Physical Activity Promotes Academic Achievement and a Healthy Lifestyle when Incorporated into Early Childhood Education

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Abstract

The detrimental effects of physical inactivity within children have enormous personal health consequences. These health conditions have the potential to impact the economic vitality of society as a whole. Studies have indicated that inactive children are far more likely to suffer from obesity, type II diabetes, and hypertension than their physically active peers. Research also indicates that these health problems tend to follow the individual into adulthood. Seventy percent of obese adolescents will become obese adults (Reilly, 2007). In addition to the health benefits of physical activity, physical activity has also been positively correlated to academic achievement when integrated into early childhood educational programs. This paper will primarily review the evidence that demonstrates the positive influence of physical activity on academic achievement in early childhood education. This paper will further provide basic guidelines for developing an early childhood education program.

Introduction

Children must develop basic academic skills to have success in a modern world where technological advances progress at exponential rates. Once students have a solid foundation in reading, writing and mathematics they can use these skills to acquire advanced knowledge in these and any other academic pursuit. Technology has brought the modern world many advantages, but also many challenges. Where it has allowed a greater degree of independence, it has also resulted, somewhat paradoxically, in producing almost as much dependence. For example, the growth in economic output world-wide is the result in mechanization, but the progress that has increased nearly everyone's standard of living has also resulted in an epidemic of sedentariness. Rather than rely on innate motor capabilities with the attendant health producing effect, modern culture dictates that mobile transportation is the first, and often the necessary choice. The result is less caloric expenditure per day than at any other time in history for the majority of people. Coupled with readily available food items, there is little to wonder about the world-wide rise in obesity rates. The outcome is frightening. A sedentary lifestyle leads to obesity which leads to degenerative diseases such as type 2 diabetes, cardiovascular disease, stroke, cancer, lung disease, gallbladder disease, and kidney disease to name just a few (CDC, 2002). While most of these diseases strike in middle age, the younger age groups are not immune. A theory of some merit is that as children become more sedentary with an attendant loss of physical fitness academic achievement suffers. If this is correct, it stands to reason that when regular physical activity is incorporated into early childhood education, academic standing improves (Rennie, Johnson & Jebb, 2005).

A recent study indicated that taking time away from traditional educational pursuits during the school day to spend an hour devoted to physical activity will not adversely influence performance of traditional educational skills (Carlson et al., 2008). Other studies showed that the incorporation of physical activity classes actually enhanced academic performance in traditional academic programs (Chomitz, et al., 2009, Tomporowski, Davis, Miller & Naglieri, 2008). Students who participate in physical activity programs in school are less likely to experience the adverse health complications resulting from degenerative diseases (Rennie, Johnson & Jebb, 2005). It is interesting, therefore, that the health of the body and the training of the mind should be linked to lifestyles measures such as regular physical activity. The purpose of this paper is to show just that.

Prevalence of Obesity in Children

Throughout most of the developed and developing world, obesity in children has been increasing rapidly (Lobstein , Baur & Uauy, 2004). This trend can be observed in Europe (Jackson-Leach, & Lobstein, 2006) and in the United States (CDC, 2002). Within the United States, the percentage of children who are overweight has doubled in the 6–11 year old age group and almost tripled in the 12–19 year old age group (CDC, 2002). In England the prevalence of obesity was 14% in 2–10 year olds and 25% in 11 to 15 year olds (Reilly, 2006). Obesity, defined as a body mass index greater than 30, results from more calories consumed than expended. To develop obesity this imbalance has to last for months, or more likely years (Reilly, 2007).

Obesity in children is a simple process that results from excess food intake in relation to caloric expenditure. However, the reasons why children do not burn a sufficient number of calories, and the reasons for children consuming excess calories is complex. Similar to the adult population, children's physical activity levels are reduced as modern technology replaces the traditional forms of entertainment which in previous generations tended to fall more towards the physical end of the spectrum, especially for the lower socioeconomic classes. The end result is a sedentary lifestyle and a pattern of creeping weight gain that escalates towards obesity.

Children are also bombarded with paper advertisements and television commercials that promote the consumption of high fat foods with limited nutritional value. The solution to this problem is a reduction of high caloric foods such as foods containing a high concentration of fat and simple sugar and the reduction of sweetened drinks including fruit juices sweetened with sugar (Rielly, 2007). Children should also be encouraged to increase their physical activity (Rennie, Johnson & Jebb, 2005).

Adverse Consequences of Childhood Obesity

Obesity in childhood creates both short-term complications (conditions that develop in childhood) and long-term complications (conditions that develop in adulthood). Short-term complications arising from obesity include: orthopedic problems particularly in the foot and hip joint, asthma, psychosocial alienation, abnormal blood lipid profile, hypertension, type 2 diabetes (once thought to only afflict the adult population), liver disease, and cancer (Rielly, 2007). The long-term consequences of childhood obesity are an increased risk of premature death resulting from numerous diseases (CDC, 2002).

Influence of Physical Inactivity on Academic Performance

In addition to the adverse physiological effects of obesity which is partly attributed to physical inactivity, research studies have also demonstrated that physical inactivity adversely influences academic performance (Chomitz, et al., 2009, Tomporowski, Davis, Miller & Naglieri, 2008). Students who are physically active perform better academically than inactive students. The relationship between physical activity and academic performance may be explained by both physiological and psychological mechanisms.

Animal studies have demonstrated that physical activity stimulates neural development (Studenski, et al., 2006) and higher capillary volume (Kramer et al., 2002). Hillman, Castelli and Buck (2007) investigated the relationship between physical activity and cognitive function by comparing high- and low-fit preadolescent children (mean age = 9.6 yr). Their findings suggest that physical fitness was positively associated with neuroelectric indices of attention and working memory. Taras (2005) also demonstrated that students who are physically active demonstrate greater attention during class than sedentary students. From a psychological perspective, physically active individuals report higher levels of self-esteem and lower levels of anxiety, which have both been associated with improved academic achievement (Flook, Repetti, & Ullman, 2005).

Cross-sectional studies have demonstrated a positive relationship between physical activity and academic performance. One study demonstrated that students who passed all components of the *Fitnessgram* had higher academic performance measured by the standardized Illinois State Achievement Test. This relationship was demonstrated in third- and fifth- grade students (Castelli, Hillman, Buck & Erwin, 2007). A study conducted by the California Department of Education (2005) evaluated the performance of over one million children on standardized tests of physical fitness, including variables such as aerobic fitness, body composition, muscular strength and muscular flexibility to the California Standards Test, which includes indices of language arts and mathematics proficiency. κPhysical fitness scores of children in fifth-, seventh-, and ninth-grade were positively correlated with measures of academic achievement. This correlation was stronger in girls and students with higher socio-economic status. However, a significant positive

relationship was also demonstrated between physical fitness and academic performance in male students and in students with lower socio-economic status.

A meta-analysis conducted on 16 experimental designs reported a positive relationship between physical activity and cognitive function in school-aged children (Sibley & Etnier, 2003). This study demonstrated that physical activity was positively related to various components of cognitive function such as: perceptual skills, academic achievement, verbal skills, mathematic skills, memory, and academic readiness. This study demonstrates that physical activity improves general cognitive function which has greater universal application than improvement in one specific skill such as mathematic performance. This study implies that physical activity improves the decision making process which that may lead to an improved overall quality of life.

There is limited causational research between the role physical activity plays in increasing academic performance in early childhood education settings. Davis et al. (2007) investigated the influence of physical activity in the form of moderate aerobic exercise on cognitive function. Examples of physical activities performed during physical activity sessions included activities such running games, tag games, jump rope and modified basketball and soccer. The emphasis was on exercise intensity (the goal was to perform activities that produced heart rates >150 bpm), enjoyment and safety, not competition nor the enhancement of skills. Heart rates were monitored during activity with a Polar pulse monitor. Nearly every child achieved this goal nearly every day. Ninety-four sedentary, overweight, but otherwise healthy children (mean age 9.6 years) were randomized to a 20 minute/day treatment, a 40 minute/day treatment, or control condition. Exercise sessions were 5 days per week for 15 weeks. The exercise sessions were conducted after school during a school semester at a location off campus. The Cognitive Assessment System, a standardized test of cognitive processes was administered individually before and following intervention. Analysis of covariance was used to examine differences in posttest scores of various cognitive scales among groups (20 min, 40 min, control) controlling for cohort and pretest scores. Group comparisons demonstrated that the control group had lower posttest cognitive scores than the 40 min/day treatment. There was no difference in posttest cognitive scores between the control group and the 20 minute/day treatment. The results of this study indicate that physical activity in the form of moderate intensity aerobics, performed for 40 minutes per day may be a simple method of enhancing children's mental functioning central to cognitive development.

One criticism of the study conducted by Davis et al. (2007) was that since the physical activity program was conducted after school, the physical activity program did not reduce the academic education programs devoted to traditional academic disciplines (i.e., history, mathematics, English, and science). A study by Carlson et al. (2008) demonstrated that when a physical education class was incorporated into the academic curriculum there was not a reduction in academic performance in traditional academic programs even though class time devoted to these areas was taken away because of the introduction of the physical education class.

Prevalence of Physical Activity (Physical Education) in Elementary Education Programs

Healthy People 2010 goals advocate requiring schools to mandate daily physical education. However, legislative programs such as "No Child Left Behind Act of 2001" have placed pressure on school systems to increase academic performance. The majority of school systems have responded to these apparently conflicting pressures by reducing school time devoted to physical education. Currently only about 3.8% of schools require daily physical education classes in early childhood education programs (Lee, Burgeson, Fulton & Spain, 2007).

Strategies for Increasing Physical Activity in Early Childhood Educational Programs

Research has found that children are not meeting daily physical activity recommendations (Dowda et al., 2004). Research has further demonstrated that children are becoming sedentary during a significant portion of the time they spend in childcare settings (Finn & Specker, 2000). Inactivity during preschool may place children at an increased risk for being overweight which could lead to obesity and place children at risk for developing all of the chronic diseases associated with this condition (Trost et al., 2003). Research has shown that physical activity behavioral patterns are established early in life (Jago et al., 2005). The time to proactively influence an active lifestyle in children is during early education. If children start life with sedentary behaviors, they are likely to continue this pattern and to experience many adverse health consequences referenced in this paper. In addition to the physiological affects of inactivity, studies have demonstrated that physical activity plays an important role in the cognitive development of children. Therefore it is essential that physical activity becomes an essential part of a child's life early in age (Moore et al., 2003). When students are at the age of early childhood education, children are not interested in competition or learning specific skills to improve performance. Therefore, the goal of physical activity programs should focus on caloric expenditure through games that require activity such as running and jumping. Simple games with limited rules require no specific skills. Examples include tag and modified sports such as Frisbee football and soccer are recommended (Davis et al., 2007). Physical activity classes should be offered daily, and the aerobic exercise should last 40 minutes (Davis et al., 2007).

Conclusions

Based on the articles reviewed in this paper, the incorporation of physical activity into an early childhood education program would have many beneficial effects. A physical activity program would help with the growing problem of childhood obesity and all the diseases associated with this condition. When a physical education class is incorporated into the academic curriculum there is not a reduction in academic performance in traditional academic programs though class time devoted to traditional academics is reduced because of the introduction of the physical education class. The research studies reviewed in this paper indicate that when physical activity is incorporated into an early education program, physical activity can reduce the growing incidence of childhood obesity and all the diseases associated with this condition. Physical

activity also has been demonstrated to promote mental functioning central to cognitive development. When considering the beneficial effects of physical activity it appears apparent that early childhood educational programs should incorporate physical activity into their academic curriculum.

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