

2013

The Effects of Physical Activity/Fitness on Academic Performance: A Review of Literature

Michaelene Powell
University of Northern Iowa

Let us know how access to this document benefits you

Copyright ©2013 Michaelene Powell

Follow this and additional works at: <https://scholarworks.uni.edu/grp>

Recommended Citation

Powell, Michaelene, "The Effects of Physical Activity/Fitness on Academic Performance: A Review of Literature" (2013). *Graduate Research Papers*. 4301.

<https://scholarworks.uni.edu/grp/4301>

This Open Access Graduate Research Paper is brought to you for free and open access by the Student Work at UNI ScholarWorks. It has been accepted for inclusion in Graduate Research Papers by an authorized administrator of UNI ScholarWorks. For more information, please contact scholarworks@uni.edu.

Offensive Materials Statement: Materials located in UNI ScholarWorks come from a broad range of sources and time periods. Some of these materials may contain offensive stereotypes, ideas, visuals, or language.

The Effects of Physical Activity/Fitness on Academic Performance: A Review of Literature

THE EFFECTS OF PHYSICAL ACTIVITY/FITNESS ON ACADEMIC PERFORMANCE:
A REVIEW OF LITERATURE

A Research Project
Submitted
In Partial Fulfillment
Of the Requirements for the Degree
Masters of Arts.

Michaelene Powell
University of Northern Iowa

JUNE 2013

This study by: Michaelene Powel

Entitled: The effects of physical activity on academic performance: a review of literature

has been approved as meeting the research project requirements for the Degree of Physical
Education

6/14/2013
Date

Dr. Fabio Fontana, Chair, Research Project Committee

6-14-13
Date

Dr. Ripley, Research Project Committee

TABLE OF CONTENTS

INTRODUCTON.....	1
Purpose Statement.....	3
Research question.....	3
Justification.....	3
Definitions.....	4
REVIEW OF LITERATURE	
Benefits of physical activity/fitness to children and adolescents.....	5
Effects of physical activity/fitness on academic performance.....	8
Effective physical activity interventions do not hurt Academic performance.....	13
Improved motor coordination may help improve academic performance.....	20
CONCLUSION.....	23
REREFERENCES.....	26

INTRODUCTION

Obesity rates have tripled among school-age youth in the last three decades, while levels of physical activity in youth continue to decline (Fedewa & Ahn, 2010). Schools have cut physical education time to increase time for academic subjects because of the focus on higher test scores and better academic performance (Masurier & Corbin, 2006). Yet a wealth of evidence suggests that the time spent in physical activity (i.e. physical education, recess) does not detract from academic performance and it may enhance performance.

Physical activity is important for children and adolescents so they can stay healthy and active. Active children are less likely to develop type 2 diabetes, cardiovascular disease, and high blood pressure. Active children will have lower body mass index (BMI), and remain more active as adults (Lee, Burgeson, Fulton, & Spain, 2007). Children and adolescents that are physically active have a better self-concept, better self-esteem, less depression and more positive peer relationships (Basch, 2010; Chomitz, Slining, McGown, Mitchell, Dausen, & Hacker, 2009; Tremblay, Inman, & Willms, 2000). Research also suggests that there is an increase in gray matter volume in the brain due to an increase in physical activity (Tompsonski, Davis, Miller, & Naglieri, 2007) and that physical activity can help control hyperactivity (King et al., 2005).

Although participating in physical activity is linked to numerous health, physical, and social benefits, legislative pressures have increased instructional time and minimized physical education and unstructured play time (i.e. recess) (Masurier & Corbin, 2006). In fact, only 50% of elementary schools and 25% of middle schools nationwide require physical education, and less than approximately 5% of American schools provide children with a daily physical education class (Fedewa & Ahn, 2010). A student's physical fitness plays a considerable role on academic performance (Van Dusen, Kelder, Kohl, Ranjit, & Perry, 2011). All children (as

young as kindergarten) can benefit from physical activity, and there is a correlation between academic test scores and physical fitness levels (Van Dusen et al., 2011). Research has linked aerobic fitness to neuroelectric and behavioral performance of children during a stimulus discrimination task (Hillman, Castelli, & Bucks, 2005). School principals and teachers suggest that students who are physically fit have greater focus in the classroom, perform better on standardized test, and exhibit fewer behavioral problems (Tomporowski et al., 2007).

Schools are the perfect place for the promotion of lifelong physical activity because most children can be reached. At school, opportunities for children to be physically active can be provided during physical education classes, during recess, class-room activity breaks, and before/after school hours (extracurricular activities). Through special school-based physical education programs, schools can increase a students' activity level and help them become more physically fit. The SPARK health-related physical education program increased physical activity during physical education classes (Sallis, McKenzie, Alcaraz, Kolody, Faucette, & Hovell, 1997). This program can also help the students develop more healthy and nutritious habits while eating.

Being physically fit seems to help academic performance, yet other skills acquired through physical education also help academics. It has been suggested that the development of coordination is related to the development of cognitive skills (Sons & Meisels, 2006). Physical activity that requires high levels of coordination takes a high cognitive demand, so learning motor skills as part of physical activity participation helps develop cognitive potential (Derri, Emmanouilidou, Tzetzis, & Kioumourtzoglou, 2008; Tomporowski et al., 2007). A brief description of the relationship between academic performance and physical activity has been described, but a more in depth description will be presented next. In addition, reasons to explain

the relationship between fitness and academic performance are provided, including an examination of each academic subjects and what type of fitness is more beneficial. Effective physical activity programs designed for school environments and the implementation and coordination are also discussed.

Purpose Statement

The purpose of this review is to study the relationship between physical activity/fitness and academic performance.

Research Questions

1. What evidence is there to support a beneficial effect of physical activity/fitness on academic performance?
2. What are characteristics of physical activity programs (school-based) considered effective at increasing physical activity levels?
3. What are the proposed mechanisms to explain an enhancement of academic performance?

Justification

Physical inactivity is responsible for approximately 191,000 deaths in the United States each year. More than 60% of the population worldwide fails to meet the physical activity recommendations (60 minutes daily) that are required to achieve healthy benefits (Fedewa & Ahn, 2010). Besides, physical education has been cut in schools (Van Dusen et al., 2011) although fitness seems also to be associated with better academic performance. (Chomitz et al., 2009).

Definitions

Obesity: Condition in which excess body fat has accumulated to the extent that it may have adverse effect on health (Fedewa & Ahn, 2010)

BMI: BMI stands for Body Mass Index (Lee, Burgeson, Fulton, & Spain, 2007), and it is a way to classify individuals in different obesity classifications in order to assist individuals who may be more prone to obesity related diseases

Type 2 Diabetes: Develops most often in obese individuals and that is characterized by hyperglycemia resulting from impaired insulin utilization coupled with the body's inability to compensate with increased production (Lee, Burgeson, Fulton, & Spain, 2007).

Hyperactivity: The state or condition of being excessively or pathologically active (King et al., 2005).

HFZ: HFZ stand for Healthy Fitness Zone (Wittberg, Northrup, & Cottrell, 2012), and refers to individuals with adequate levels of fitness

Physical Activity/Fitness: physical activity and fitness are separate concepts. Physical activity is the bodily activity that enhances or maintains physical fitness and overall health, and fitness is a set of characteristics that people have or achieve that relates to the ability to perform physical activity. Due to the fact that this literature is to inform physical education practices, and in physical education practices physical activity is the process to achieve fitness and fitness is a product of physical activity, a decision was made for the purpose of this literature to use both terms interchangeably.

REVIEW OF LITERATURE

The purpose of this study was to determine the effects of physical activity on academic performance. The review looked at the benefits of physical activity/fitness, the effects on physical activity, fitness and coordination on academic performance, and quality school-based physical activity programs. Specifically, this review focused on gathering information about how physical activity/fitness affects cognitive performance in order to influence physical education practices.

Benefits of Physical Activity to Children and Adolescents

Physical activity is critical to the health of children and adolescents. Physical inactivity is associated with increased obesity rates in children and young adults, increased cardiovascular disease risk during adulthood, and increased type 2 diabetes in children (Lee et al., 2007). Each of the above impacts health independently of one another. Besides having lifelong benefits, the engagement in physical activity by children and adolescents tends to remain relatively stable across development with more active children becoming more active adults (Wittberg, Northrup, & Cottrell, 2012). Thus, the benefits are not limited to current health conditions, but include reducing health conditions and health care costs in the future.

In addition to the physical benefits, physical activity has a positive impact on the psychological well-being of children and adolescents. Children and adolescents who participate in physical activity have shown an increase in self-esteem (Basch, 2010; Chomitz, Slining, McGowan, Mitchell, Dawson, & Hacker, 2009; Tremblay, Inman, & Willms, 2000). This increase in self-esteem seems to promote positive relationships between children and

adolescences. It seems that respect for themselves and between peers is a learned behavior during participation in physical activity (Fox, Barr-Anderson, Neumark-Sztainer, & Wall, 2010). Children and adolescents can also alleviate the symptoms or avoid depression with engagement in physical activities, although the necessary amount of physical activity is inconclusive and seems to depend on the mode of physical activity (Grissom, 2005). Finally, continuous aerobic physical activity has been supported to have a positive effect of a child's self-concept. More specifically, research shows an increase with self-concept in children and adolescents who are engaged in physical activity for 60 minutes daily in terms of global self-concept increase, sport competence, social self-concept, and academic self-concept (Grissom, 2005). The social/emotional stimulation provided by physical activity is critical to young minds as it encourages a healthy preparation for adult life.

In addition to immediate physical and psychological benefits, children and adolescents who participate in physical activity reduce their chances of future health conditions as adults. Research shows children and adolescents who participate in physical activity when they are younger develop the skill set and behaviors for life long physical fitness (Chomitz et al., 2009). Research also shows that an active lifestyle during childhood may delay the onset of cardiovascular disease and high blood pressure, and children are less likely to develop these things later in life (Marks, Katz, Styner, & Smith, 2010; Tremblay et al., 2000). When current physical activity guidelines for children and adolescents of 60 minutes of daily moderate or higher cardiovascular physical activity is followed, there is a decrease in the chances of children acquiring some serious health conditions.

Physical activity, cognitive functioning and hyperactivity/inattention difficulties are some big factors associated with children's academic performance (King et al, 2005).

Hyperactivity/inattention are related to poor academics in children (King et al, 2005), and children are at greater risk for problems with hyperactivity/inattention. Research indicates that interventions with physical activity or extra physical education time improve the children's attention and hyperactivity which consequently improve academic performance (King et al, 2005).

Research also shows that young children can increase the gray matter volume in their brain by participating in physical activity (Tomporowski, Davis, Miller, & Naglieri, 2007). Exercise can produce neurotrophins that regulate the survival, growth, and differentiation of neurons during development (Tomporowski et al., 2007). Research also indicates that high-fit preadolescent children have a larger population of neurons and faster neurocognitive processing than low-fit children and this can lead to better task involvement, which leads to better academic scores (Hillman, Castelli, & Buck, 2005). This suggests that exercise can directly affect neurological development. As children are becoming more physically fit, they are also helping their brain to grow and do more complexed operations.

Physical activity for children can help them now and later in life. Children that are more active tend to be more active as adults (Wittberg, Northrup, & Cottrell, 2012) and this leads to better health. Being physically active helps a child's self-esteem and promotes positive relationships with other peers (Chomitz et al., 2000) along with developing better healthy habits and life long fitness with friends. This activity also helps cognitive functioning, which leads to less hyperactivity and better academic skills. While children are staying active and exercising they are also increasing their gray matter volume and neurocognitive functions (Tomporowski et al., 2007). All this leads to happier, healthier, and more academically sound children.

Effects of Physical Activity/Fitness on Academic Performance

Pressure for better academic scores has forced many schools nationwide to eliminate or reduce less academic oriented subjects such as physical education (Fedewa & Ahn, 2010). This is a great concern considering that physical inactivity is associated with several physical and psychological health problems such as obesity, cardiovascular problems, and depression (Kropski, Keckley, & Jensen, 2008). Interestingly, enhanced physical fitness of students has also been associated with better academic performance and cognitive function. A more detailed discussion of the association between fitness and academic performance follows.

A student's physical fitness plays a considerable role on academic performance. Van Dusen, Kelder, Kohl, Ranjit, and Perry (2011) measured several fitness constructs such as cardiovascular and overall body strength and compared performance on fitness tests to academic performance. They found that although fitness affected the performance of students from elementary throughout high school, the effects were larger for older students. These results were attributed by the authors to the unreliability of fitness tests performed with younger students. The authors also found that cardiovascular fitness had the highest correlation with academic performance, followed by strength and flexibility (Van Dusen et al., 2011). Yet other studies show younger students benefiting from physical activity. Son & Meisels (2006) suggested that fitness helps students as young as kindergarten with academics. Similarly, Van Dusen et al. (2011) found a positive correlation between academic test scores and physical fitness levels in elementary school children (Van Dusen et al., 2011). In sum, a student's cardiovascular fitness is imperative when determining the effects of fitness in school age children, and although evidence is stronger for older students, it seems that younger students' academic performance is also associated to their level of fitness.

In addition to indicating that fitness and academic performance are positively correlated, studies have also shown that aerobic performance may have the highest correlation to academic performance among the fitness components (Racett, Cade, & Beckmann, 2010; Wittberg, Northrup, and Cottrell, 2012). Wittberg, Northrup, and Cottrell (2012) investigated the association between academic performance and fitness components over time. Students' academic skills were associated with their aerobic capacity. Greater aerobic capacity translated into better academic skills. These greater academic skills seemed to stay with the students over-time as long as the students stayed in their HFZ. Although other components of fitness were measured such as body composition, muscular strength, endurance, and flexibility, aerobic capacity had the strongest support to help academic skills. Curl-ups, push-ups, flexibility, and trunklift were also associated with better academic performance. It seems that physical activity programs targeting academic performance improvement need to have a strong aerobic capacity component.

Cardiovascular fitness seems to be specifically important when improvements in math scores are desired. A student's over-all cardio-vascular fitness has a strong relationship to math scores. The better cardio-vascular shape the student is in, the better math scores the student seems to have (Chomitz et al., 2009). Aerobic performance is the component of fitness most likely to be positively correlated to academic performance; however, the association between fitness and aerobic performance in particular to academic performance seem larger when the subject is math (Van Dusen et al., 2011). Aerobic performance may be especially important for schools that need specific improvement in math scores.

Thus far it has been demonstrated that fitness affects the academic performance of students, but there has been no mention about the mechanisms mediating the relationship

between fitness and academic performance. One possible mechanism may be through improvement in the student's perceptions of themselves. In other words, fitness may also help improve academic performance by improving the student's perceptions of themselves. Florin (2011) investigated whether students' perceptions of their weight affected their self-esteem and academic performance. The authors found that regardless of their actual weight, students who perceive themselves as overweight had lower self-esteem and worse academic performance. Chomitz et al. (2009) also showed that when a student is fit, he will tend to have a better self-image. Feeling better about yourself may be a reason why students have better academic performance when they are fit.

Another possibility is that fitness may help cognitive function, which in turn helps academic performance. Cognitive processes such as attention span, working memory, reaction time and overall processing speed may be affected by physical activity levels (Van Dusen et al, 2011). Van Dusen et al (2011) used electroencephalography to measure reaction times and mental functioning. Children who were physically fit had better response times and faster cognitive processing speed than children who were not physically fit (Tomporowski et al., 2007). It is possible that when children improve their fitness level, they improve their cognitive function which may make them more apt to learn academic subjects.

Another mechanism that can be used to explain by academic performance after improvements in fitness may be through the control of hyperactivity. Hyperactivity can be a problem in the classroom, which leads to academic problems. Research has indicated that hyperactivity is related to executive function (Tomporowski et al., 2007), and this can hinder the academic learning process. Executive functions help children to know when to apply the knowledge they have at the correct time (Son & Meisels, 2006). Children who can not plan

ideas and use their working memory, move from one mental set to another, and lack control over impulsive behaviors because of hyperactivity are usually not going to be on-task in the classroom. These children are likely not going to excel academically (Tompsonowski et al., 2007). It has been suggested that physical activity can help hyperactive students calm down in class and focus more while at the same time helping their executive functions (Marks et al., 2010). Increased attention in class will help the students academically.

After discussing the association between physical activity and academic performance and its possible mechanism, it is important to focus on how to best help children improve their fitness levels. Peer influence in school-age children seems to have a substantial effect on physical fitness (Ahamed, Macdonald, Reed, Naylor, Liu-Amrose, & McKay, 2007). Ahamed et al., (2007) found that students in a small group intervention had the largest academic benefits. In the small groups, students were able to be more engaged with peer students they most enjoyed. Grouping children with close peers may increase their energy towards acquiring higher levels of physical activity in class. It is also important to highlight that mixing genders in the small physical activity groups had a positive effect on academic achievement and cognitive abilities (Ahamed et al., 2007). Along these lines, a connection can be made to sport teams. Sport teams are small groups, and participation in sports teams has been related to higher GPA's in middle and high school students (Fox, Barr-Anderson, Neumark, & Wall, 2010). To increase participation in physical activity, physical education teachers and coaches should focus on organizing students into small groups.

Considering that fitness, especially aerobic performance, seems to be positively associated with academic performance, especially math, it is important to find strategies that most effectively improve the fitness of students. Research shows that students who are more

physically fit will do better in academics than students who are not as physically fit. Research has also shown that students who had less hours of academic instructional time and more physical activity time did just as well academically as students who had more academic time and less physical activity time (Wittberg, Northrup, & Cottrell, 2012). Physical educators and administrators need to see the potential impact of physical fitness on academic achievement. Physical education should be a priority subject in the curriculum. Within physical education, cardiovascular fitness should be emphasized since it shows the greatest contribution toward academics.

Effective Physical Activity Interventions do not hurt Academic Performance

Schools are the ideal setting for the promotion of lifelong physical activity because it is easy to reach a large number of children. At school, opportunities for children to be physically active can be provided during physical education classes, classroom hours (activity breaks), recess periods, and before/after school hours (extracurricular activities). In addition, teachers can teach children the behavioral skills necessary to develop and maintain a healthy nutritious and active lifestyle (Cardon et al., 2009). School physical education classes are the primary societal institution with the responsibility for promoting physical activity in youth, and 97% of elementary school students take physical education. Schools are a great environment to provide physical activity and educate children about healthy living (Cardon et al., 2009).

Of immediate concern, the frequency of physical education lessons in school has been shown to be less than desirable. Current guidelines for children's daily physical activity state that children should participate in 60 minutes or more of moderate to vigorous physical activity (Sollerhed & Ejlertsson, 2008). Considering how much time during the day children spend in school, schools should be heavily involved in assuring that students are physically active for 60 minutes a day. Physical education programs can be a great place for children to be active in schools, after all it is the only class with focus on providing physical activity opportunities. In order to contribute to the achievement of daily physical activity guidelines, children should be active 50% of physical education class time (Sallis et al., 1997). Unfortunately, physical education programs are being cut or reduced. Thus, there is need to examine efficiently designed physical education programs.

Well-designed physical education programs should promote physical activity in and outside of school. Since physical activity recommendations cannot be met through physical education alone, the

school-based programs are designed to increase physical activity during physical education classes, during school, and help students become more aware of more healthy and nutritious habits while eating.

The Sports, Play, and Active Recreation for Kids (SPARK) program is a comprehensive curriculum and professional development program designed to promote physical activity in and out of school. SPARK physical education classes are designed to promote high levels of physical activity that will improve health-related fitness, promote movement skills that add to success and enjoyment in physical activity, and encourage positive socialization. The SPARK curriculum calls for physical education classes to be taught a minimum of 3 days a week throughout the school year (36 weeks). The yearly plan is divided into instructional units typically 4 weeks (12 lessons) in length. A standard SPARK lesson lasts 30 minutes and has two parts: a health-fitness activity (15 min) and a skill-fitness activity (15 min) (Sallis et al., 1998). With the health-fitness section of SPARK, there are 13 activity units based around fitness (jogging, aerobic dance, jump rope). These activities will progress by increasing the intensity, duration, and complexity of the activities. The sport-fitness part includes nine sports units that utilize the potential for cardiovascular fitness. (e.g. soccer, basketball, Frisbee), some activities were included to develop upper body and abdominal strength.

There is also a self-management program that is taught by the classroom teachers. The self-management program teaches behavior change skills to help students generalize regular physical activity outside of school. Self-management is taught in weekly 30 minute classroom sessions. Skills taught include self-monitoring, goal setting, stimulus control, self-reinforcement, self-instruction, and problem solving. Homework and monthly newsletters are intended to stimulate parent-child interaction and support for physical activity (Sallis et al., 1997).

The SPARK health-related physical education program has been shown to increased physical activity during physical education classes but not out of school (Sallis et al., 1997). Three other studies

have investigated the effect of an enhanced physical education curriculum on academic performance and also reached similar results where physical activity during physical education increased (Sallis et al., 1999 & Ahamed et al., 2007 & Shephard, 1997). To the author's knowledge, there are no studies showing that devoting increased time to physical education harmed academic performance (Sallis et al., 1999 & Ahamed et al., 2007 & Shephard, 1997). In fact, in the two studies conducted by Sallis et al. (1997, 1999), the academic scores in reading and language increased after the implementation of SPARKS. SPARKS is an effective physical education program that has helped students increase physical activity level with no negative consequences to their academic performance.

Dobbins et al. (2009) conducted a Cochrane review of randomized controlled trials and quasi-experimental studies of school-based physical activity interventions designed to promote physical activity and fitness in children and adolescents. Dobbins et al. (2009) used this review to develop a school-based program to optimize the good ideas of the models that were reviewed and used what worked best in each one to create a new model. This model suggests that the program should be a minimum of 18 weeks and benefits may include improvements in students' physical activity levels, cardio respiratory fitness, and cholesterol levels as well as a reduction in time spent watching television. The program also includes a nutrition component designed by a dietitian. Finally, teachers were trained and had access to lesson plans that were consistent with the national and state physical education and health standards.

Racette et al. (2010) investigated the effectiveness of the program developed by Dobbins et al. (2009). Physical activity interventions included activities such as Wii Fit training and the use exercise balls in the classrooms instead of chairs, a "walking school bus" (a group of children walking to school with one or more adults), hip-hop dance, and "footsteps to fitness" cross-curricular program in which students wear pedometers and are challenged to walk to a particular destination on a world map by

charting their daily pedometer steps. Zumba, setup, and other exercise classes were also offered by certified instructors through the local YMCA. In addition, a portfolio including information about physical activity, fitness, nutritional goals, heart rate monitoring, pedometry and self-efficacy assessment results were put together by students and maintained each day. During this 3-year intervention-and-assessment period, changes were observed in 4 physical fitness standards: endurance, upper-body strength, abdominal strength, and flexibility. The number of students K through 12 who met all 4 physical fitness standards increased from 15.5% to 21.2%. Physical activity among elementary students increased 13% and K – 12 students healthy BMI scores increased from 61.5% to 63.3% (Racette et al., 2010). The students that increased their physical fitness had higher test scores than students who improved their BMI levels. The program designed by Dobbins was successful at increasing physical activity and fitness levels as at the same time improving academic performance.

A similar comprehensive physical activity program is the Action Schools!BC (AS!BC) School-based model. AS!BC uses a comprehensive school health framework to increase physical activity in elementary schools which relies on a whole-school approach. The AS!BC model creates individualized action plans that provide increased physical activity opportunities across six action zones: school environment, extracurricular, family and community, school spirit, scheduled physical education, and classroom action (Ahamed et al., 2007). The ultimate goal is providing students with 150 minutes of physical activity per week.

The AS!BC model provides classroom teachers with training and resources to utilize during the implementation of the program. Classroom teachers are asked to provide students with 15 minutes of additional minutes of classroom physical activity each day (75 min per week). The teachers are provided with training, workshops, written materials, classroom action bins (equipment, balls, jump ropes, etc.), school newsletter inserts for families, and an ongoing curriculum. The physical education

program consists of regular physical education classes for 40 minutes two times a week. With 80 minutes a week of regular physical education and 15 minutes of classroom physical activity each day (75 min per week), the students are expected to have 150 minutes of physical activity a week. Research on the AS!BC model has found that despite dedicating approximately 15 additional minutes of daily physical activity, instead of 15 minutes of academic work, the children's academic performance was not compromised (Ahamed et al., 2007).

The findings of the studies measuring the effectiveness of school-based models support several things, including that children are not currently getting enough physical activity, not every school-based physical activity program is the same, and a good quality school-based physical activity program can at least improve students physical activity levels without hurting academic performance. All the programs helped the students become more physically fit and be more aware of their physical activity habits.

The models that involved the more factors: school, physical education, after-school program, nutrition and family seemed to have the most success. The after-school program seemed to be the least effective in terms of finding improvements in physical activity levels. Looking at all the models it seems that extracting the most effective elements of each may be the best strategy for teachers thinking about implementing them at their schools.

A model that trains the classroom teachers and integrates physical activity into the classroom seems to work well. Having a nutrition, health and goal setting lesson during class is optimal with goals and rewards at lunch for healthy eating. The use of technology (pedometers and heart rate monitors), challenges, and keeping journals keeps the students motivated. When families and the community (i.e. YMCA and recreation centers) are involved, it helps with the after-school and out of school activity levels. Physical education classes need to focus on students acquiring more moderate to vigorous

physical activity during class. With all these conditions working together, a healthier and more active school will happen and that would be a good school-based program.

With the shrinking opportunities for physical activity in schools, and a nation-wide overweight problem, a good school-based activity program is recommended. When a school-based program includes all areas of the school, parents and community the impact on physical activity, academic performance, healthy and nutritional habits is likely to be more positive. A model that keeps the students' activity level moderate to vigorous during physical education and having physical education three days a week is recommended. The teachers must be trained in teaching nutritional habits and some physical activity for in the classroom. The schools are the ideal setting for enhancing physical activity in students, so schools need to incorporate a school-based program to help physical fitness levels as well as academic levels and healthier habits for the students.

Improved Motor Coordination may Help Improve Academic Performance

Physical education helps improve physical fitness, and fitness is positively associated to academic performance. In addition to fitness, physical education may also help improve academic performance in multiple ways. One of these ways may be improved motor skills. Literature suggests that the development of motor skills is related to the development of cognitive skills, and motor skills can be an indicator of cognitive skill development (Son & Meisels, 2006). Son & Meisels (2006) talked about Piaget's (1952) developmental theory states that motor skills contribute to an infants' active exploration of the environment, and through these explorations infants get their knowledge of the world. Physical education is the prime place for children to learn, develop, and enhance the motor skills they need to become physically fit and academically fit. Physical education can help children develop motor skills, and as a consequence get students more involved in sports and improve their cognitive and academic performance.

The mediator between motor skill and academic performance may be coordination. The human body can perform different and complex movements at the same time (Planinsec & Pisot, 2006). Turvey (1990) was cited by Planinsec & Pisot (2006) was describing coordination as a patterning of body and limb motions relative to the patterning of environmental objects and events. When performing a motor task successfully, a high cognitive demand is conditioned by the processing of information and decision making; therefore, the performance of motor tasks with high cognitive demands relies on the use of cognitive processing of information (Tomprowski et al., 2007). When movements become more complex, the intellectual demand becomes higher (Planinsec & Pisot, 2006). So in developing your motor skills, coordination

improves and you develop your cognitive capacities, and in turn help academic performance improve.

Motor skills and visual skill movements are greatly associated with cognitive skills and achievement (Son & Meisels, 2006). Results have found correlations between kindergarten motor skills and cognitive achievement, and the under achievement of some students in occurring simultaneously in academic and motor skills (Son & Meisels, 2006). Cognition is related to higher motor skill acquisition, and higher motor skill development in turn will help with better thought processes (Derri, Emmanouilidou, Tzetzis, & Kioumourtzoglou, 2008). Improved motor skills may also help with the child's visual skills which exert important self-regulatory functions important for academic performance (Son & Meisels, 2006). Things such as not being able to hold a pencil correctly or draw correctly could slow the learning process. If students have good motor skills, the thought processes, holding a pencil, and writing are expected to improve.

Participation on a sports team is a good way to get physical activity and the motor coordination exercises performed during sports. Improved coordination may be partially the reason why many studies have said that being on a sports team is also associated with better academic achievement (Fox et al., 2010). As an example, Fox et al., (2010) looked at how physical activity, sports team participation, and GPA's are related for middle and high school students. Higher GPA's were associated with students being involved in sports, and if you were involved with more than one sport, your GPA was higher and sustained over the whole academic year. Obviously, sports may contribute to better academic performance in multiple ways such as by increasing the levels of physical activity or improving the social and emotional development

of children (King et al, 2005). However, improved coordination acquired through the participation of students in sports may also be a factor.

Learning motor skills in physical education classes or practicing a sport seem to be sound ways for our youngsters to improve academic performance. It seems that at least partially that may be related to the levels of coordination required by the activities. When students learn new patterns of coordination because they want to be involved in a sport, the brain has to work harder, and cognitive and academic performance improves. Physical education and playing on a sports team can improve students' coordination, help their GPA, and over-all improve their cognitive academic performance.

CONCLUSION

In the process of integrating all this information, I think several factors come to light. Information gathered in this study strongly supports that physical activity is good for all individuals, at all ages. These studies have supported that physical activity helps with children staying fit, healthy, lowering obesity rates, and lowering rates of type 2 diabetes and high blood pressure, (Lee et al., 2007; Basch, 2010; Trembly et al., 2000; Chomitz et al., 2009; Tomporowski et al., 2007; Yli-Piipari et al., 2009). Physical activity also helps psychologically. There is improvement in self-esteem, self-concept, and more positive relationships with peers are developed for children who are more active (Chomitz et al., 2000). More importantly for the purpose of this paper, physical activity is positively associated with academic performance (Van Dusen et al., 2011). This association may be explained by the fact that greater aerobic fitness is associated with changes in neurocognitive function, as higher fit children exhibit a more effective neuroelectric profile than lower fit children. The higher fit children also perform better along behavioral measures of reaction time and response accuracy, perhaps stemming from greater allocation of attentional resources to working memory (Castelli et al., 2007). Children that are physically fit have better response times and faster cognitive processing speed than children that are not physically fit (Tomporowski et al., 2007). It seems that young students have a stronger academic performance when they are physically fit.

Although physical activity is clearly important, children are becoming obese and very few of them achieve daily recommendations for physical activity (Marks et al., 2010). Students are watching more TV, playing video games and increasing computer time, instead of going outside to be active. Our schools are not helping. Years ago physical education was offered everyday, then went down to three times a week and now most schools offer it once or twice a

week for 30 minutes (Madsen, Hicks, & Thompson, 2010). Our schools are taking away physical education because there is pressure in society for children to do well academically and perform better on academic standardized tests. It is important to remember that children enjoy physical activity, and are more likely to be active later in life if the behavior is practiced during childhood and adolescence (Chomitz et al., 2009).

Aerobic capacity seems to be the biggest influence on academic skill levels. The greater the aerobic capacity, along with being able to sustain higher aerobic capacity seems to help to do better academically, especially in math (Masurier, 2006). Yet body composition, muscular strength, endurance, and flexibility can also help academic performance (Wittberg, Northrup, and Cottrell, 2012).

Hyperactivity is a problem in the classroom, with hyperactive students disrupting class and not being able to focus. Increasing the amount of physical activity students with hyperactivity is exposed to can alleviate these symptoms and help them better control themselves and focus in academic classes (Marks et al., 2010). It has been suggested that improvement in execution function will occur after students who are hyperactive are exposed to physical activity programs. Improvement in executive function will also help these students excel academically (Tompsonski et al., 2007).

In order to promote physical activity in schools, this review also focused on programs designed to improve students' physical activity levels and getting in better cardiovascular shape. Based on the review, it is recommended that programs should have activity breaks in the classroom, encourage eating healthy and have incentives for students who do. It is also recommended that schools have daily physical education classes that promote moderate to vigorous activity and extracurricular activities after school. These programs should also involve

the families, and attempt to increase students' intake of fruits and vegetables and cut down on television time. School based programs can be a great solution to help curb obesity and physical inactivity. Motor coordination is another component that can be improved as part of physical education programs. The development of coordination and motor skills is related to the development of cognitive skills. In fact, coordination is an indicator of cognitive development (Son & Meisels, 2006). When students are performing a motor task that takes a high degree of coordination, a high cognitive demand is needed which helps cognitive development (Tomporowski et al., 2007).

In my opinion most children enjoy going to physical education, but schools have cut back on physical education. At the same time, more children are obese because of lifestyle choices and family situations. To help the whole academic and healthier lifestyle situation, I believe that school systems need to be heavily involved in providing opportunities for the students to be active. Adopting one of the school-based programs discussed (i.e. SPARK, Action!BC) would be a good start. Physical educators and administrators need to see the potential impact of physical fitness on academic achievement. This evidence should be presented and emphasized so physical education stays in the curriculum (Van Dusen et al., 2011), and receives the supports it needs. Cardiovascular fitness is strongly and significantly related to academic performance. With that in mind, policymakers should consider physical education mandates in elementary, middle, and high school. School administrators should consider increasing physical education time and physical education teachers should emphasize cardiovascular fitness.

References

- Ahamed, Y., Macdonald, H., Reed, K., Naylor, P., Liu-Ambrose, T., & McKay, H. (2007). School-Based Physical Activity Does Not Compromise Children's Academic Performance. *Medicine and science in sports and exercise*, 39, 371-376.
- Basch, C. E. (2010). Perception of Overweight Is Associated With Poor Academic Performance in US Adolescents. *Journal of School Health*, 81, 663-670.
- Cardon, G. M., Haerens, L. L., Verstraete, S., & Bourdeaudhuij, I. d. (2009). Perceptions of a School-Based Self-Management Program Promoting an Active Lifestyle Among Elementary Schoolchildren, Teachers, and Parents. *Journal of Teaching in Physical Education*, 28, 141-154.
- Castelli, D. M., Hillman, C. H., Buck, S. M., & Erwin, H. E. (2007). Physical Fitness and Academic Achievement in Third-and Fifth-Grade Students. *Journal of Sport and Exercise Psychology*, 29, 239-252.
- Chomitz, V. R., Slining, M. M., McGowan, R. J., Mitchell, S. E., Dawson, G. F., & Hacker, K. A. (2009). Is There a Relationship Between Physical Fitness and Academic Achievement? Positive Results From Public School Children in the Northeastern United States. *Journal of School Health*, 79(1), 30-37.
- Cottrell, L. A., Northrup, K., & Wittberg, R. (2007). The Extended Relationship between Child Cardiovascular Risks and Academic Performance Measures. *Obesity*, 15, 3170-3177.
- Derri, V., Emmanouilidou, O., Tzetzis, G., & Kioumourtzoglou, E. (2008). Relationship between Academic Learning Time in Physical Education (ALT-PE) and Skill Concepts Acquisition and Retention. *Physical Educator*, 65, 134-151.
- Dobbins, M., Corby, K. D., & Robeson, P. (2009). School-Based Physical activity programs for promoting physical activity and fitness in children and adolescents aged 6-18. *Cochrane*

Database System Review, 1, 765-778.

- Fedewa, A. L., & Ahn, S. (2010). The Effects of Physical Activity and Physical Fitness on Children's Achievement and Cognitive Outcomes: A Meta-Analysis. *Research Quarterly for Exercise and Sport, 82*, 521-535.
- Florin, T. A., Shults, J., & Stettler, N. (2011). Perception of Overweight Is Associated With Poor Academic Performance in US Adolescents. *Journal of School Health, 81*, 663-670.
- Fox, C. K., Barr-Anderson, D., Neumark-Sztainer, D., & Wall, M. (2010). Physical Activity and Sports Team Participation: Associations With Academic Outcomes in Middle School and High School Students. *Journal of School Health, 80*, 31-37.
- Grissom, J. B. (2005). Physical Fitness and Academic Achievement. *Journal of Exercise Physiology, 8*, 11-25.
- Hillman, C. H., Castelli, D. M., & Buck, S. M. (2005). Aerobic Fitness and Neurocognitive function in healthy preadolescent children. *Medicine and science in sports and exercise, 37*, 1967-1974.
- King, G., McDougall, J., DeWit, D., Hong, S., Miller, L., Offord, D., Meyer, K., LaPorta, J. (2005). Pathways to Children's Academic Performance and Prosocial Behavior: Roles of physical health status, environmental, family, and child factors. *International Journal of Disability, Development and Education, 52*, 313-344.
- Kropski, J. A., Keckley, P. H., & Jensen, G. L. (2008). School-based Obesity Prevention Programs: An Evidence-based Review. *Obesity, 16*, 1009-1017.
- Lee, S. M., Burgeson, C. R., Fulton, J. E., & Spain, C. G. (2007). Physical Education and Physical Activity: Results From the School Health Policies and Programs Study 2006. *Journal of School Health, 77*, 435-463.

- Madsen, K. A., Hicks, K., & Thompson, H. (2010). Physical Activity and Positive Youth Development: Impact of a School-Based Program. *Journal of School Health, 81*, 462-470.
- Marks, B., Katz, L., Styner, M., & Smith, J. (2010). Aerobic Fitness and Obesity: Relationship to Cerebral White Matter Integrity in the Brain Active and Sedentary Older Adults. *Journal of Sports medicine, Jan*, 208-215.
- Masurier, G. L., & Corbin, C. B. (2006). Top 10 Reasons for Quality Physical Education. *Journal of Physical Education, Recreation, and Dance, 77*, 44-53.
- Planinsec, J., & Pisot, R. (2006). Motor Coordination And Intelligence Level in Adolescents. *Adolescence, 41*(164), 667-676.
- Racette, S. B., Cade, W. T., & Beckmann, L. R. (2010). School-Based Physical Activity and Fitness Promotion. *Physical Therapy, 90*, 1214-1218.
- Sallis, J. F., McKenzie, T. L., Alcaraz, J. E., Kolody, B., Faucette, N., & Hovell, M. F. (1997). The Effects of a 2-Year Physical Education Program (SPARK) on Physical Activity and Fitness in Elementary School Students. *American Journal of Public Health, 87*, 1328-1334.
- Sallis, J. F., McKenzie, T. L., Kolody, B., Lewis, M., Marshall, S., & Rosengard, P. (1999). Effects of Health-Related Physical Education on Academic Achievement: Project SPARK. *Research Quarterly for Exercise and Sport, 70*, 127-134.
- Shephard, R. (1997). Curricular Physical Activity and Academic Performance. *Pediatric Exercise Science, 9*, 113-126.
- Sollerhed, A., & Ejlertsson, G. (2008). Physical Benefits of Expanded Physical Education in Primary School: Findings from a 3-Year Intervention Study in Sweden. *Scandinavian*

Journal of Medicine and Science in Sports, 18, 102-107.

- Son, S., & Meisels, S. J. (2006). The Relationship of Young Children's Motor Skills to Later Reading and Math Achievement. *Merrill-Palmer Quarterly*, 52, 755-778.
- Tomprowski, P. D., Davis, C. L., Miller, P. H., & Naglieri, J. A. (2007). Exercise and Children's Intelligence, Cognition, and Academic Achievement. *Educational Psychology Review*, 20, 111-131.
- Tremblay, M. S., Inman, W. J., & Willms, D. J. (2000). Relationship Between Physical Activity, Self-Esteem, and Academic Achievement in 12 Year-Old Children. *Pediatric Exercise Science*, 12, 312-323.
- Van Dusen, D. P., Kelder, S. H., Kohl, H. W., Ranjit, N., & Perry, C. L. (2011). Associations of Physical Fitness and Academic Performance Among Schoolchildren. *Journal of School Health*, 81, 733-740.
- Van, D. P., Kelder, S. H., Kohl III, H. W., Ranjit, N., & Perry, C. L. (2011). Associations of Physical Fitness and Academic Performance Among Schoolchildren. *Journal of School Health*, 81, 733-740.
- Veugelers, P., Paul, J., & Fitzgerald, A. L. (2005). Effectiveness of School Programs in Preventing Childhood Obesity: A Multilevel Comparison. *American Journal of Public Health*, March, 432-435.
- Weuve, J., Kang, J. H., Manson, J. E., Breteler, M., Ware, J. H., & Grodstein, F. (2004). Physical Activity, Including Walking and Cognitive Function in Older Women. *Journal of American Nurses Association*, Sept, 1454-1461.
- Wittberg, R. A., Northrup, K. L., & Cottrell, L. A. (2012). Children's Aerobic Fitness and Academic Achievement: A Longitudinal Examination of Students During Their Fifth

and Seventh Grade Years. *American Journal of Public Health*, 102(12), 2303-2307.

Yli-Piipari, S., Watt, A., Jaakkola, T., Liukkonen, J., & Nurmi, J. (2009). Relationship between Physical Education Students' Motivational Profiles, Enjoyment, State Anxiety, and Self-Reported Physical Activity. *Journal of Sports Science and Medicine*, Sept, 327-336.