The Impact of Physical Activity and Obesity on Academic Achievement Among Elementary Students*

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Abstract

This study compared the effect of physical activity and obesity on academic achievement and was based on the premise that the health of a child has an effect on his or her ability to learn and to achieve academically. Specifically, health-related topics of inactivity and obesity were considered. The participants included 12,607 third grade children entering kindergarten for the first time during the 1998-99 school year. The data were obtained from the National Center for Educational Statistics' Early Childhood Longitudinal Study (Third Grade), which is a national representative sample of students entering Kindergarten in 1998-99 with the latest wave of individual student, parent, teacher, administrator and school data collected on these same students in third grade. Third grade is a crucial year in elementary school as high stakes exams begin in third grade in most states. The results indicated that the Body Mass Index (BMI) of students, as well as the opportunity for physical activity within the school day affected the students' performance in both reading and mathematics achievement. The implications for school and district leaders are discussed with direction for future research presented.

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NOTE: This module has been peer-reviewed, accepted, and sanctioned by the National Council of the Professors of Educational Administration (NCPEA) as a scholarly contribution to the knowledge base in educational administration.

With the mandates of No Child Left Behind (NCLB, 2001), there is enormous pressure on educators to improve academic skills among students. Schools must accomplish the daunting task of educating all children while preparing them to achieve mastery on high-stakes assessments. For many years, there has been a demand on educators to improve academic skills among students (Symons, Cinelli, Iames, & Groff, 1997).

School officials are constantly searching for the best educational programs or curriculum to ensure that all children learn. Because of the burden of high-stakes testing, many districts are cutting back or even eliminating non-academic subjects in favor of direct teaching in the assessed subjects (American Association of School Administrators, 2006; Vail, 2006). Siegel (2006) opined that many school officials view non-assessed subjects as "superfluous" (p. 9), thus creating a case for the eradication of any subject that is not directly measured through high-stakes testing.

While few educators would voice opposition to the emphasis on academics, there remains a need to holistically educate children to prepare them for the future. Amidst numerous competing issues, educating the whole child involves addressing both the academic and the health needs of students. Linking health and learning is a way to ensure a comprehensive approach to educating the whole child (Laitsch, Lewallen, & McCloskey, 2005).

An added benefit to focusing on students' health has been proposed by Novello, Degraw, and Kleinman (1992). According to Novello et al., both health and achievement are important in a child's life and health issues are indeed intertwined with students' academic achievement. For that reason, "healthful living is as important to quality of life as academic achievement" (AASA, 2006, p. 8).

Nature of the Problem

The topics of obesity and insufficient physical activity in childhood have been highlighted over the last few years (AASA, 2006; The Center for Health and Health Care in Schools, 2005; Villaire, 2001). The prevalence of children with high blood pressure, type-two diabetes, and obesity has been on the increase (AASA; The Center for Health and Health Care in Schools). The number of adolescents who are overweight has tripled since 1980 and the prevalence among younger children has more than doubled. According to the 1999-2002 National Health and Nutrition Examination Survey (NHANES), 16 percent of children age 6-19 years are overweight (U.S. Department of Health and Human Services, 2006).

Being overweight during childhood and adolescence increases the risk of developing high cholesterol, hypertension, respiratory ailments, orthopedic problems, depression and type-two diabetes as a youth.

Looking at the long-term consequences, overweight adolescents have a 70 percent chance of becoming overweight or obese adults, which increases to 80 percent if one or more parent is overweight or obese (Torgan, 2002). Obesity in adulthood increases the risk of diabetes, high blood pressure, high cholesterol, asthma, arthritis, and a general poor health status. In 2000, the total cost of obesity for children and adults in the United States was estimated to be $117 billion ($61 billion in direct medical costs) (Center for Disease Control, 2005).

Because of these health issues, these children are also missing more school than those students who are healthy (AASA; Marx & Northrop, 2000; Smith, 2003). Undeniably, absenteeism places these children at-risk for learning difficulties and failures. Yet, even more than being concerned over attendance, schools must consider the role they will play in combating health issues, such as obesity, that may cause impediments to the learning process. Although school programs alone cannot overturn the unhealthful trends, school officials can partner with families and communities to implement policies and practices that will combat unhealthy living and promote healthful choices (AASA; Deutsch, 2000; Scherer, 2000). Absenteeism is but one issue in the quest for improving the health among students.

Although several authors have focused on the health of children and how health issues may affect students in the school setting, there is little research that specifically links physical activity and obesity with academic achievement (AASA, 2006). There is a deficiency in research-based information regarding how physical activity and obesity influence academic achievement. This study will fill a void in existing research. Hence, the purpose of this study was to examine the relationship between physical activity within the school day, obesity, and academic achievement. In addition, gender, race, and poverty levels of students were considered as variables that may impact students' physical activity, obesity, and academic achievement.

Significance of the Study

The high prevalence of obesity among school-age children has made obesity a hot topic in education. The results of this study will be helpful to school leaders as they implement health initiatives to counteract rising obesity rates among children. In addition, the study will serve two practical purposes: a) inform school leaders as they develop and implement broad health-related policies and initiatives, and b) assist school leaders in determining appropriate scheduling of academic and non-academic subjects. Without a doubt, if school leaders are aware of atypical academic practices that could improve academic achievement, they will be able to implement needed changes within the school day schedule.

Definitions of Key Terms

Physical Activity

Physical activity is the bodily movement that results in an expenditure of energy. Physical activity is not synonymous with group sports. Although many children derive physical activity from group sports, children can be physically active by walking, playing freely at recess, or doing yard work. Strenuous activity is not required. Instead, children should aim for getting at least 30-60 minutes of activity three to four days a week (Governor's Conference on Children's Obesity in Texas, 2004). The NASPE (2006) suggested an even higher amount of physical activity. They recommend that children acquire 60 minutes of physical activity every day. Unfortunately, in today's society, very few children meet these guidelines for healthy living.

Body Mass Index

Body Mass Index (BMI) is calculated by dividing weight in pounds by the square of height in inches, and then multiplying that number by 703. According to the Centers for Disease Control and Prevention (n.d.), the BMI is a "reliable indicator of body fatness for most people and is used to screen for weight categories that may lead to health problems". A score of 18.5-24.9 is considered normal. Health care officials use the BMI score to "detect, treat, and prevent obesity" (Health Policy Tracking Service, 2005, p.78,¶ 1).

Obesity

Obesity is an adult with a BMI over 30. Being obese increases a person's chance of having other medical issues such as particular types of cancers, diabetes, hypertension, and heart disease (Health Policy Tracking Service, 2005). The exact ranking of obesity for children varies with age and gender. Obesity that begins in childhood places the person at a much higher risk for developing the co-existing medical problems listed above. To be certain, obesity exacerbates chronic health problems (Health Policy Tracking Service). The Centers for Disease Control and Prevention (n.d.) provides an online tool to determine obesity levels for children. This tool may be accessed by visiting the following web address: http://www.cdc.gov/nccdphp/dnpa/bmi/index.htm.

Coordinated School Health

Coordinated school health is the efforts of educators to provide a healthy school environment through various services, such as "counseling and psychological services, family involvement, food services, health education, health services, physical education, and staff wellness" (Grebow, Greene, Harvey, & Head, 2000,

p. 65).

Review of Literature

In the amalgamation of 25 prominent reports on health and education issues, Lavin, Shapiro, and Weill (1992) found a common theme: 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). By addressing the health needs of children, schools can ensure that the children are in attendance and are physically, emotionally, and mentally in the best situation to learn (Smith, 2003; Deutsch, 2000).

In March 2000, an entire volume of Educational Leadership focused on children in public schools and the needed emphasis on the relationship between healthy bodies and minds. In this volume, Scherer (2000) offered the viewpoint that "the topic of health involves scientific challenges, ethical conflicts, (and) social dilemmas" (p. 7). In reality, providing students with quality instruction in healthy lifestyles has been and will continue to be a challenging task. In spite of this challenge, students can be taught that their healthy development is important when they "receive consistent health-promoting messages from all aspects of the school environment–in class; in the food choices offered; [and] in the opportunities for daily physical activity" (Grebow et. al, 2000, p. 65).

Grissom (2005) investigated the link between fitness levels of students and their Stanford Achievement Test scores. He presented evidence of a correlation between students' fitness scores and their achievement. Grissom speculated that physical fitness levels impacted the health of the child, in turn, promoting higher achievement. Studies such as this one provide documentation of the importance of including non-academic subjects in the daily curriculum taught in public schools (Siegel, 2006).

Health Issues

Several factors have been identified as being important to a child's health. In the past, the study of hygiene was at the forefront of health education in public schools (Scherer, 2000). However, those simplistic days have ended. Since the mid-to-late 1990s, schools have been asked to promote student health by creating health programs within the school setting (Scherer,2000). By dealing with health issues that might hinder learning, school officials can proactively develop interventions that influence and promote learning (Deutsch, 2000). Smith (2003) stated that schools have a unique opportunity to address health issues to promote learning; after all, a large majority of children are enrolled in public schools.

Interventions in health can be best integrated into other academic disciplines where every teacher shares in the responsibility of teaching healthy lifestyles (Deutsch, 2000). Through this purposeful teaching, schools can equip students with the information needed to lead healthy lives. Grebow et al. (2000) asserted that when all components of a health program are implemented, "students are better able to focus on learning" (p. 65). These components include teaching children about healthy living and making healthy choices by properly eating and getting physical exercise. Wechsler, McKenna, Lee, and Dietz (2004) stated, "Health and success in school are interrelated. Schools cannot achieve their primary mission of education if students and staff are not healthy and fit physically, mentally, and socially (p. 4).

School systems may choose to address topics relating to student health in numerous ways. Because children spend a greater part of their weekdays away from home, schools have a unique opportunity to influence and guide students towards actions and activities that promote healthy lifestyles (Smith, 2003; VanLandegham, 2003). When schools take advantage of this opportunity, healthy students increase the capacity to become better learners (Association for Supervision, n.d.; Deutsch, 2000; Dixon et al., 2003; Novello et al., 1992; Tomlinson, 1999).

Laitsch et al. (2005) expressed, "academic achievement is inextricably linked with the... emotional, physical, and social health of our students" (p. 6). Thus, another area where schools influence a healthy lifestyle is in the instruction of health-related topics. Deutsch (2000) surmised, "Every teacher is a health teacher" (p. 10); further; important themes in health are best integrated into other academic disciplines. Ultimately, health instruction should be planned and sequential beginning in Kindergarten and continuing through 12th grade. The physical, emotional, mental, and social aspects of health should be addressed through the curriculum (Cooper & Taras, 2003).

Rhiner (2004) expressed, "policies around. . .physical activity have the power to change the behavior of our children...." (p. 21). However, Rhiner found that only a handful of over 75 proposed bills addressing

nutrition and/or physical activity have actually passed over the prior four years. Specifically, AASA (2006) reported that in 2005, 48 states required physical education, 39 states had contemplated physical activity requirements, and 21 states actually passed some form of physical activity legislation, but specific policies and practices varied widely. And Rhiner asserted that federal and state policies regarding nutrition and physical activity are not usually enforced. In order for students' health needs to be fully addressed, policies should be in place and enforced at the local level. The realization of these laws is ultimately left up to the local education agencies to implement and enforce.

Coordinated School Health Programs

Recently, there have been health initiatives set in motion by legislation and policies, which require schools to be a beacon of information regarding health-related topics (AASA, 2006). As of July, 2005, 23 states required schools to educate children on the benefits of physical activity (Health Policy Tracking Service, 2005). In addition, 18 states required schools to report on the BMI of public school students (Health Policy Tracking Service).

Yet, simply promoting healthy lifestyles among students is no longer sufficient. In June 2004, the Child Nutrition and WIC Reauthorization Act (2004) made it mandatory for all school districts participating in the Federal School Meal Programs to establish and implement a local wellness policy by July 2006 (AASA, 2006; Action for Healthy Kids, n.d.). This policy must include district goals in the following areas: nutrition, physical activity, wellness activities, governance, and evaluation of programs (Child Nutrition and WIC Reauthorization Act). Although these components must be evident in the wellness policy, the federal government has ensured that local districts be given the autonomy to decide the specifics of the policy.

The Child Nutrition and WIC Reauthorization Act (2004) initiated the prospect that schools can and should be a primary source for the education of students on combating obesity through nutrition and physical activity. The prime objective of the new law is to curtail the growing trend toward childhood obesity (Action for Healthy Kids, n.d.). Because this is a newly implemented course of action, only time will tell if the policies will truly make a difference in students' lives. The accurate and authentic evaluation of these programs will be paramount in order to inform future practices.

By establishing and maintaining a coordinated school health program, schools can develop programs that benefit students' health while promoting a healthy school environment. According to Smith (2003), "most students in poor health have difficulty learning" (p. 3). Numerous publications have stressed the need for schools to develop and maintain coordinated school health programs (American Public Health Association, 2004; Dixon, Mauzey, and Hall, 2003; Education Development Center, n.d.; Joint Interim Committee on Nutrition, 2004; National Association of State Boards of Education, 1998; Satcher and Bradford, 2003).

The Center for Disease Control (n.d.) suggested an eight-component model for a coordinated school health program. The eight interdependent components were originally proposed by Allensworth and Kolbe (1987). The eight components are as follows: health instruction, health services, healthful school environment, school food services, health promotion for staff, counseling and psychological services, physical education, and parent/community involvement. The components of a coordinated school health program that are relevant to this research involve a healthful school environment, and specifically the amount of time that is allotted to physical activity within the school day.

Physical Activity

An essential component of a comprehensive school health program is physical activity. The significance of physical activity on a person's well being and general health was acknowledged in several reports (Dixon et al., 2003; Paige, 2004; Seefeldt, 1986). Regular physical activity and fitness topped the list of recommendations needed for a healthy lifestyle (Spain & Franks, 2001). After compiling information from numerous federal and health promotion agencies, Lambert (2000) found that increasing the levels of physical activity was one of the most "emphatic recommendations" (p. 34) to improve a person's health. Drawing upon information from a model proposed by Allensworth and Kolbe in 1987, Marx and Northrop (2000) asserted that quality health and physical education programs would emphasize lifelong physical activity.

School programs can equip students with the information needed to lead healthier lives through physical activity. Furthermore, schools may greatly influence the student by providing regular opportunities for physical activity within the school day. There are many ways in which schools can implement programs to

ensure that students have opportunities for physical activity (Garcia, Garcia, Floyd, & Lawson, 2002; Kidd, 2003). School leaders have been encouraged to ensure that students are allowed the opportunity to play at recess and receive physical education instruction on a daily basis.

Interestingly, some physical activity advocates have even gone as far to suggest that schools be required to assess students' physical fitness levels and identify their individual BMI scores. For instance, the Governor's Conference on Children's Obesity in Texas (2004) recommended that a TAKS test in physical fitness be implemented. As of this writing, this proposal has not been implemented.

In the spring of 2001, California began mandating that all students in grades five, seven, and nine be administered a Physical Fitness Test (Grissom, 2005). These fitness scores are part of the assessment process, which is disseminated to parents, and also to various stakeholders. In 2003, North Carolina included recess as part of the school day in addition to requirements that were already in place for physical education classes (AASA, 2006). According to AASA, 21 states established requirements in 2005 for physical activity or physical education within the school day.

The National PTA and the Center for Disease Control have jointly begun an effort called Rescuing Recess (n.d.). These organizations feel that, in an effort to push academics in the age of high accountability, elementary schools have disregarded the benefits of physical activity during a period of the day called recess. The National Association for Sport and Physical Education (NASPE, 2004) has called for the continuation of 20 minute recess periods for elementary school students. The NASPE believes that physical activity can help children to develop healthier bodies. Therefore, ensuring that children receive daily recess will contribute at least a partial amount of the physical activity that children need.

Those who work with children would not argue that children enjoy the freedom and fun associated with recess. In addition, there is no question of the link between physical activity and the general health of a child (Vail, 2006). Many health benefits are obtained through regular physical activity (Lambert, 2000). Nevertheless, a review of the literature did not illustrate definitive results that verify the link between physical activity and academic achievement. Existing studies, particularly in the educational field, have suggested that future health-related research examine the link between physical activity and academic achievement. Jarrett (n.d.) concluded:

The available research suggests that recess can play an important role in the learning, social development, and health of elementary school children. While there are arguments against recess, no research clearly supports not having recess. However, more research is needed to determine the current percentage of schools that have abolished recess and assess the effect of no-recess policies on student test scores, attitudes, and behaviors. (¶12).

Concomitant to this view, Siegel (2006) conjectured that supplementary research should concentrate on determining the correlation between physical fitness and academic achievement. However, whereas past studies have focused on fitness levels or the general health of students and examined the link with academic achievement, this study focused on physical activity, which affects obesity, to ascertain whether a physically active, healthy weight student is in a better position to learn and achieve academically.

Obesity in Children

The American Academy of Pediatrics (2006) identified obesity by calculating a person's weight and height in a measurement called the Body Mass Index (BMI). People with BMI scores in the 85th to 95th percentiles are considered obese. An entire American Association of School Administrators (AASA) publication was devoted to the topic of obesity and the role schools play in combating this epidemic. The executive director of AASA, Paul Houston, believed that the topic of childhood obesity has received the attention of the media, which in turn, has caused schools to focus on ways to address this issue (AASA,2006).

In recent years, there has been much discussion and controversy over obesity and insufficient physical activity in childhood (AASA; The Center for Health and Health Care in Schools, 2005; Villaire, 2001). Even so, teachers at the elementary level may reduce or eliminate times for physical activity in favor of more instruction time because of the unrelenting pressure to prepare students to perform well on high-stakes assessments (Jarrett, 2001; Paige, 2004; Vail, 2006).

Obesity in children has been identified as a national problem (Benson, 2003; Christie, 2003; Paige, 2004; VanLandegham, 2003). According to the Health Policy Tracking Service (2005), "The politics of obesity

remains front and center in state houses across the country" (p.1). In Texas alone, a record 35% of school-age children have been identified as overweight or obese (Texas Department of Agriculture, 2005). Further, the medical problem of obesity affects children in all socioeconomic groups (Eberstadt, 2003). There are plenty of information and general statistics regarding obesity, yet a paucity of useful information on how to counteract childhood obesity.

In addition, there is a lack of empirical data on the effects of obesity and educational attainment and success. Even so, Trager (2004) stated that experts in the field of health agree that public schools are an essential partner in the campaign against obesity. Furthermore, former United States Secretary of Education, Rod Paige, insisted that schools must do a better job of educating children regarding healthy eating and leading an active lifestyle (Paige).

The Joint Interim Committee on Nutrition and Health in Public Schools (2004) declared, "The state of Texas is facing an unprecedented crisis of...obesity among its public school children" (p. 1). Healthy eating and increased physical activity are two of the main concerns in combating obesity in children (The Center for Health and Health Care in Schools, 2005). This study investigated one of these concerns-physical activity-to determine whether there was a relationship between physical activity, obesity, and academic achievement.

Method

Past studies have focused on the health of children and how this affects learning; however, there is little research that specifically links physical activity and obesity with academic achievement (AASA, 2006). Therefore, the purpose of this study was to examine the relationship between physical activity, obesity, and academic achievement. Because of the NCLB mandate that all students will learn, schools must consider health issues, such as obesity and lack of physical activity, which may cause impediments to the learning process.

Initially, exploratory data analyses were conducted to determine if independent variables should be collapsed into fewer categories in order to gain insight into student achievement as measured by student performance on the reading proficiency exam. Because logistic regression is especially effective in answering questions that involve predicting the probability that something will occur, logistic regression was employed to ascertain which variable(s) best predicted students scoring above the median (being proficient) on the reading exam. The AM (American Institute for Research, 2006) software package was utilized in the study to calculate logistic and other statistical tests. AM is a statistical software package for analyzing data from complex samples, especially large-scale assessments, such as the Early Childhood Longitudinal Study (Tourangeau et al., 2006).

Participants

The participants included 12,607 third grade children who participated in the Early Childhood Longitudinal Study conducted by the National Center for Educational Statistics (Tourangeau et al., 2006). The researchers in the longitudinal study began collecting data when these same students were entering kindergarten for the first time during the 1998-99 school year. These students were part of a nationally representative sample of children enrolled in about 1,000 public school third grade programs during the 2001-2002 school year. When appropriately weighted, the sample was representative of the 2,495,702 children nationally enrolled in third grade during the 2001-2002 school year (Tourangeau et al.).

Over half of the participants were White, non-Hispanic, and above the poverty-level threshold. Regarding gender, the distribution was evenly split with 49.5% of the sample identified as male and 50.5% percent identified as female. Table 1 displays the distribution of selected child and family demographic variables examined in the study.

Table 1

Distribution of Child and Family Characteristics

Variable	Percent	Frequency
Gender		
Male	49.5	1,234,781
Female	50.5	1,260,921
Total	100	2,495,702
Race		
White, Non-Hispanic	58.9	1,469,589
Black, Non Hispanic	14.7	365,656.93
Hispanic	19.3	479,241.9
Asian	2.5	61,257
Other	4.6	119,957.3
Total	100	2,495,702
Poverty		
At or Above Threshold	80.8	2,075,533
Below Threshold	19.2	420,169
Total	100	2,495,702

Table 1

Definition and Coding of Variables

Reading (T-Scores).

A dichotomous variable indicating norm-referenced measurements of achievement, i.e., estimates of achievement relative to the population as a whole. The T-scores represent the extent to which an individual ranked higher or lower than the national average and how much this relative ranking changed over time. Participants were coded 1 = at or above median; 0 = otherwise.

Body Mass Index (BMI).

A dichotomous variable indicating the calculation of the child's body weight adjusted for height. This index was calculated by multiplying the composite weight in pounds by 703 and dividing by the square of the child's composite height in inches. Individuals at or above the 95th percentile on their BMI calculation (based on gender) were considered overweight, supported by the standards of the U.S. Department of Health and Human Services. The exact ranking of obesity for children varies with age and gender. Coding of BMI among participants included 1 = overweight; otherwise, BMI = 0.

Number of Days in Recess (Per Week).

Total number of days per week child participated in recess. This was categorized as a continuous variable, representing the number of days per week student participated in recess (ranged from $0 - 5$).

Race.

A categorical variable for race was created, which included: Anglo = 1, African American = 2, Hispanic = 3, Asian = 4, and Other = 5.

Gender.

A dichotomous variable identified as Male = 1, Female = 2

Poverty Level.

A dichotomous variable categorized as 0 = students living in below poverty conditions; while 1 = students living in conditions at or above the poverty threshold.

Procedure

All main effects and two-way interactions were considered. Results from the log-likelihood test revealed that the addition of interaction terms would not improve the model fit for either of the models examined. Therefore, these interaction terms were not included in the results reported below. An a priori (α) level of .05 (the probability of a Type I error) was required for statistical significance to be achieved for all analyses. All analyses were conducted with the AM software package (American Institute for Research, 2006).

Results

On average, students participated approximately 1.5 hours in recess per week (SD = 1.98). Recess occurred daily (M=1.26, SD = 1.25) or approximately 4 days a week (SD=2.7). Regarding BMI, 14.4% of the participants (n=335,950) were identified as overweight according to the Body Mass Index calculation.

Table 2 reports the Pearson product-moment correlations among the variables examined in the study. The strongest association with BMI was poverty level ($r = 240$, $p < .01$), suggesting that as family income increases, the participant's BMI index increased. On the other hand, as BMI increased, the participant's reading scores decreased.

Table 2

Pearson Product-Moment Correlations

	1	2	3	4	5	6
Reading Exam (1)	1.00					
Poverty Level (2)	.240 **	1.00				
Gender (3)	.051 **	-.030 **	1.00			
Race(4)	-.171 **	-.179 **	-.011 **	1.00		
BMI (5)	-.027 **	-.006 **	-.029 **	.014 **	1.00	
Days in Recess (6)	.075 **	.090 **	-.009 **	-.057 **	.055 **	1.00

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 1

Table 3 displays the results of the logistic regression model. In the model, estimates of odds ratios are given in terms of the increase of one unit change of the independent variable. The odds ratio for number of days in recess is 1.034, which means that participants scoring above the median cut score on reading proficiency increased their odds of scoring at the proficient level by a factor of 1.034 (p=.005). Further, students identified as overweight decreased the odds of scoring proficient on the reading exam by almost 2%. Those students above the poverty threshold were 1.192 as likely to score proficient on the reading exam as the students living below poverty conditions, holding the remaining variables constant.

Table 3

Results of the Logistic Regression Analysis

								95.0% C.I. for EXP(B)
Variable	B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Poverty Level (SES)	1.192	.094	66643.270	1	.000	3.295	3.265	3.325
Gender	.218	.064	4447.890	1	.001	1.244	1.236	1.252
Race	-.178	.022	27015.398	1	.001	.837	.835	.839
BMI	-.005	.096	366.129	1	.009	.995	.995	.996
No. Days in Recess	.034	.013	2915.276	1	.005	1.034	1.033	1.035
Constant	-2.098	.012	32080.975	1	.000	.123		

Table 2

The degree to which predicted probabilities agree with actual outcomes was determined by results of the Gamma statistic of .8560 for the model. It can be said that 85.60% fewer errors were made in predicting which of two participants would score proficient on the reading exam by using the estimated probabilities than by using chance alone. The final model predicted 86.7% of the responses correctly, which according to Hosmer & Lemeshow (1989) is an acceptable model.

Limitations of the Study

The relationship between academic achievement and an emphasis on developing healthy students in a school setting was the conceptual framework for this study. However, several concepts within the general category of health were not included in the present study. Health issues involving intentional injuries (abuse, homicide, and suicide) were not studied. In addition, risk factors such as sexual behaviors and the use of alcohol, tobacco, and other drugs for potential health problems were beyond the scope of this research.

Wherein the study of physical fitness was included in this study, more precise definitions of physical fitness, such as cardio-respiratory endurance or muscular strength and endurance, were not included. For purposes of this research, medical terms that identified a student's fitness level such as pulse rate, respiration, cholesterol, or blood pressure, were not the focus. However, obesity was studied since the medical state of obesity as measured by the Body Mass Index (BMI) is related to a student's physical fitness.

Another limitation of the study was that only the amount of time given to recess within the school day has been reported. Therefore, some students may participate in rigorous activity, while others may choose to simply visit with friends during recess. The wide variance in these two scenarios reveals the limitation in using recess as a physical activity variable. However, offering recess to students affords students the opportunity to participate in physical activity.

Conclusion

Novello et al. (1992) stated that both health and achievement are important in a child's life and that health issues impact students' academic achievement. The current study was based on the premise that the health of a child has an effect on his or her ability to learn and to achieve academically. More specifically, though, the purpose of this study was to examine the relationship between physical activity within the school day, obesity, and academic achievement.

Because of the stringent accountability measures in place through NCLB, many schools have chosen to eradicate those subjects that are not a part of the high stakes testing venue (AASA, 2006; Vail, 2006). An often heard argument from educators is that they simply do not have enough time within the school day to instruct students in the subjects that will be tested (AASA). Therefore, non-academic subjects have often times been severely reduced, or even eliminated.

Based on the results of this study, there was a relationship between students' BMI, physical activity, and their academic achievement levels. A positive relationship existed between physical activity and academic achievement. In other words, students that maintained a higher level of physical activity maintained higher grades and learned at a faster rate than those students who were less physically active. Conversely, a negative relationship was observed between obesity, as rated by the BMI, and academic achievement. In other words, obese students performed below their more physically fit counterparts regarding academic achievement.

Schools that have reduced or eliminated recess times for students should question their stance on this critical issue. The results of this study indicated that the opportunity for physical activity improved students' chances of scoring proficient on the reading exam. In addition, since physical activity reduces a person's BMI (American Academy of Pediatrics, 2006; Centers for Disease Control and Prevention, n.d.) and a high BMI has a negative relationship with academic achievement, schools should be keenly aware of any policies and practices that may influence a students' BMI.

Although schools may have considered that the mind and the body are two separate entities, this research provided evidence that the two items are really not competing factions at all. Instead, they are two fields that need to be connected to ensure that students are given the best opportunity for achieving. Even with the pressure to prepare students for high stakes testing, educators need to find ways to incorporate physical activity within the school day. Just as Grissom (2005) speculated, "conditions that promote a healthy body also promote a healthy mind" (p. 24), this study provided information to support this link.

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