiles, and Grade Point Averages in order to compare physical fitness to academic achievement based on the premise that the health and physical fitness of the child has an effect on his or her ability to learn and to achieve academically. Study in this area was warranted because physical fitness is significantly important for all students and because more research is needed in the comparison of physical fitness to academic achievement. It was hypothesized that:

- There will be a significant positive relationship between physical fitness levels based on the FitnessGram Physical Fitness Assessment Program and academic achievement based on STAR Reading Percentiles, STAR Math Percentiles, and Grade Point Averages.

The Null Hypothesis stated:

- There will not be a significant positive relationship between physical fitness levels based on the FitnessGram Physical Fitness Assessment Program and academic achievement based on STAR Reading Percentiles, STAR Math Percentiles, and Grade Point Averages.

In addition to the hypotheses stated above, a research objective was added. Data was collected to compare gender, academic achievement, and FitnessGram fitness levels. These groups were compared statistically and results are reported.

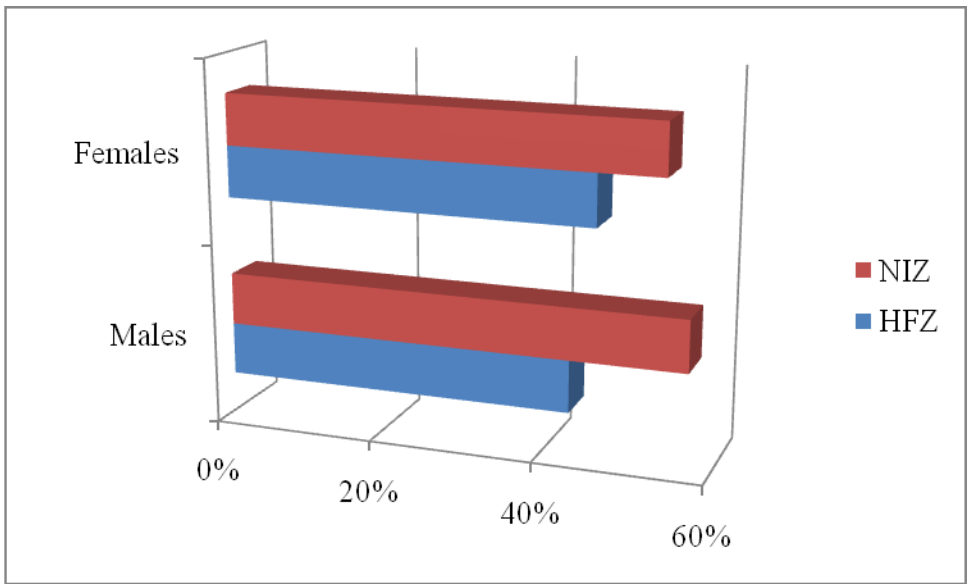
The results of this study will contribute to the existing body of knowledge by assisting academic leaders and administrators in making better decisions about physical fitness programs within the school day along with promoting daily physical education while improving academic achievement. Findings from this study suggest that educational leaders re-evaluate the need for daily physical education in schools so that students can meet and maintain an overall level of physical fitness, thereby contributing to academic achievement. Keep in mind however, that a correlational study does not prove causality so results should be interpreted with caution.

Findings

One hundred thirteen individuals participated in the study; sixty-five (58%) were Male, and forty-eight (42%) were Female. Twenty-nine (26%) participants were ten years of age, seventy-one (63%) were eleven, and thirteen (11%) were twelve. Overall, twenty-eight (43%) of the males scored within the HFZ, while twenty-two (46%) of the females scored within the HFZ (see Figure 4.1). The breakdown per test for males who scored in the HFZ per test on the FitnessGram Assessment is as follows (see Figure 4.2): One Mile Run, forty-seven (72%); Body Mass Index, thirty-nine (60%); Curl-Up, sixty-three (97%); Trunk Lift, fifty (77%); Push-Up, forty-seven (72%); Back-Saver Sit and Reach, sixty (92%). The breakdown per test for females who scored in the HFZ per test on the FitnessGram Assessment is as follows: One Mile Run, thirty-six (75%); Body Mass Index, thirty-six (75%); Curl-Up, forty-five (94%); Trunk Lift, thirty-eight (79%); Push-Up, thirty-six (75%); Back-Saver Sit and Reach, forty-three (90%).

Figure 4.1

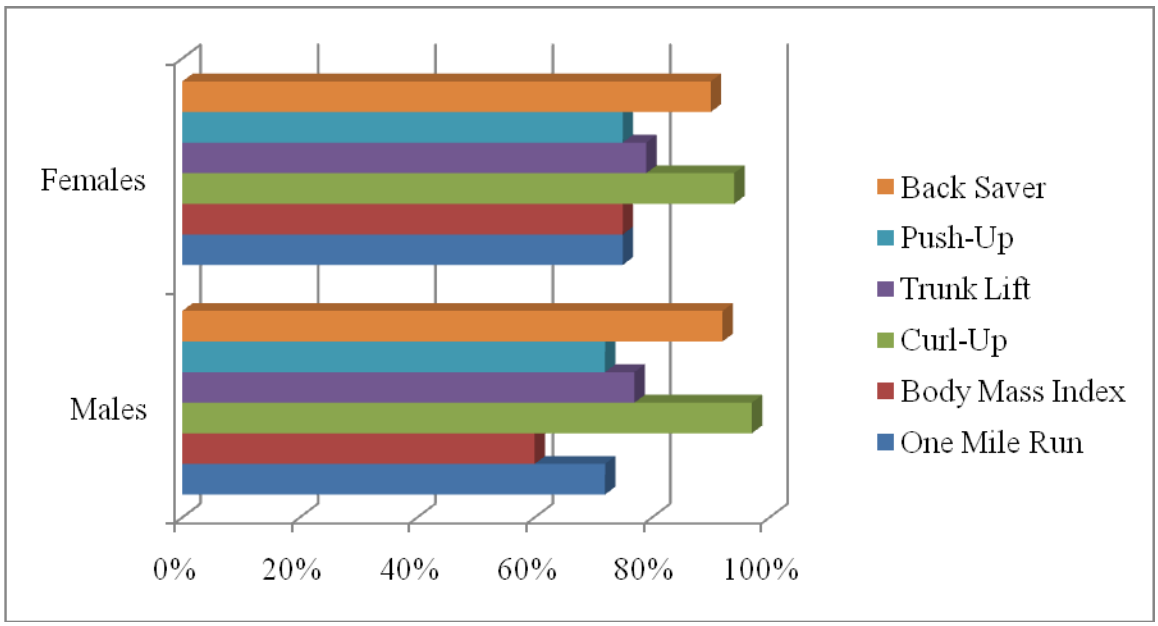
Percentages of Males and Females who Scored in the HFZ and NIZ



The percentages for both males (43%) and females (46%) falling within the HFZ overall indicate a relatively low to moderate level of physical fitness among the students tested for this research. Results showed that males and females exhibited close percentages in both the HFZ and NIZ categories. This finding could imply on its' own that gender does not play a significant role in the relationship between physical fitness and academic achievement in this study. However, these percentages show that not even half of the students tested fell within the HFZ which should sound an alarm of concern amongst the students, parents, and educational leaders alike.

Figure 4.2

Percentages of Males and Females who Scored in the HFZ per Test



The only major difference in percentages of males and females falling within the HFZ to be noted here is in the Body Mass Index category. Only 60% of the males, as opposed to 75% of the females, scored within the HFZ. Due to obesity and overweight being on the rise in children, this finding could imply that males are struggling more than females with weight.

Multiple Regression

Multiple regression is a correlational procedure that looks at the relationships among several variables (Ary, Jacobs, & Sorenson, 2006). Specifically, it enables researchers to find the best possible weighting of two or more independent variables to yield a maximum correlation with a single dependent variable. Multiple regression is used when a researcher wants to assess if variables (FitnessGram Score Levels and Academic Achievement) are related and also to what degree they are related. Statistical significance was determined at $p < 0.05$ and $R > 0.195$ values with a 95% Confidence

Interval. Three multiple regressions were conducted to examine if relationships exist between FitnessGram Score Levels (HFZ 0-6) and STAR Math Percentiles (Table 4.1, Figure 4.3), STAR Reading Percentiles (Table 4.2, Figure 4.4), and GPA's (Table 4.3, Figure 4.5).

Table 4.1

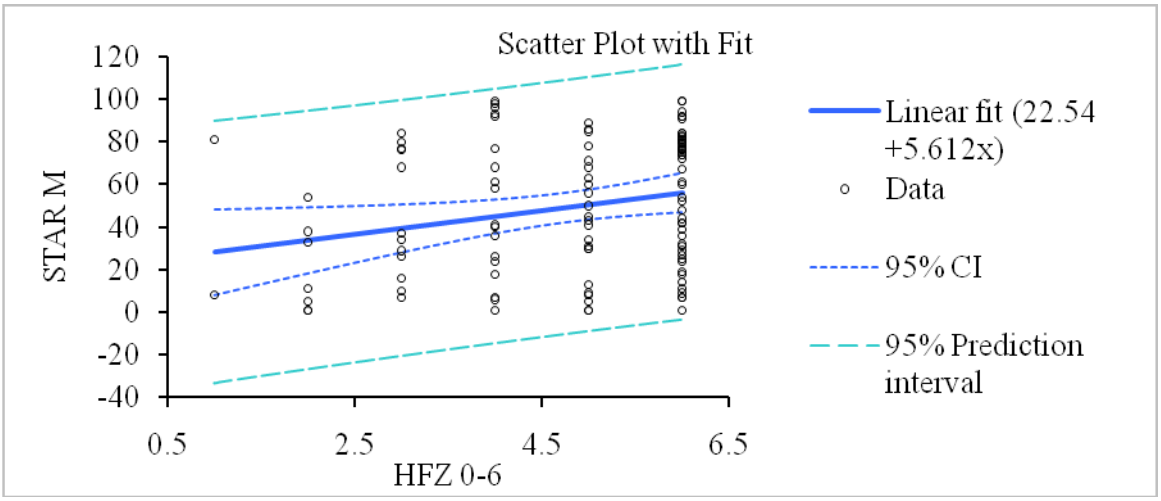
HFZ Levels and STAR Math Percentiles

n	113
R	0.26
R^2	0.07
Adjusted R^2	0.06
SE	30.0

Term	Coefficient	95% CI		SE	t statistic	DF	P
Intercept (STAR M)	22.54	2.66	to 42.41	10.030	2.25	111	0.0266
Slope (HFZ)	5.612	1.621	to 9.603	2.0142	2.79	111	0.0063

Figure 4.3

HFZ Levels and STAR Math Percentiles



The coefficient of multiple correlation (R = 0.26) indicates a moderate degree of correlation between fitness levels and STAR Math Percentiles. Since the coefficient of

multiple correlation is above 0.195, it is considered to be statistically significant. Due to this result, the researcher accepted the hypothesis thereby linking fitness and Math achievement. Two other factors led to this decision also, the value of *p* and the *t* statistic. The *p* value is 0.0063 (< 0.05), meaning that physical fitness is a significant predictor of STAR Math Percentiles, and a *t* statistic of 2.79 (> 2.0) indicating a strong correlation among the variables also. However, only 6% of the variance in STAR Math Percentiles can be accounted for by HFZ levels, leaving 94% unexplained with a Standard Error of 30.0 indicating low reliability.

Table 4.2

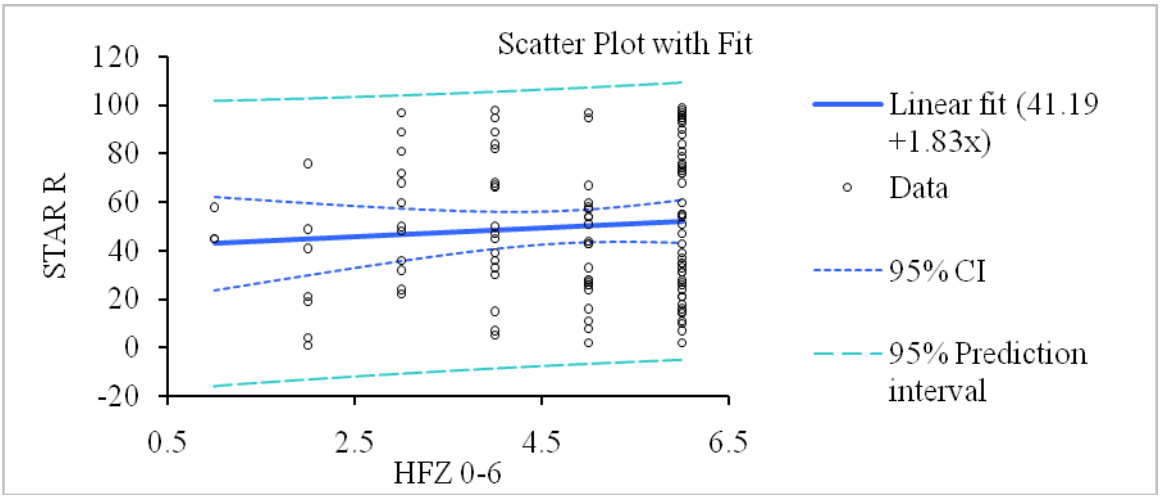
HFZ Levels and STAR Reading Percentiles

n	113
R	0.09
R^2	0.01
Adjusted R^2	0.00
SE	28.6

Term	Coefficient	95% CI	SE	t statistic	DF	p
Intercept (STAR R)	41.19	22.21 to 60.16	9.577	4.30	111	<0.0001
Slope (HFZ)	1.83	-1.98 to 5.64	1.923	0.95	111	0.3435

Figure 4.4

HFZ Levels and STAR Reading Percentiles



The coefficient of multiple correlation (R = 0.09) indicates no correlation between fitness levels and STAR Reading Percentiles. Since the coefficient of multiple correlation is below 0.195, it is considered to be statistically nonsignificant. Due to this result, the researcher retained the null hypothesis meaning there is no relationship between fitness and the academic predictor Reading. Two other factors led to this decision also, the value of *p* and the *t* statistic. The *p* value is 0.3435 (> 0.05), meaning that physical fitness is not a significant predictor of STAR Reading Percentiles, and a *t* statistic of 0.95 (< 2.0) indicating no correlation among the variables also. 0% of the variance in STAR Reading Percentiles can be accounted for by HFZ levels, leaving 100% unexplained with a Standard Error of 28.6 indicating low reliability.

Table 4.3

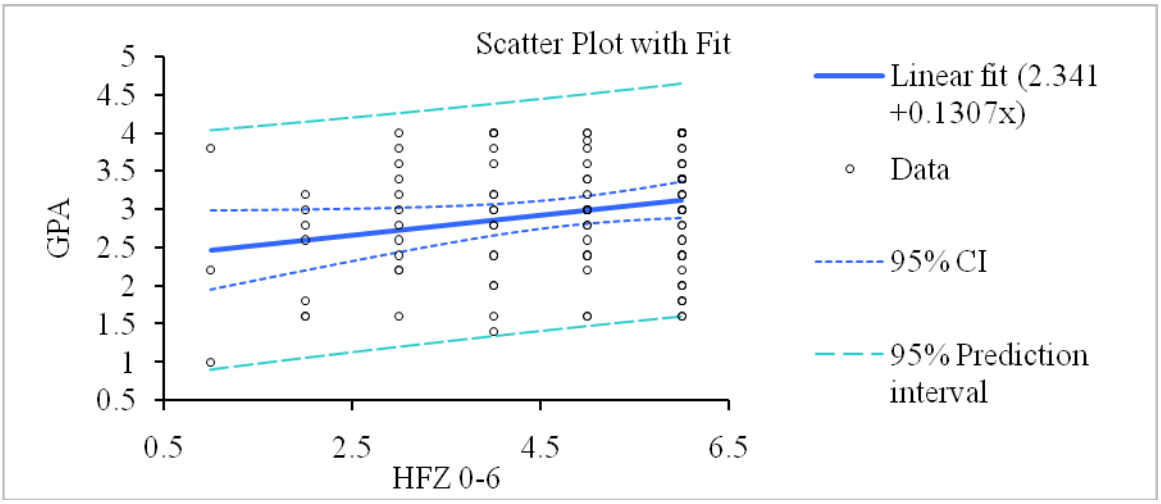
HFZ Levels and Grade Point Averages

n	113
R	0.23
R^2	0.06
Adjusted R^2	0.05
SE	0.76

Term	Coefficient	95% CI		SE	t statistic	DF	P
Intercept (GPA)	2.341	1.834	to 2.848	0.2558	9.15	111	<0.0001
Slope (HFZ)	0.1307	0.0288	to 0.2325	0.05138	2.54	111	0.0124

Figure 4.5

HFZ Levels and Grade Point Averages



The coefficient of multiple correlation (R = 0.23) indicates a low degree of correlation between fitness levels and GPA's. However, since the coefficient of multiple correlation is above 0.195, it is considered to be statistically significant. In this case, the hypothesis was supported showing a relationship between overall academic achievement and physical fitness. Two other factors led to this decision: the value of *p* and the *t* statistic. The *p* value is 0.0124 (< 0.05), meaning that physical fitness is a significant

predictor of GPA's, and a *t* statistic of 2.54 (> 2.0) indicating a strong correlation among the variables also. However, only 5% of the variance in GPA's can be accounted for by HFZ levels, leaving 95% unexplained. Although a Standard Error of 0.76 indicates high reliability.

Once the above results were found, the researcher chose to conduct six additional multiple regressions to examine the relationships among STAR Math, STAR Reading, GPA and HFZ Levels (Tables 4.4 – 4.9, Figures 4.6 – 4.11) in order to determine which variables had an affect on others and which ones did not. Gender was also analyzed yielding correlation coefficients between 0.03 – 0.17 which all conclude that no relationship exists among Gender and any of the other variables (fitness or academic) in this study. More explanation on Gender is provided in Chapter Five.

Table 4.4

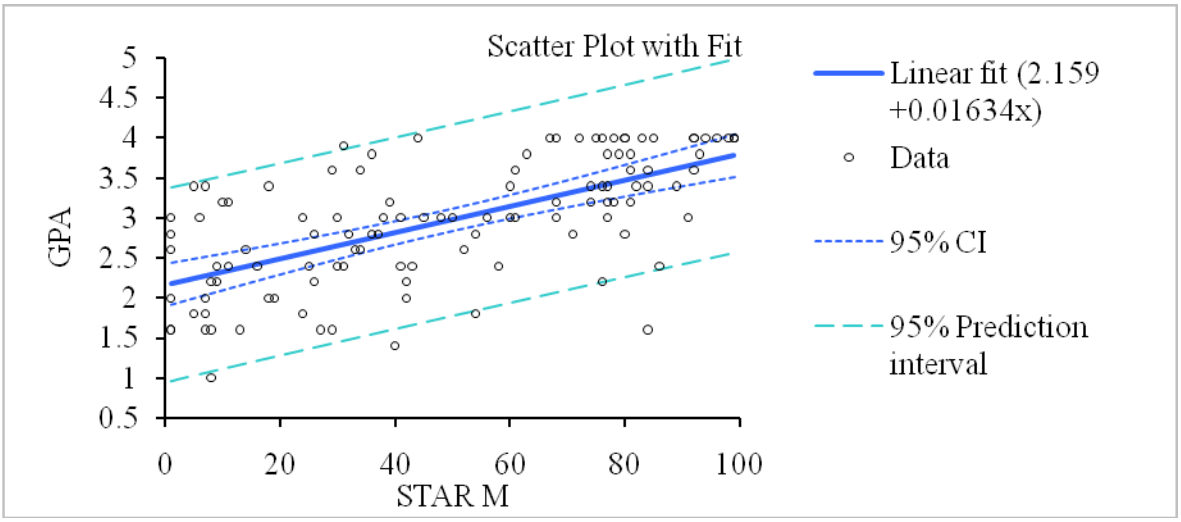
STAR Math Percentiles and Grade Point Averages

n	113
R	0.64
R^2	0.41
Adjusted R^2	0.41
SE	0.60

Term	Coefficient	95% CI		SE	t statistic	DF	P
Intercept (GPA)	2.159	1.947	to 2.371	0.1071	20.16	111	<0.0001
Slope (STAR M)	0.01634	0.01269	to 0.01999	0.001842	8.87	111	<0.0001

Figure 4.6

STAR Math Percentiles and Grade Point Averages



The coefficient of multiple correlation (R = 0.64) indicates a moderate degree of correlation between STAR Math Percentiles and GPA's. Since the coefficient of multiple correlation is above 0.195, it is considered to be statistically significant. The *p* value is < 0.0001 (< 0.05), meaning that STAR Math Percentiles are a significant predictor of GPA's, and a *t* statistic of 8.87 (> 2.0) indicating a strong correlation among the variables also. 41% of the variance in GPA's can be accounted for by STAR Math Percentiles, leaving 59% unexplained, although a Standard Error of 0.60 indicates high reliability.

Table 4.5

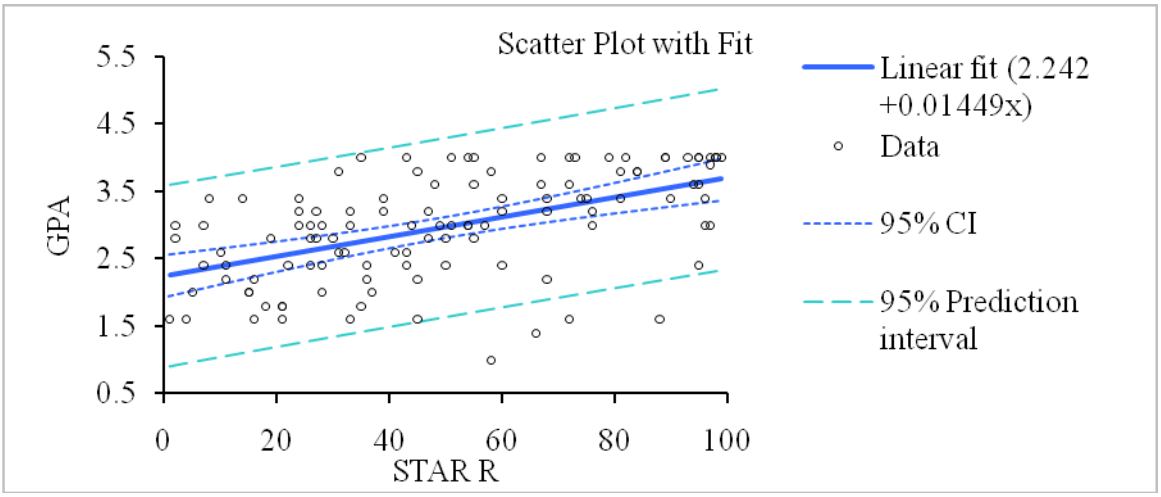
STAR Reading Percentiles and Grade Point Averages

n	113
R	0.53
R^2	0.28
Adjusted R^2	0.27
SE	0.67

Term	Coefficient	95% CI		SE	t statistic	DF	P
Intercept (GPA)	2.242	1.991	to 2.493	0.1267	17.70	111	<0.0001
Slope (STAR R)	0.01449	0.01012	to 0.01886	0.002204	6.57	111	<0.0001

Figure 4.7

STAR Reading Percentiles and Grade Point Averages



The coefficient of multiple correlation (R = 0.53) indicates a moderate degree of correlation between STAR Reading Percentiles and GPA's. Since the coefficient of multiple correlation is above 0.195, it is considered to be statistically significant. The *p* value is < 0.0001 (< 0.05), meaning that STAR Reading Percentiles are a significant predictor of GPA's, and a *t* statistic of 6.57 (> 2.0) indicating a strong correlation among the variables also. However, only 27% of the variance in GPA's can be accounted for by

STAR Reading Percentiles, leaving 73% unexplained. Although a Standard Error of 0.67 indicates high reliability.

Since both STAR Reading Percentiles (R = 0.53) and STAR Math Percentiles (R = 0.64) showed moderate correlations with GPA's, the researcher ran another multiple regression to determine if HFZ Levels, combined with STAR Reading and Math Percentiles would have any effect on the correlation amongst the variables.

Table 4.6

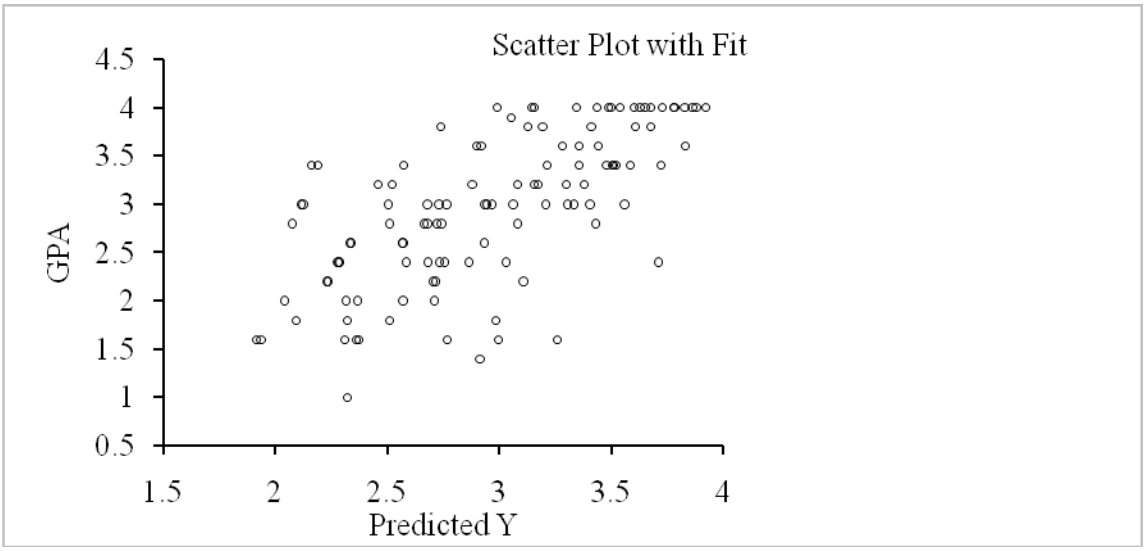
HFZ Levels, STAR Math Percentiles, STAR Reading Percentiles and Grade Point Averages

n	113
R	0.68
R^2	0.46
Adjusted R^2	0.44
SE	0.59

Term	Coefficient	95% CI		SE	t statistic	DF	P
Int. (GPA)	1.8	1.4	to 2.2	0.21	8.50	109	<0.0001
HFZ 0-6	0.05039	-0.03053	to 0.13132	0.040830	1.23	109	0.2198
STAR M	0.0122	0.0076	to 0.0168	0.00230	5.30	109	<0.0001
STAR R	0.006458	0.001681	to 0.011235	0.0024101	2.68	109	0.0085

Figure 4.8

HFZ Levels, STAR Math Percentiles, STAR Reading Percentiles and Grade Point Averages



The coefficient of multiple correlation (R = 0.68) indicates a moderate degree of correlation among HFZ Levels, when combined with STAR Math and STAR Reading Percentiles, and GPA's. Since the coefficient of multiple correlation is above 0.195, it is considered to be statistically significant. This finding supports the hypothesis showing a positive relationship between physical fitness and academic achievement. However, 44% of the variance in GPA's can be accounted for by HFZ Levels, and STAR Math and STAR Reading Percentiles, leaving 56% unexplained. Although a Standard Error of 0.59 indicates high reliability.

Table 4.7

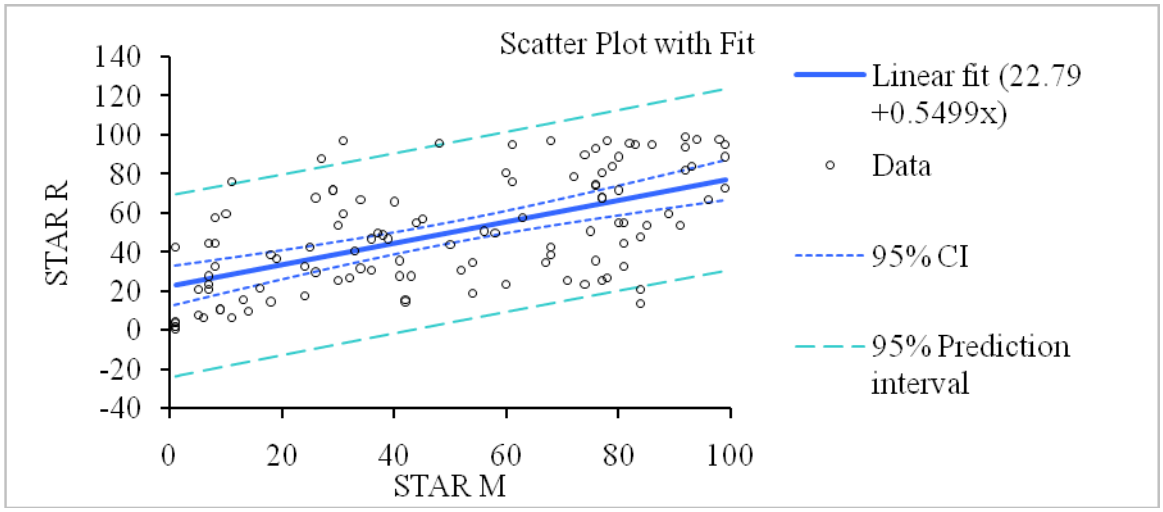
STAR Math Percentiles and STAR Reading Percentiles

n	113
R	0.59
R^2	0.35
Adjusted R^2	0.35
SE	23.1

Term	Coefficient	95% CI		SE	t statistic	DF	P
Int. (STAR R)	22.79	14.63	to 30.95	4.117	5.53	111	<0.0001
Slope (STAR M)	0.5499	0.4096	to 0.6902	0.07082	7.76	111	<0.0001

Figure 4.9

STAR Math Percentiles and STAR Reading Percentiles



The coefficient of multiple correlation (R = 0.59) indicates a moderate degree of correlation between STAR Math Percentiles and STAR Reading Percentiles. Since the coefficient of multiple correlation is above 0.195, it is considered to be statistically significant. The *p* value is < 0.0001 (< 0.05), meaning that STAR Math Percentiles are a significant predictor of STAR Reading Percentiles, and a *t* statistic of 7.76 (> 2.0) indicating a strong correlation among the variables also. However, only 35% of the

variance in STAR Reading Percentiles can be accounted for by STAR Math Percentiles, leaving 65% unexplained with a Standard Error of 23.1 indicating low reliability.

Since both STAR Math Percentiles (R = 0.59) and GPA's (R = 0.53) showed moderate correlations with STAR Reading Percentiles, the researcher ran an additional multiple regression to determine if HFZ Levels, combined with STAR Math Percentiles and GPA's would have any effect on the correlation amongst the variables.

Table 4.8

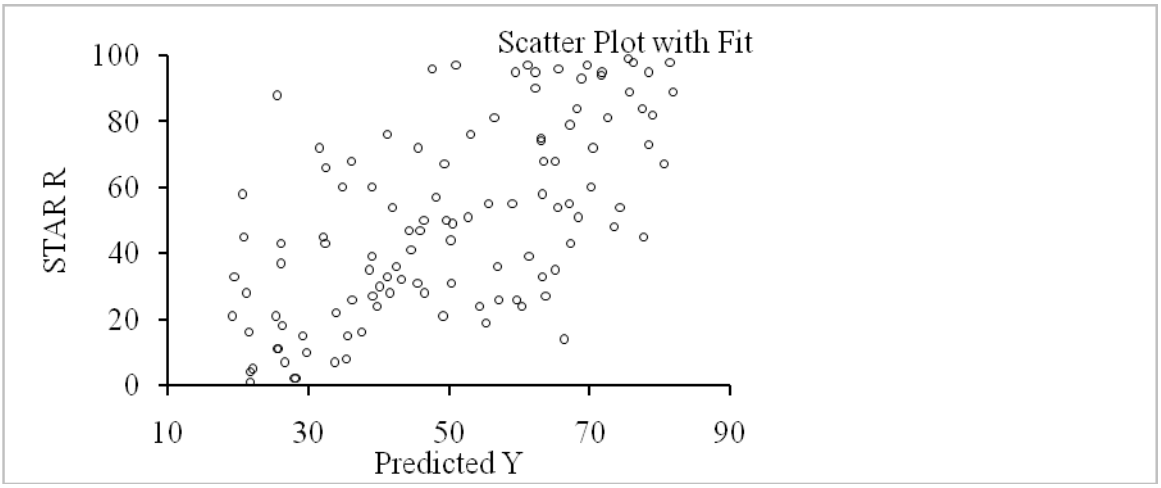
HFZ Levels, STAR Math Percentiles, Grade Point Averages and Star Reading Percentiles

n	113
R	0.63
R^2	0.40
Adjusted R^2	0.38
SE	22.5

Term	Coefficient	95% CI		SE	t statistic	DF	p
Int. (STAR R)	9.455	-11.302	to 30.212	10.4728	0.90	109	0.3686
HFZ 0-6	-1.743	-4.863	to 1.376	1.5738	-1.11	109	0.2704
STAR M	0.4139	0.2333	to 0.5944	0.09110	4.54	109	<0.0001
GPA	9.569	2.491	to 16.648	3.5713	2.68	109	0.0085

Figure 4.10

HFZ Levels, STAR Math Percentiles, Grade Point Averages and Star Reading Percentiles



The coefficient of multiple correlation (R = 0.63) indicates a moderate degree of correlation among HFZ Levels, when combined with STAR Math Percentiles and GPA's, and STAR Reading Percentiles. Since the coefficient of multiple correlation is above 0.195, it is considered to be statistically significant. Once again, this results in the acceptance of the hypothesis linking academic achievement and physical fitness. However, only 38% of the variance in STAR Reading Percentiles can be accounted for by HFZ Levels, and STAR Math Percentiles and GPA's, leaving 62% unexplained with a Standard Error of 22.5 indicating low reliability.

Since both STAR Reading Percentiles (R = 0.59) and GPA's (R = 0.64) showed moderate correlations with STAR Math Percentiles, the researcher ran another multiple regression to determine if HFZ Levels, combined with STAR Reading Percentiles and GPA's would have any effect on the correlation.

Table 4.9

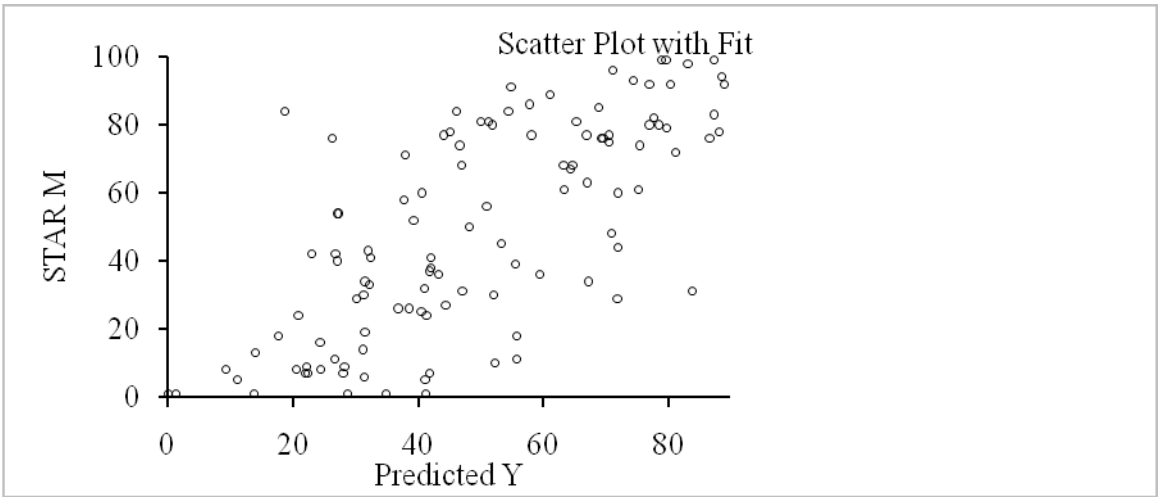
HFZ Levels, STAR Reading Percentiles, Grade Point Averages and Star Math Percentiles

n	113
R	0.72
R^2	0.52
Adjusted R^2	0.50
SE	21.7

Term	Coefficient	95% CI		SE	t statistic	DF	p
Int. (STAR M)	-32.64	-51.74	to -13.53	9.640	-3.39	109	0.0010
HFZ 0-6	2.713	-0.267	to 5.693	1.5036	1.80	109	0.0739
STAR R	0.3847	0.2169	to 0.5525	0.08467	4.54	109	<0.0001
GPA	16.8	10.5	to 23.1	3.17	5.30	109	<0.0001

Figure 4.11

HFZ Levels, STAR Reading Percentiles, Grade Point Averages and Star Math Percentiles



The coefficient of multiple correlation (R = 0.72) indicates a moderate degree of correlation among HFZ Levels, when combined with STAR Reading Percentiles and GPA's, and STAR Math Percentiles. Since the coefficient of multiple correlation is above

0.195, it is considered to be statistically significant, therefore the hypothesis was supported yet again, linking fitness and academic achievement. 50% of the variance in STAR Math Percentiles can be accounted for by HFZ Levels, and STAR Reading Percentiles and GPA's, leaving 50% unexplained with a Standard Error of 21.7 indicating low reliability.

Summary

The results for both males and females falling within the HFZ overall indicate a relatively low to moderate level of physical fitness among the students tested for this research. Results also showed that males and females exhibited close percentages in both categories. The only difference in percentages of males and females falling within the HFZ to be noted was in the Body Mass. Only 60% of the males, as opposed to 75% of the females, scored within the HFZ. Research indicates that elevated levels of body fat are associated with increased risk of coronary heart disease, stroke, and diabetes. Although children are not commonly in jeopardy for heart disease or stroke, increases in blood pressure and cholesterol transpire in overweight and obese children.

The results presented above indicate a varying degree of correlation between physical fitness and academic achievement. The coefficient of multiple correlation is considered significant between HFZ Levels and GPA's and also between HFZ Levels and STAR Math Percentiles which proves consistent with other studies conducted in this field of research discussed later in Chapter Five. There was no relationship found between HFZ Levels and STAR Reading Percentiles, of which the researcher was intrigued, with possible explanations being provided in the next chapter. Since two of the predictors showed a positive correlation with statistically significant results, this research supports

the hypothesis of a positive relationship existing between fitness levels and academic achievement, especially with math and overall achievement. This correlation improved when fitness levels were combined with academic measures to predict outcomes. The strongest relationship was between HFZ Levels (when combined with STAR Reading Percentiles and GPA's) to predict STAR Math Percentiles.

Due to the positive findings in this study as well as others, it is important for educational leaders to recognize the need for daily physical activity so that health benefits and academic success will be reflected in the process. In addition, according to Smith and Lounsbery (2009), there are both physical, as well as social benefits of participation in physical activity. The physical benefits include improved physical fitness, decreased risk of chronic diseases, and improved health status. Improved relationships with parents, improved mood, increased involvement in extracurricular activities, decreased drug use, and increased self-esteem which may account for higher grade-point averages are among the social benefits found by Field, Diego, and Sanders (2001). As stated before, the researcher did not attempt to determine causality, so it cannot be inferred from this data that physical fitness causes academic achievement to increase or vice versa. However, since statistically significant results were yielded, this study supports other claims of a relationship existing between fitness and academic achievement which contributes to the educational arena of research in this field. A more detailed summary and discussion of the findings are presented in the next chapter.

Chapter Five: Summary, Conclusions, and Recommendations

Introduction

Chapter Five includes a statement of the problem influencing the study along with the methodology used, plus a summary of the results and a discussion of the findings related to the study. Implications for practice are discussed as are limitations of the study. In addition, recommendations are provided for further practice and research in the area of physical fitness and academic achievement.

Summary

Introduction

Learning is not done in isolation; there are numerous factors and components that affect learning. Physical activity lends itself to physical fitness which is only one of the many factors that effect academic performance. Nevertheless, schools must recognize and act on the direct connection between good health, physical fitness, and achievement. Together, schools and families can develop healthy students by articulating a common vision and supporting the health and well-being of students. As early as 1983, E. L. Boyer from the Carnegie Foundation for the Advancement of Teaching underscored the importance of such an approach by stating, "Clearly, no knowledge is more crucial than knowledge about health. Without it, no other life goal can be successfully achieved."

Change is desperately needed. According to Tennessee Coordinated School Health Director Connie Givens (2009),

> Tennessee ranks among the highest states in the nation for the incidence of heart disease, stroke and diabetes. Forty-one percent of students in the state's schools

> are overweight or obese. These adolescents have a 70 percent chance of becoming overweight adults who are subject to these life-threatening health conditions (Capitol Hill Week in Review, para. 14).

Considering the current state of affairs of our children, there is a mounting awareness that thorough research is needed to examine the relationship between physical fitness and academic achievement among school aged children. The educational system must begin to offer solutions to these health-related problems through physical education. This study aimed to find a connection between physical fitness and academic achievement, and report the findings. The linkage of physical fitness to academic achievement will help schools become more focused on the task at hand. This study contributes to the existing body of knowledge by assisting academic leaders and administrators to make better decisions about physical fitness programs within the school day along with promoting daily physical education while improving academic achievement.

Purpose

The purpose of this study was to determine fifth grade students' fitness levels using the FitnessGram Assessment Tool, and academic achievement using STAR Reading Percentiles, STAR Math Percentiles, and Grade Point Averages in order to compare physical fitness to academic achievement based on the premise that the health and physical fitness of the child has an effect on his or her ability to learn and to achieve academically. This study did not attempt to determine causality. The researcher sought to build on and add to the previous correlational research by documenting the strength of the relationship between physical fitness and academic achievement. By using the FitnessGram Assessment Tool, fifth grade students from a rural East Tennessee Title I

middle school were assessed on upper body strength and endurance, flexibility, abdominal strength and endurance, aerobic capacity and body composition. The research occurred during the first and second semesters of the 2008–2009 school year.

Participants

The population for this study consisted of 113 (65 males and 48 females) fifth grade students from a rural East Tennessee Title I middle school. Approximately 62% of these fifth graders qualified for a free or reduced lunch rate. Of those 113 students, 96 were Caucasian, 3 were African American, 1 student was Asian, and 3 were Hispanic. All 113 students were proficient in English. The attendance rate was fair at 93.7 percent within the population sample. The transfer rate for 2008-2009 was 34 percent with the withdrawal rate at 32 percent.

The students' fitness levels were assessed using the FitnessGram Assessment Program to determine if the students were within the Healthy Fitness Zone, or if they needed improvement. Academic data was determined by using STAR Reading Percentiles, STAR Math Percentiles, and Grade Point Averages. Demographic data, such as the students' gender was also obtained, and correlations between that variable and fitness level and academic achievement test results were evaluated.

Methods

The researcher obtained the physical fitness data by working with the certified physical education teachers to administer the FitnessGram Assessment. It was determined that all of the fitness information being collected for the FitnessGram Assessment was already required for both the Coordinated School Health Program and the Fun and Fitness Program previously being performed by the school on the selected students. The

accumulated testing time was approximately 200 minutes over several class periods, and the assessments were given during regular physical education class; therefore, no other classes were disturbed, and the school day was unchanged.

A parental consent form was deemed unnecessary by both the school principal and the university's IRB. The students were assessed during their regular physical education time, and because all information was confidential and anonymous, both she and the university's IRB did not see the need for consent to be given. Students were given a code to use for the data collection and names were used.

Fifth Grade reading and math teachers administered the STAR Reading and STAR Math computer-assisted tests during the first semester of the 2008-2009 school year, as was done every year. GPA's were calculated for the first semester and compiled with data from STAR Math and STAR Reading. Data was analyzed to assess if relationships existed among the FitnessGram Fitness Level Scores and academic achievement by comparing fitness levels to STAR Math Percentile Ranks, STAR Reading Percentile Ranks, Grade Point Averages, and gender. Data was entered into Microsoft Excel and then analyzed using the statistical program Analyse-it to determine if any relationships existed among the data. Multiple regression was used examine the relationships among FitnessGram Fitness Level Scores, STAR Reading Percentile Ranks, STAR Math Percentile Ranks, GPA's, and Gender (Male vs. Female).

The physical fitness data was collected, placed into the FitnessGram software, and calculated to determine whether it was in the Healthy Fitness Zone or Needs Improvement Zone. The software calculated this automatically when the data was input by the researcher, and the data was be reported through percentages, means, medians,

frequencies, and standard deviations. Students were also assigned a fitness score of 0-6 based on how many fitness tests they scored within the HFZ. By ranking students in this manner, it helped the researcher determine the degree of fitness of each student along with assigning a numerical rating. The FitnessGram fitness level scores, along with academic percentiles for STAR Reading and STAR Math, GPA's and Gender were entered into Microsoft Excel and then analyzed using the statistical program Analyse-it running multiple regression. Finally, the data was displayed through narrative text, tables, and graphs.

Hypothesis

It was hypothesized that:

- There will be a significant positive relationship between physical fitness levels based on the FitnessGram Physical Fitness Assessment Program and academic achievement based on STAR Reading Percentiles, STAR Math Percentiles, and Grade Point Averages.

The Null Hypothesis stated:

- There will not be a significant positive relationship between physical fitness levels based on the FitnessGram Physical Fitness Assessment Program and academic achievement based on STAR Reading Percentiles, STAR Math Percentiles, and Grade Point Averages.

In addition to the hypotheses stated above, a research objective was added. Data was collected to compare gender, academic achievement, and FitnessGram fitness levels. These groups were compared statistically and results are reported.

Discussion

The findings of this study contribute to a growing body of research indicating a relationship between physical fitness and academic achievement. One hypothesis was examined in this study implicating statistically significant results. A test of the hypothesis demonstrated that a positive correlation exists between HFZ levels and two academic predictors: STAR Math Percentiles and GPA's. Although the coefficient of multiple correlation (R = 0.26 and R = 0.23) indicated a moderate to low degree of correlation between fitness levels and academic achievement (STAR Math Percentiles and GPA's), the correlation was considered to be statistically significant since $p < 0.05$ and $R > 0.195$. However, the correlation yielding the highest reliability existed between HFZ levels and GPA's with a Standard Error of 0.76.

Although no relationship was found between physical fitness levels and the academic predictor STAR Reading Percentiles (R = 0.09), the researcher discovered correlations among the variables by combining fitness levels with academic measures to predict outcomes. The strongest relationship (R = 0.72) was found between HFZ Levels (combined with STAR Reading Percentiles and GPA's) when used to predict STAR Math Percentiles. This relationship indicates a strong positive correlation between physical fitness and academic achievement.

As stated earlier, two of the academic achievement methods used in this study were found to have statistically significant, positive relationships with physical fitness. STAR Math Percentiles ($p = 0.0063 < 0.05$; $R = 0.26 > 0.195$) and GPA's ($p = 0.0124 < 0.05$; $R = 0.23 > 0.195$) yielded significant positive relationships between physical fitness and academic achievement. The findings suggest that physical fitness does play a role in

academic achievement thereby supporting the California Department of Education research (2002) which used the FitnessGram to measure physical fitness levels of students and Standardized Achievement Test scores to measure academic achievement (Grissom, 2005). Preliminary data in the Grissom study also showed that higher physical fitness levels of students were related to higher academic achievement, especially between fitness and math achievement (Satcher, 2005). It further validates a more recent study conducted by Chomitz, et al. (2009) which demonstrated a significant positive relationship between fitness levels using five domains of fitness adapted from the Amateur Athletic Union and FitnessGram guidelines and Math academic achievement using the raw Massachusetts Comprehensive Assessment System scores. Based on previous research and the results of this study, the researcher believes educational leaders should further explore the link found between fitness levels and math achievement.

Another connected study conducted by Castelli et al., similar to the Grissom study, also compared fitness levels on the FitnessGram with students' math and reading scores on the Illinois Standard Achievement Test (Vail, 2006). Findings indicated that schools with higher fitness levels also had higher scores on the test, particularly in math as associated with aerobic fitness (Vail, 2006). However, the results of this study both support and negate Castelli's study (2007) which found that "Associations were demonstrated in total academic achievement, mathematics achievement, and reading achievement, thus suggesting that aspects of physical fitness may be globally related to academic performance in preadolescents" (p. 239). While the researcher found a positive relationship between physical fitness and math achievement, this study did not yield a positive relationship with reading achievement as found by Castelli's research.

Explanations of this result could include several possibilities. The age level of the students tested, along with the reading skills possessed by the students are both valid possibilities. Further research is needed to explore these variables in greater depth.

The researcher found no relationship to exist between gender and any of the other variables in the study, physical fitness or academic achievement. This study does not support findings from the California study which implicated that "girls in the higher fitness levels demonstrated higher achievement than males at similar fitness levels" (Satcher, p. 27, 2005). The researcher suspects her findings are due to the age group tested. Results may have varied if other age groups rather than fifth graders had been included. Again, further research is needed in this area to determine if relationships exist among fitness levels, academic achievement, and gender.

While research to date cannot explain why physical fitness and academic achievement are related, there are possible extraneous variables which may help explain the relationship. To begin with, motivation or intrinsic desire could help explain why some students excel in both physical fitness and academic achievement. Secondly, a student's fitness level may help concentration in the classroom which could lead to better academic performance. Thirdly, earlier studies have proven that physical activity and fitness may affect brain and cognitive functions. It is a plausible theory that fitness relates stronger with math achievement than reading due to the areas of the brain being stimulated during the both the physical and learning process. Brain research lends itself to exploring the undiscovered connections which may exist in the discrepancy found within this study, as well as others, between fitness and reading achievement. Next, genetics could also play a part in the relationship between fitness and intelligence. Finally,

socioeconomic or demographic factors could influence fitness and academic achievement also. After controlling for the effects of gender, weight status, grade, ethnicity, and socioeconomic status, students' odds of passing the academic tests increased by the successive number of fitness tests passed (Chomitz, et al., 2009). Separately, or in combination, these variables could help explain the connection between physical fitness and academic achievement. More research needs to be conducted to test the relationship's depth as to the causal factors of the connection between fitness and intelligence.

Conclusions

Health professionals and educators have long believed that a positive relationship exists between physical activity and academic performance (Sallis et al., 1999), but the existing empirical research on the relationship between physical fitness and academic performance is meager. The purpose of this quantitative, nonexperimental, correlational study was to compare physical fitness to academic achievement based on the premise that the health and physical fitness of the child has an effect on his or her ability to learn and to achieve academically. Demographic data, such as the students' gender was also obtained, and correlations between that variable and fitness level and academic achievement test results were evaluated. A correlational study does not prove causality, so results from this study should be cautiously interpreted. It is possible that the relationship between fitness and academic achievement was interceded by unknown variable(s) not analyzed in this study.

It should be noted that gender was found to have no relationship with any of the variables: academic achievement or fitness. This result could be due to the age group (10 and 11 year olds) researched. Maturation plays a role in the development of a child and

what motivates them. Maturational changes are just beginning to occur within the females of this age group with the onset of menstruation. Males usually have not begun the process of puberty at this age. Prepubertal children have not been exposed to the increased production of estrogenic and androgenic hormones which influence physiologic and performance fitness during puberty. Puberty influences performance in aerobic fitness by increasing body size, particularly the dimensions of the heart, lungs, muscles, and circulatory system. Thus, it makes sense that gender would not have an impact on fitness or academic achievement within this age group due to maturation.

Obesity is one of the most urgent health concerns of our children today. In the last 20 years, the proportion of overweight children between ages 6 and 19 has tripled, to nearly one in every three kids (Tyre, 2003). "An estimated 17 percent of U.S. children are overweight, and policymakers are turning to schools to help students trim down and shape up" (Gill, 2007, para. 1). The literature also notes that the self-esteem scores of obese children drastically decrease between the ages of 9 to 11 in comparison to the scores of nonobese students (Pierce & Wardle, 1997). Results from this study show that 40% of the males and 25% of the females did not fall within the HFZ in the Body Mass Index category. These results indicate that the problem of overweight children is above the national percentage which should sound the alarm to the school community. This could be due to variables not researched such as the income level of the parents whose children attend the Title I school where the study was conducted. Approximately 62% of these fifth graders qualified for a free or reduced lunch rate.

Some studies of school age children have found that television watching is directly associated with obesity. Because children in the United States spend, on average,

more than 20 hours a week watching television (more time over the course of the year than they are in school) school-based programs should help counter the effect of television watching on young peoples' eating habits. According to Murray et al (2007, p. 589), "… school health programs hold promise for improving academic outcomes for children." Coordinated School Health Programs can serve as a catalyst for healthier communities. Opportunities to educate the students, as well as the parents, about health, nutrition, and physical fitness should be sought within the school system. The only way the problem is going to be solved is for everyone to work together on the solution.

Research has shown that the health of students is one of the most significant influences on learning and academic achievement today. Results of this study show that not even fifty percent of the students tested fell within the Healthy Fitness Zone. This should sound the alarm, not only for the role fitness may play in academic achievement, but also for the health status of our youth and tomorrow's leaders. With obesity rates continuously climbing, we should be mindful of the struggles these children face such as poor self-esteem, social discrimination, and depression, which all factor in to student achievement. Through this study, and others like it, connections between the mind and body have been established. Educators should explore the possibilities this research brings to the classroom environment making it more conducive to learning.

Implications for Practice

The mind/body connection holds fascinating implications for the educational community. In a recent study, "physical activity was positively related to school contentment and academic achievement" (Kristjánsson, Sigfúsdóttir, Allegrante, & Helgason, p. 69, 2009). Physical activity can also increase academic performance

indirectly by improving emotional health, self-esteem, and alertness – all of which are related to improved academic performance (Tremblay, Inman, & Willms, 1998). Research in Georgia on fourth-grade students exhibited notably more on-task classroom behavior and considerably less fidgeting on days with a scheduled activity break than on non-activity days (Jarrett, Maxwell, Dickerson, Hoge, Davies, & Yetley, 1998). Our society is facing health problems which have roots in and are linked to living a sedentary lifestyle. Physical activity that is performed regularly has positive health outcomes and can reduce the risk of developing a wide array of health illnesses such as coronary heart disease, high blood pressure, and diabetes. By sharing the results of this study with educational leaders, it is hoped that they will better understand the importance of physical fitness as related not only to academic achievement, but also to overall health and make daily physical activity time in order to promote physical fitness for all school-aged students.

Earlier studies have also demonstrated that physical activity is connected to physiological aspects of cognitive functioning (Sallis et al., 1999; Shephard, 1997) and suggest that learning complex movements stimulates the part of the brain used in problem solving and learning (Sallis et al., 1999). Other research suggests that physical exercise increases neural connections and cerebral blood flow (Jensen, 1998). Research in this area of expertise has blossomed during the last ten years, unlocking mysteries hidden deep inside the brain. Recent brain research has shown that the brain benefits from exercise, specifically aerobic exercise due to increased blood flow to the brain, which has several effects. The brain's energy and oxygen increases due to the blood vessels being stimulated to grow. Memory formation is aided because of this increased blood flow.

Exercise also heightens production of the chemical brain-derived neurotrophic factor (BDNF) which is found in the hippocampus, an area which is directly used during the learning process. These findings are invaluable to the educational community due to the implications they have for fitness, health, and academic achievement.

Subject area teachers can combine movement within their structured day as well by starting classes with fun calisthenics or dancing. Some mathematics teachers have even reported incorporating math skills into hip hop dance movements (Yaussi, 2005). Curriculum must not only be driven by NCLB and standardized test scores; the connection between physical fitness and academic achievement implies that students should not only exercise their brains, but their bodies also. This is turn could prove beneficial for both the health of the future generation along with yielding better standardized test scores through NCLB.

While the FitnessGram Program is not used in the school where the research occurred, it was an extremely useful tool used by the researcher to interpret whether or not students fall within the Healthy Fitness Zone (HFZ) or Needs Improvement Zone (NIZ). The FitnessGram emphasizes participation in a wide variety of activities to help develop and promote fitness and also promotes the notion that physical activity should be fun and enjoyable (Cooper Institute for Aerobics Research, 1992). Educational leaders can use their understanding of fitness levels as related to academic achievement, to devise and employ curriculum decisions that will be more beneficial to students.

Delimitations/Limitations

1. Only students from a local, rural, Title 1 school participated in this study and therefore, the results may not be generalizable to other schools.

2. Only fifth grade students participated in this study, therefore, the results may not be generalizable to other grade levels.
3. Only three representations of academic achievement were used in this study, therefore, the results may not be generalizable to other instruments of academic achievement.
4. Although the P.E. teachers received training on administering the tests of the FitnessGram, consistency and reliability of the data is unknown. However, the researcher does not believe that a systematic bias was introduced in the fitness data.

Recommendations for Future Practice

The purpose of this study was to determine whether or not a correlation exists between academic achievement (STAR Reading Percentiles, STAR Math Percentiles, and Grade Point Averages) and physical fitness levels determined by the FitnessGram. This study was based on the premise that the health and physical fitness of the child has an effect on his or her ability to learn and to achieve academically. Since significant relationships were found between fitness and math as well as overall GPA, the school should explore different possibilities for physical education classes that promote physical fitness. Physical activity should be encouraged at both school and home to further accelerate the levels of physical fitness among the students. Classroom teachers can also aid in accommodating physical activity breaks throughout the day. Research shows that short activity breaks can improve students' concentration skills and classroom behavior. Since the school is already a part of the Coordinated School Health Program, combined

efforts should be employed in the pursuit of health, physical fitness, and academic achievement.

The researcher understands the need for the promotion of physical fitness among school-aged students. However, she alone cannot initiate the scale of change in mindsets which need to occur concerning fitness and academics. The community as a whole needs to be informed about the associated benefits and risks imposed upon our students. According to Carter (2002), schools have the potential to influence students' beliefs and attitudes about nutrition and weight control. Several studies show that investing in children's physical health needs promotes learning over the school years (Mistry, Crosby, Huston, Casey, & Ripke, 2002). Educational leaders must make physical fitness a priority and continue to encourage daily physical activity in our schools and at home. Neglecting to share the importance of the relationship between physical fitness and academic achievement could prove disappointing to the educational system. By using the data provided in this study, educational leaders can stress the importance of the relationship between physical fitness and academic achievement thereby gaining instructional time spent in the areas of physical education and recess.

Recommendations for Future Research

The current study is significant because it examined the relationship between students' levels of fitness and academic achievement. This study also examined the role of gender as it relates to physical fitness and academic achievement. The study found significant relationships between physical fitness and two of the three measures used for academic achievement: STAR Math and GPA's. Gender was found to have no relationship with any of the variables in this study. This could be due to the fact that fifth

graders were used as subjects for this study; this age group shows little difference between genders.

Further research is still needed in this area. In order to increase the validity of the scale and generalizability of the findings, the study needs to be replicated at other schools across the country. Additional research should evaluate specific grade levels other than just fifth grade students to determine the relationship of fitness levels and academic achievement. Different measures of academic achievement should be employed to see if relationships exist. Since this study found relationships between physical fitness and STAR Math Percentiles, but not STAR Reading Percentiles, the researcher wonders why math showed a correlation but reading did not. This finding negates results found from previous studies; therefore more research needs to be conducted to offer validation in this area. This study, along with other related correlational studies, used the FitnessGram to determine fitness levels of the participants. Other forms of data collection and analysis need to be employed to determine if results would vary upon using different instrumentation. Gender is another variable that needs more exploration in the field of fitness and academic achievement. Researching different age groups may yield different results in the role of gender. A deeper investigation similar to the existing study would provide more information that would enable educational leaders to improve physical education programs that promote physical fitness.

Brain research has exploded within the last ten years. It has been more than twenty years since suggestions were made about connections between brain function and educational practice. A generation ago, it was unknown that exercise is strongly correlated with increased brain mass, mood regulation, better cognition, and new cell

production (Jensen, 2008). The brain is involved in everything we do; to ignore its' influence in education would be irresponsible. Cognitive development, through brain research, needs to be explored more deeply to determine if exercise and fitness play a more important role in the mind body connection than was originally thought.

Although the researcher was not looking for a difference on the subtests between males and females, results did show that the percentages of males and females falling within the HFZ in the Body Mass Index category exhibited the highest degree of difference from any of the other fitness tests. Only 60% of the males, as opposed to 75% of the females, scored within the HFZ. This is an interesting finding which could lead to further research.

"Some inherited biological characteristics may make it easier for some individuals to achieve high levels of physical activity or fitness…" (Leskinen, et al, p. 108, 2009). Research has already been conducted in the area of genetic makeup and physical fitness, however the researcher feels this would be another variable to explore in future research in terms of fitness and academic achievement. The sequencing of the human genome could help in the identification of gene variants that make up successful athletes and academic achievement. Therefore, research, in the area of genetics, could possibly lead to a better understanding of overall physical fitness and academic achievement.

Schools should encourage students to excel in all aspects of life. Educators should strive to develop strategies and curriculums that foster that growth. Academic achievement is one area in which educators pride themselves in nurturing the next generation of leaders. However, school leaders should not ignore possible contributing factors to this success such as fitness and activity. Physical fitness, through this study and

others, shows a relationship with academic achievement, especially in terms of math and GPA. Educational leaders must search for ways to improve the physical fitness of our couch-potato society so as to possibly contribute to academic success.

The quality of physical education is vitally important not only to the health and physical fitness of school aged children, but also to academic and cognitive outcomes. Physical education classes that fail to encourage moderate, sustained aerobic and cardiovascular exercise are unlikely to provide noteworthy improvement to health, fitness, weight control, or academic achievement (Sattelmair & Ratey, 2009). Traditional physical education classes endorse competitive play rather than individual aerobic exercise which focuses on personal progress and lifelong fitness activities. This restructuring should provide students with a curriculum that promotes fitness and exercise in a fun and enticing manner which thereby fosters not only academic achievement but overall health and well-being for the future. Studies should focus on both the quality and quantity of physical education being offered in schools as well as testing the programs to determine the extent to which physical fitness correlates with academic achievement.

While causality was not proven, results indicate that as fitness levels went up, so did academic achievement. With this in mind and with our nation's problems relating to poor health and undesirable academics, it is imperative that educational leaders continue to strive towards finding solutions to these problems by conducting further research in this field and by applying the knowledge gained. With NCLB pushing educators to show academic results on standardized tests, educational leaders cannot allow time to be taken from physical activity in order to accommodate for more time on task in the classroom.

Physical activity has been proven to show positive results when combined with cognitive tasks and is a huge contributing factor to physical fitness. Future generations are depending on the guidance and direction of the educational leaders of today. Physical fitness should be highly encouraged in schools due to the connection it has been found to have with both health and academic achievement.

Summary

Chapter Five restated the problem influencing the study, recapitulated the methodology used, presented important findings pertaining to the investigation, discussed the implication for practice, revealed limitations of the study, and offered recommendations for future practice and research. Due to the findings of this study, more research should be conducted in the area of physical fitness and academic achievement in order to further validate this field of study.

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Appendixes

Appendix A

Abdominal Strength and Endurance (Curl-Up)

Appendix B

Trunk Extensor Strength and Endurance (Trunk Lift)

Appendix C

Upper Body Strength and Endurance (90 Degree Push-Up)

Appendix D

Flexibility (Back Saver Sit-and-Reach)

Appendix E

FitnessGram Boys' Standards for HFZ

THE PRUDENTIAL FITNESSGRAM
STANDARDS FOR HEALTHY FITNESS ZONE*

BOYS

AGE	ONE MILE min/sec		PERCENT FAT		CURL-UP # completed		TRUNK LIFT inches		PUSH-UP # completed		BACKSAVER SIT&REACH** inches
5	Time Standards Not Recommended.		25	10	2	10	6	12	3	8	8
6			25	10	2	10	6	12	3	8	8
7			25	10	4	14	6	12	4	10	8
8			25	10	6	20	6	12	5	13	8
9			25	10	9	24	6	12	6	15	8
10	11:30	9:00	25	10	12	24	9	12	7	20	8
11	11:00	8:30	25	10	15	28	9	12	8	20	8
12	10:30	8:00	25	10	18	36	9	12	10	20	8
13	10:00	7:30	25	10	21	40	9	12	12	25	8
14	9:30	7:00	25	10	24	45	9	12	14	30	8
15	9:00	7:00	25	10	24	47	9	12	16	35	8
16	8:30	7:00	25	10	24	47	9	12	18	35	8
17	8:30	7:00	25	10	24	47	9	12	18	35	8
17+	8:30	7:00	25	10	24	47	9	12	18	35	8

* Number on left is lower end of HFZ; number on right is upper end of HFZ.
**Test scored Pass/Fail; must reach this distance to pass.

Appendix F

FitnessGram Girls' Standards for HFZ

THE PRUDENTIAL FITNESSGRAM
STANDARDS FOR HEALTHY FITNESS ZONE*

GIRLS

AGE	ONE MILE min/sec		PERCENT FAT		CURL-UP # completed		TRUNK LIFT inches		PUSH-UP # completed		BACKSAVER SIT&REACH** inches
5	Time Standards Not Recommended		32	17	2	10	6	12	3	8	9
6			32	17	2	10	6	12	3	8	9
7			32	17	4	14	6	12	4	10	9
8			32	17	6	20	6	12	5	13	9
9			32	17	9	22	6	12	6	15	9
10	12:30	9:30	32	17	12	26	9	12	7	15	9
11	12:00	9:00	32	17	15	29	9	12	7	15	10
12	12:00	9:00	32	17	18	32	9	12	7	15	10
13	11:30	9:00	32	17	18	32	9	12	7	15	10
14	11:00	8:30	32	17	18	32	9	12	7	15	10
15	10:30	8:00	32	17	18	35	9	12	7	15	12
16	10:00	8:00	32	17	18	35	9	12	7	15	12
17	10:00	8:00	32	17	18	35	9	12	7	15	12
17+	10:00	8:00	32	17	18	35	9	12	7	15	12

* Number on left is lower end of HFZ; number on right is upper end of HFZ.
**Test is scored Pass/Fail; must reach this distance to pass.