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Implications of Physical Activity on Academic Outcomes

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Abstract

This thesis explores the implications physical activity has on academic outcomes for students. Current research is reviewed to provide an overview of what movement opportunities are already being implemented in schools. Reviewed research discusses the need and impact movement has on the brain and the body. The research also explores limitations and barriers schools, teachers, and students are encountering that makes having physical education programs difficult as well as why the provision of physical activity through interventions in the classroom is challenging. Physical education programming, interventions, play, and increasing the intensity of movement are reviewed in this thesis. Additional research is included demonstrating the impact of social economic status and race on students' access to movement and the impact it has on academic achievement. Additional research is provided on the impacts physical activity has on student behavior as a support to the academic achievement outcomes seen when physical education or movement programming is utilized in schools. The collection of research indicates that growth in academic achievement correlating to physical activity occurs when students are active in a consistent program offering exercise at an intensity level within or challenging to their aerobic capacity for a developmentally appropriate amount of time.

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CHAPTER I: INTRODUCTION

Having started my career in one of 40 elementary schools in the Saint Paul Public School District, I have been teaching in an urban, Title I elementary school for six years. Firsthand I have witnessed the effects of poverty in the classroom, budget cuts and high teacher turnover. In my first year of teaching I watched six teachers be let go mid-year for reasons that rooted in an inability to manage the behavioral needs of their classrooms. With a "no-excuse" mindset in our district I have been observing, analyzing, and navigating the causes of the challenges we see students and educators obtain. I do not believe that all six of those teachers let go lacked the capability or skills to effectively educate students. The needs our students have are great, behavior is a communication tool utilized by people in order to glean a need. My wondering of what exactly students are communicating and what resources we have as public educators to support them began evolving. There is a need for adjustments in order for our students to find more consistent and daily successes both emotionally and academically. The needs are great, the workers are few, and schedules are most often planned overflowingly full for teachers all under the pressure of ensuring students are meeting benchmarks and standards.

In the fall of 2015, I participated in the parent-teacher home visit project through the Saint Paul Federation of Teacher's Union. Being welcomed into my students' homes by their parent(s) or guardian(s) was an incredible door opened into another world of education, the family. Taking nothing but a colleague in addition to an open heart and mind for conversation, I learned from families who are providing the best that they know how or are capable of as the experts of their child. My eyes quickly noticed the reality that many of the students in my class were coming from homes, neighborhoods, and tiny

apartments that do not foster space for the students to be running around and exhausting extra energy through games of tag or soccer or climbing trees alongside the ignition of their imaginations before or after school. Examples of reasons were because of safety, no yards, one parent homes with many children resulting in a lack of time or resources for something extra such as exercise, or a high value of technology usage in the home. Following this observation, I paired it with recognizing what opportunities students are receiving through school. Minnesota weather creates a lack of movement due to long, snowy, and cold winters. It got me thinking about choices teachers in my school make about indoor and outdoor recess during those seasons as well as what our schedule provides students in the area of physical education. The students at my school only get 50 minutes of physical education class five days a week, every three weeks. Kindergarten through fifth graders all have the same allotment of a fifteen-minute recess, one time each day. Thinking about the behaviors our school works hard to prevent and the achievement gap we are diligently working to close, I began to wonder how the lack of physical movement is impacting our students academically. If students have indoor recess there is no requirement or asurance that movement is an option. Educators in our building give students the choice in the winter to go outside or stay inside. This means these children have no requirement to physically raise their heart rates at all in any way. In combination with our P.E. program there is a possibility that a student at our school would not engage in any physical exercise for ten school days at a time during the months of January through the end of February. These observations, wonderings, and thoughts led me to seek out research on how physical activity correlates to academic outcomes and what the trends are across the nation and the world.

Narrowing the achievement gap is a consistent conversation that is driving curriculum development, intervention supports, and the physical composition of school buildings. One of the largest achievement discrepancies continues to be among students of color (Jackson, 2011). As the mission to close the achievement gap is strong, many districts and schools continue to struggle with budget cuts resulting in less staffing and fewer programs for students. Physical education programs are one of the many disappearing from students' regular learning regiment (Adkins, Bice, Bartee, & Heelan, 2015).

In addition to a large achievement gap across the nation, childhood obesity and increased health concerns are prominent. The technology era is affecting the amount of movement children are averaging throughout their day. Children's activity levels have been influenced by more sedentary avenues of play such as video games and computer usage. The results of reviewing literature on childhood health showed an increase in obesity, Type II diabetes and arteriosclerosis (Tremblay, Inman, & Willms, 2000). Children in low income households as well as children with backgrounds of trauma or poverty are also at risk for not meeting adequate amounts of exercise per day and week (Greeff et al., 2014). Many of these same children are students who have challenges in school as a result of mental health needs, transient life situations, etc. that are contributing causes for falling behind the standardized measures the curriculum expects. These are often the students on office referral, suspension, or even expulsion lists.

It could be that our at-risk students haven't been able to successfully take advantage of school programming that is considered "regular." The predictability of these students falling further behind or dropping out is high. I sought out research from

Putnam, Tette, and Wendt (2004) who looked at the strategies for increasing student success through interventions and developed creative consideration for how an exercise intervention could provide additional options to staff, parents, and students. Wilson School District in Wilson, New York piloted the Exercise Lab program. All of the equipment they used promoted aerobic exercise. Gameboy bikes, steppers, elliptical trainers, rowing machines, and a rock-climbing wall helped to ensure that the students were completing twenty to forty-five minutes of exercise at 75 percent of their maximum heart rate (Putnam et al., 2004). The results included a decrease in hyperactivity, medication dosages, student defiance, aggressiveness, and arguing (Putnam et al., 2004).

Finding the staffing and time to implement interventions like these used by Wilson School District can be an obstacle. Looking at what school districts and teachers are doing to overcome the challenges, Hall, Poston, and Harris, (2015) joined Build Our Kids' Success (BOKS) launching a pilot program in the Natick Public School District in Natick, Massachusetts at an elementary school. The programming of an average of twenty minutes of moderate-to-vigorous activity two to three mornings a week was conducted over a three-year time span (Hall et al., 2010). Hall et al., in their work from 2010, concluded that physical activity is linked to a particular type of learning which is the executive function, linking to many different areas of learning including language comprehension, reading, and writing. This program overcame the time obstacle by implementing a program outside of the regular school day.

Delving a little deeper into the research, I began discovering differences emerged regarding how physical activity, gender, and race correlate as well. Hobbs' (2014) quantitative research study was completed to determine if students in the fifth grade,

meeting the Healthy Fitness Zone (HFZ) for aerobic capacity on the FITNESSGRAM test scored higher on their Measures of Academic Progress (MAP) test. The results showed a positive academic growth trend for all subgroups for both gender and race. A special note of interest from the study was that the African American subgroup, compared to the other subgroups, had the largest difference between met and not met math scores (Hobbs, 2014).

The reviewed research began affirming and leading me to more literature in order to answer the following questions: are schools cutting the wrong programming, making learning less efficient and effective for students? Could an increase of physical activity through movement breaks and physical education programs affect academic growth? Does the inclusion of more physical activity also impact student behavior and engagement? Chapter II reviews literature that delves into these areas and will help answer my research question for this thesis which is: What are the implications on academic outcomes from adequate or increased physical activity through the strategies of interventions as well as physical education programs? The results of this literature review can be first steps in providing direction for administrators choosing programming that could impact teaching strategies used in their building and current classrooms.

CHAPTER II: LITERATURE REVIEW

Literature Search Procedures

To locate the literature for this thesis, searches of Educator's Reference Complete, Expanded Academic ASAP, Education Journals, ERIC, Academic Search Premier, and EBSCO MegaFILE were conducted for publications from 1991-2017. This list was narrowed by only reviewing published empirical studies from peer-reviewed journals that focused on the impact physical activity has on academic outcomes for programming, teachers, and in math and reading found in journals that addressed the guiding questions. The key words that were used in these searches included: physical activity, physical movement, academic achievement, academic outcomes, impacts of physical activity on math and reading, physical activity in the classroom, physical education programs and academic achievement. The chapter will review the literature on physical activity and impacts on academics in three sections in this order: Quality of Movement, Impact on Behavior and Academics, and Increasing Physical Activity.

Quality of Movement

It is a common finding that more movement enables how auditory and visual input is absorbed in the brain. Jensen (2000) questioned what role movement has in learning. Movement enhances circulation, episodic encoding, and the maps formed in the brain from the connection provide more access to learning points for students (Jensen, 2000). The brain is created to learn by getting small bursts of information and in order for the "settling" process to occur the memory needs down time. Physical activity is linked to specific learning styles including the executive functions which are also connected to many aspects of learning like language comprehension, reading, and writing.

Furthermore, children's activity levels have been influenced by more sedentary avenues of play, such as video games and computer usage. The result has been an increase in obesity, Type II diabetes, and arteriosclerosis. According to Jensen (as cited in Tremblay et al., 2000), exercise channels oxygen-rich blood, nourishing the brain and releasing more neurotransmitters and endorphins to develop more neural networks. Movement can look different in the learning environment. Teachers can have students move through extracurricular avenues such as typical physical education, drama, as well as the arts. Brain breaks between academic content provides the movement to stimulate the neurons and electrical wiring that facilitates children's ability to take in new information and learn (Stevens-Smith, 2016). This also supports that lack of time for curricular tasks is not enough of a reason to take out physical engagement activities. The quality of a physical education program should provide a diet of play, free time, physical enhancement and structured learning (Stevens-Smith, 2016). Examining the relationship between physical engagement and the development of the mind-body connection, Stevens-Smith (2016) noted that as a way of life, our ancestors, on average, would walk twelve miles per day. Over 800 participants listened to nearly 80 studies presented through a panel with the goal to show the link among the cerebellum, memory, spatial perception, language, attention, emotion, nonverbal cues, and even decision making. The research from Stevens-Smith (2016) summarized that the engagement in physical activity is associated with academic achievement, cognitive performance improved significantly when children engage in movement, and many of the social and physical benefits of movement are associated with success in school. Summarizing nine studies, Stevens-Smith's (2016) literature review highlighted how healthy bodies, throughout human history were

developed from the need to survive and now individuals are used to being sedentary in a classroom or office for eight or more hours a day. Brain scans have shown evidence that children learn best when they are active and moving because movement stimulates brain neurons aiding in a child's ability to absorb and remember information (Stevens-Smith, 2016).

Movement and Cognitive Functioning

Regular movement is essential for the health of every human. Regular school-based physical activities have shown through research to have benefits on cognitive functioning and academics. The main purpose of the research done by Mavilidi, Okely, Chandler, Cliff, and Paas (2015) was to compare integrated physical exercise to non-integrated physical exercise in students' learning day. Their wondering was if an intervention that combined task integrated physical exercise was more effective than interventions only targeting task-relevant gestures or non-integrated physical exercise. Participants included 125 preschool children, divided between 64 boys and 61 girls. From the fifteen childcare centers recruited for the study, children were randomly assigned and dispersed among three to four centers for each condition. Written consent forms were completed by parents and children attending childcare two or more days per week could participate. The research was language based; therefore, children having prior knowledge or Italian speaking relatives in their home were excluded from the research. None of the participating children had any developmental disorders or learning difficulties. For each condition, the number of participants equaled 31 in the integrated condition, 23 in the non-integrated condition, 31 in the gesturing condition, and 26 in the conventional condition (Mavilidi et al., 2015). An extrinsic sticker was awarded to

children when they finished the activity and test. In the non-integrated physical exercise group during learning, children fulfilled physical exercises at the same intensity level that were unrelated to the learning tasks. The gesturing group of children engaged in actions that matched the vocabulary being learned; however, they did this seated at their work space. Finally, the conventional condition group included children repeating words while remaining in their seats. The study had three phases: instruction, learning, and testing (Mavilidi et al., 2015). Children were given an appropriate accelerometer attached on an elastic belt and this was worn around the waist during the intervention lessons. The purpose of using the accelerometer was to gain data points to estimate children's time in various intensity levels.

The process of the study involved instruction where children were given each vocabulary word in English to ensure understanding of its meaning. The instructional period lasted twenty minutes. Children were assigned to a center during the learning part, the words were presented in auditory and visual modes. The integrated physical exercise condition involved students either acting out the words physically or just getting physical exercises unrelated to the vocabulary. In the testing section, children were assessed on their ability to recall the Italian words verbally. At the end of week two and again after week four, the effects of the short-term or acute effects that physical activity had on learning were evaluated. The results of this study showed that children in the integrated condition remembered more words than children in the non-integrated condition, gesturing condition, and conventional condition (Mavilidi et al., 2015). The results confirmed that attaching knowledge into physical exercises which are integrated in the learning task is an effective teaching and learning strategy. Although this study was short

and removed an important demographic of learners, it showed that physical exercise positively affects the physical and mental health of children. The use and implementation of physical activity into the classroom does not have to take away from the learning, it proves to not add additional work, and it is a way to increase student engagement and provides support for memory and cognition.

Bailey and DiPerna (2015) furthered this research area by pointing their study toward determining the effects of classroom-based exercise breaks. Bailey and DiPerna, (2015) hypothesized that the implementation of the Energizers program would increase students' school-based physical activity levels. They chose a rural elementary school in the Northeast and used three first grade classrooms and three second grade classrooms. The average of students participating was 16 first graders and 14 second graders per classroom. The percentage of participating female students was 50.3 percent and 49.7 percent male students. Demographics included 97 percent Caucasian, 2 percent African American and 1 percent Hispanic students. Of the participating students, 37 percent of students received free and reduced lunch.

The Energizers program did have effects on students' daily school-based accelerometer steps in both first and second grade. Bailey and DiPerna (2015) used specific criteria to measure data, the d-index effect sizes span to infinity so it may exceed 1.0 and can be interpreted as follows: .8 or greater is a large effect size. Greater than or equal to .5 is a medium effect and greater than or equal to .3 is a small effect (Bailey & DiPerna, 2015) . The effects of energizers on students' daily school-based accelerometer steps were 1.18 and 1.17 in two of the three first grade classrooms and .71 (medium) in the other class. In second grade, all three classes' results showed growth and

effectiveness of the program. Seventy-six percent of students reported being able to pay better attention in class after engaging in an energizer activity (Bailey & DiPernna, 2015).

The research by Bailey and DiPerna, (2015) support the Simons Foundation Powering Autism Research for Knowledge (SPARK) autism research. The voice of both students and teachers were a part of the research results. It is clear that the results did not relate physical activity to learning effects and are not inclusive of a real assessment of ethnic groups and socioeconomic status. Compared to the research Mavilidi et al. (2015) did with researching integrated and non-integrated physical activity with students having disabilities, this study supported that movement impacts students' abilities to engage and process information. Eighty-two percent of the students who participated reported having a lot of fun with the Energizer activities. Sixty-three percent of the students felt more physically fit (Bailey & DiPerna, 2015). The studies supported the belief that students who received more hours of physical movement per week will maintain, if not score higher on tests than students who are getting less movement. Including brain breaks and time for the brain to be re-oxygenized will not hinder students' learning in the classroom, movement positively affects brain, body, proving to impact a diverse repertoire of students' personal and academic behaviors in the classroom.

A teacher-initiated action research study on physical activity breaks and student learning sought to find and answer to what happens when the classroom teacher uses teaching time to build a classroom community where exercise and movement is integral to the educational culture (Camahalan, & Ipock, 2015). The purpose of the action

research was to collect data and measure how the implementation of exercise breaks affected student learning and engagement.

The research was conducted throughout five one-hour periods of math instruction observing ten fifth grade students who performed within the average math range. Three of the students in the study struggled with Attention Deficit Hyperactivity Disorder. Throughout the implementation, the teachers saw students gradually adopt the idea of learning through motion. The behaviors observed were fidgeting, out of seat, off task, and engagement. During the first session, the number of students fidgeting was six. By the fifth session only one student was observed fidgeting. Out of seat behavior decreased from four students in the first lesson to only one in the fifth lesson. Finally, eight students were engaged in work during the first lesson observation. By the fifth lesson, all ten participating students showed complete engagement. Teachers reported an increase of calmness in the learning environment. Overall, the physical activity breaks decreased off-task behaviors, which increased learning of the academic content. This study was limited by its short test span and not a huge sample size.

Intensity levels of physical activity. A consistent hypothesis from educators and parents is that students are in need of more physical education time and because schools are allotting for less and less time this may be impacting student achievement. Stevens, To, Stevenson, and Lochbaum (2008) wanted to evaluate how structured physical education and physical activity set apart from one another are related to young children's academic achievement while accounting for the effects of socioeconomic status and prior achievement. It is a consistent finding that American public-school administrators continue to decrease time in schedules for physical education in order to increase time

allotted for direct instruction of the core academic areas (Stevens et al., 2008). It is important to distinguish physical activity and physical education as two important avenues including free play and directed play or physical education. Stevens et al. (2008) chose children from the Early Childhood Longitudinal Study-Kindergarten (ECLS-K) database. The ECLS-K is a project involving all three of the following departments: Department of Agriculture, U.S. Department of Health and Human Services, and the U.S. Department of Education. The ongoing assessment of 22,000 children and families attending over 1,200 public and private schools is a part of the project's overall goal of collecting data on school readiness, elementary school transitions, relationships between the kindergarten experience, and school performance following, as well as growth in cognitive and non-cognitive domains (Stevens et al., 2008). The sample of students was split by gender including 3,256 girls for the mathematics achievement analysis and 3,226 for the reading achievement analysis. The sample of boys included 3,226 participants for the mathematics achievement analysis and 3,167 for the reading achievement analysis (Stevens et al., 2008). Socioeconomic status was assessed in the fall and spring of the students' kindergarten, and again in their third-grade school year using a composite variable. The measures during each assessment included parent reports of income assessed across time, education level, and prestige scores from parents' occupations. Physical activity was assessed using three variables collected during participants' third grade school year (Stevens et al., 2018). These three variables included parents rating of the following: their child's frequency of aerobic activity on a consistent basis in comparison to other children the same age, their child's aerobic activity that would increase breathing, heart rate and cause perspiration, finally participation in sports or

leagues (Stevens et al., 2008). In the spring of kindergarten, spring of first grade, and the spring of third grade school, administrators responded to the frequency of students receiving physical education classes. Data collected on students' math and reading achievement came from standardized test scores collected in the spring of the students' third and fifth year. The study took the reports and used the Structural Equation Modeling with SIMPLIS command language to evaluate the proposed model's fit across all samples (Stevens et al., 2008). The results indicated that physical education within the school day neither improved or detracted from academic achievement in either reading or math. The key exercise need is intensity. The length of the study was short but suggested that the influence of physical activity on achievement may increase over time. The sample size was large, which could have impacted the direct results. Stevens et al. (2008) controlled the socioeconomic status of the participants and there were no significant intelligence differences between the two groups of children. Positive observations were found leading to looking at activities and the intensity involved. This study researched Physical Education the way it is and students only averaged 19 minutes of activity out of a fifty-five-minute class period. This leads to a wondering about where students who show greater levels of physical fitness and academic achievement are accessing the movement.

Coe, Pivarnik, Womack, Reeves, and Malina (2006) hypothesized an aligning question, determining how academic achievement is affected by physical education using physical activity recall, body mass index (BMI) documentation, grades for courses, and the system for observing fitness instruction time (SOFIT). Does physical education class enrollment and overall physical activity have an impact on academic achievement in middle school children over the course of a year (Coe et al., 2006)? In western Michigan,

one public school with an average income level comparable to the state average, 214 sixth-grade students participated, on a volunteer basis, with the goal of measuring how much physical education impacted their academic achievement. The participating students were split into two groups. The first group had physical education class the first semester and the second grouping having it during the second semester. On the semester students did not have physical education, they were enrolled in a class such as arts or computer classes. The classes all met five days a week for 55 minutes. Using BMI, recall of habitual physical activity, and using SOFIT, the students were measured on academic progress based on grades for core classes and a standardized test score. The results of the investigation done with the groups of students showed that the timing of the physical education class enrollment, whether first semester or second, did not have an impact. Students who performed vigorous physical activity at a level that met or exceeded the Healthy People 2010 guidelines achieved higher academic scores compared with the other students in both 1st and 2nd semesters (Coe et al., 2006). The results indicated that students who received an hour of physical education per day in addition to standard physical education showed better academic performance compared to the group with a standard physical education class (Coe et al., 2006). The randomization of the group's bias-free enrollment is a strength of this research. It is possible that in order to surface changes in a child that contribute to improved academic performance a threshold of activity intensity may be needed. In this study participants were able to do that through sports participation.

The opportunity for students to participate in extracurricular activities outside of the school day is not always available to all students especially students of lower

socioeconomic status. What are ways to help students improve their aerobic fitness? Is the best practice for achieving enough fitness to see positive academic performance outcomes the same for boys and girls? These two questions guided the research of Wittberg, Cottrell, Davis, and Northrup (2010) in assessing student aerobic fitness information. Wittberg et al. (2010) used the number of pacer circuits using FITNESSGRAM to measure student fitness levels. The exploration was seeking to find if the association between students' aerobic fitness and academic achievement is based on a threshold or a dose-response schedule (Wittberg et al., 2010). The subjects for the research were 1,941 students 9-13 years old from one county school district in a primarily rural and Caucasian area of West Virginia. Participation was through passive school-based consent. The physical education teacher decided which fitness test to administer. All students took the WESTEST-criterion-based reference for academic performance used to identify areas in need of additional instruction and given in the spring of the academic year (Wittberg et al., 2010). Reading and language arts, math, science, and social studies were the content areas academic progress was measured for. Over the two years students doing the mile run equaled 471 (241 boys, 230 girls). Finishing the Pacer test included 694 boys and 689 girls. One hundred fourteen students completed both the Pacer and the mile run. Overall, 201 students did not complete one or more of the WESTEST achievement tests or did not complete the aerobic fitness test which reduced the 1,941-original sample to 1,740 students who had all necessary information (Wittberg et al., 2010). The boys' mile average was correlated with each WESTEST score but the boys' Pacer was not related to any academic score. Conversely, girls' pacer circuits average was associated with all standardized scores but the girls' mile average was not

related to any academic score. Data was cross-sectional and the results obtained indicated that higher levels of aerobic fitness caused improved academic achievement or vice versa (Wittberg et al., 2010). The FITNESSGRAM tests were administered by different PE teachers and tests were only administered on time so students who were ill were not counted. Students' varying athletic made their fitness thresholds changeable. Having not a lot of diversity among subjects for this test, the results were strongly based off of a large range of schools and subjects. Tests were used as measurements, consistently given at specified times of the year and data was presented clearly, all aiding in the strength of the research.

The association between physical activity and academic performance in Korean adolescent students was investigated by So (2012). The purpose of the study was to determine the effects of various types of physical activity undertaken at various frequencies, on the academic performance of Korean adolescent students. The question guiding the research was: Is there a relation between physical activity and academic performance in Korean adolescent students? A total of 75,066 students (39,612 males and 35,454 females) from the 7th to the 12th grades took part in the 5th Korea Youth Risk Behavior Web-based Survey (KYRBWS-V) project, conducted in 2009 (So, 2012). Using data from that survey it is evident that there are potential relations between physical activity and academic performance. These were explored in this current study through multivariate logistic regression analysis incorporating adjustment for covariate variables including age, body mass index, the parents' education level, and the income status of family (So, 2012). Students were given the option to take the survey which was administered to a group of Korean adolescent students that adequately represented the

population nationally. There was no identifier information and ethical approval was not required. The survey was completed anonymously through the internet at school. Results showed that both boys and girls who participated in vigorous physical activity twice a week, three times a week, and five or more times a week had a 95 percent opportunity to perform average or above-average academically (So, 2012). Strengthening exercises did not impact academic performance positively. Both males and females who engaged in strengthening exercises five or more times showed an average difference of being 1.2 points below average or above-average in academic performance (So, 2012). Physical activity and exercise increased oxygen saturation and angiogenesis in regions of the brain needed for performing tasks. They also increase the activity of neurotransmitters such as serotonin and norepinephrine in the brain, facilitating information processing (So, 2012). This study was conducted online; reflecting family income status, parents' educational qualifications or the measurement of students' height and weight. It was a study that reflected a wide range of subjects with a pool that represented the wider range of the Korean population. Data collection on alertness and attention wasn't taken and behavioral conduct and attendance were not factors. The research primarily focused on the interrelation between variables as opposed to the cause and effect.

Harrington's (2013) research focus was to objectively measure and statistically compare the relationships among the following variables: sleep, activity intensities, weight status, and academic parameters. Harrington (2013) guided the study with the following question: Are there differences in physical activity intensities and sleep variables as they compare to academic achievements as measured by pass or fail in reading and math (Harrington, 2013)? The sample of subjects was chosen by convenience

sample of 3rd graders who were an average of eight-years old from three urban charter schools in the Midwest region of the United States. Two charter school systems consisted of three campus locations within one-mile radius of each other were used in the research. Campuses chosen for the study had similar demographics and geographic proximities. The study sample was of predominantly African American students as well as students of low socioeconomic status according to the qualifying criteria for the federal school lunch program. The 3rd grade students had to be currently enrolled in one of the participating charter schools as well as have a consistent caregiver or parent during the study. Parents had to provide approval of his or her child to wear an accelerometer for twenty-four hours for seven days.

The study started with seventy-five children who were screened and had returned signed consent forms from their parent(s). Prior to wearing the monitor, four children were eliminated because they did not meet the age requirement. This started a chain of some students dropping out of the study which left fifty-five children to meet all the inclusion criteria in addition to successfully wearing the monitors for the required time, rendering usable data. The study showed that the students with failing reading grades had less steps per hour than students with passing reading grades. The mean number of steps of students with failing reading scores was 624. Students passing reading had a mean average number of 752 steps. The better readers were more active as seen by the number of moderate-vigorous activity bouts per day in this study (Harrington, 2013).

The sample size decreased due to a number of dropouts. Reasons students were not included in the data were because of monitor malfunctions, students improperly wearing monitors, and students transferring to a new school. The data for these students

was then not collected. The researchers used the school day, a diverse demographic and quantitatively recorded data on possible multiple influencers on academic progress making it a comprehensive study.

Impact on Behavior and Academics

Students who are performing poorly or failing in school are our at-risk students because they haven't been able to successfully take advantage of the school programming that is considered "regular" (Putnam, Tette, & Wendt, 2004). The predictability of these students falling further behind or dropping out is high. Putnam et al. (2004), looked at the strategies for increasing student success through interventions and developed creative consideration for how an exercise intervention could provide additional options to staff, parents, and students when designing Tier 2 and Tier 3 interventions and Individual Education Plans (IEPs). Wilson School District in Wilson, New York piloted the Exercise Lab. All of the equipment promoted aerobic exercise. Gameboy bikes, steppers, elliptical trainers, rowing machines, and a rock climbing wall helped to ensure that the students were completing twenty to forty-five minutes of exercise at 75 percent of their maximum heart rate. The results included a decrease in hyperactivity, medication dosages, student defiance, aggressiveness, and arguing (Putnam, Tette, & Wendt, 2004).

It can be a common struggle for school administrators and educators to find time for children to engage in both physical activity and adequate academic instruction (Hall, Poston, & Harris, 2015). Finding the staffing and time to implement interventions like Wilson School District did can be an obstacle. Hall et al. (2015) joined Build Our Kids' Success (BOKS) and launched a pilot program at one elementary school in the Natick Public School District in Natick, Massachusetts. The programming consisted of

approximately twenty minutes of moderate-to-vigorous activity two to three mornings a week and conducted over a three-year time span, starting in 2009. When discontinued for students Hall et al. (2015) saw a decrease in student engagement and concentration. Their research suggests that physical activity or fitness are not necessarily causes of improved academic performance (Hall et al., 2015). The students' learning is enhanced by way of concentration, memory, and mood. Another conclusion found was when time in physical education is increased, academic performance is at least maintained, despite the reduction in classroom time (Berg, 2010, as cited in Hall et al., 2015).

Impact on behavior

Everhart, Dimon, Stone, Desmond, and Casilio (2012) designed a study to determine the trends and patterns that occur in elementary school children with intellectual disabilities when an additional structured segment of physical activity is added to their school days prior to engagement in math or language arts learning on a regular basis. Engaging in a daily structured physical activity lesson in addition to getting physical education two times every six days included students in two intact life skills special education classes. The students consisted of seven primary grade students and six intermediate elementary grade students.

It was evident that the academic success was more consistent over time for the intermediate grades group due in part to the treatment of structured physical activity (Everhart et al., 2012). The data trends were not as evident for primary grades. The evidence of academic gains when academics immediately followed physical activity were prominent in any of the graphs. The range included 5 to 20 points of growth in language arts. In math the range of growth was between 10 and 40 points. This study related with

previously reviewed literature showing that the intensity exerted by participants played a role in consistent academic success in both math and literacy.

Snyder, Dinkel, Schaffer, Hiveley, and Colpitts (2017) studied the integration of physical activity into a mathematics unit and the impact on academic achievement was evaluated. The research was gathered from a school with 44.17 percent of students qualifying for free and reduced meals and demographics as follows: 65.35 percent Caucasian students, 16.54 percent Hispanic, 11.81 percent African American, and 6.3 percent identifying as two or more races. Overall a medium-sized Title I elementary in the Midwest region of the United States was utilized for the implementation of the purposeful movement intervention. The intervention was conducted during school hours and over the course of one five-week math unit. A total of 34 third grade students, two classroom teachers, and one physical education teacher were eligible for this study (Snyder et al., 2017). One classroom teacher consented to doing the intervention and the other teacher agreed to be the controlled room. For the intervention the goal was to have the students active for at least 50 percent of the 70-minute math lesson. Activities included in the lessons on average were the following: jumping jacks, burpees, and squats. The classroom not doing the intervention taught using typical teaching strategies. After taking baseline data on students' on task and off task behavior before the intervention, the results showed a significant higher rate of active engaged learning time and lower rates of off-task passive behavior from the intervention group. This project's goal was to evaluate how effective teacher-created purposeful-movement was on both behavior and academic achievement. The findings parallel previous research while the results demonstrate a need for more physical activity embedded into students' learning.

Furthermore Stegelin, Anderson, Kemper, and Wagner, (2014) were motivated to know what the typical physical activity and nutrition patterns in community-based early learning settings for children ages four to seven were in the United States. The overall subset included children in the Head Start program, after-school programs, and four different kindergarten primary public-school classrooms. The quantitative research involved the researcher observing students during a thirty-minute block of time. Tracking data was done using a running record of child behavior and a time-sampling checklist completed every thirty minutes throughout the regularly scheduled school day (Stegelin et al., 2014). Data recording began when the students arrived at school and ended when the students went home. The four students observed were ages five through eight and of ethnicities as follows: one Latino student observed in a preschool Head Start program, two African American students in an after-school program, and one Latino student observed in an elementary classroom. It is important to note that when in the outdoor area, the children had ownership of the activity and it was not teacher directed. When indoors, the physical activity was teacher directed; overall the results of this study suggested that the percentage of time students in the Head Start program and after school program had to engage in direct physical activities was greater than compared to students in a typical elementary school setting. The results of the study supported that no matter the quantity or how structured or unstructured the physical activity, students will engage in either. For example, if it is a structured physical education class, students will engage or if it is free-play center or recess, students will also participate in movement.

Malek and Mitchell (1997) reported in their research that in students with autism there is a decrease in self-stimulatory behaviors post physical exercise while increasing

academic performance. Their study showed an increase in work-related outcomes with the addition of aerobic exercise and did not show any decrease in other positive behaviors persons with autism demonstrate. In their research, five young males diagnosed as autistic participated in the experiment. The subjects were a mean age of 14.88 and all attendees of the same special education class located in an urban public school (Malek & Mitchell, 1997). Two prerequisites for the experiment included an aerobic precondition and an academic precondition (Malek & Mitchell, 1997). The aerobic exercise involved a warm up as follows: stretching and light jogging that did increase the boys' breathing rates yet did not push them into a zone of discomfort. Subjects jogged independently for a total of 20 minutes. This daily routine was established at the start of the school year and data collection began one month in. The academic preconditions included a range of academic subjects held in the normal classrooms. There were no additional changes to the routines students would have normally followed. After either the aerobic condition or academic condition, students were then asked to do either an academic or community-based workshop where an assessment of self-stimulatory behaviors as well as academic responses and work performance were taken (Malek & Mitchell, 1997). This study looked at the response of student behavior during workshops that were both seat-work based and asked the students to be independent workers. Led by classroom teachers, the amount of work the boys needed to complete was not controlled, just observed. Engagement, correct responses, and less behaviors were all results of the aerobic exercise group. The effects of this research lead to observations that students need a minimum of eight to twenty minutes of sustained aerobic exercise, which increases their heart rate. The studies agree that physical movement either structured or unstructured by adults had

positive effects on both behavior and academic achievement; however, there is basis to proceed with including a sustained duration and intensity of aerobic activity in each day of a child's educational routine. These studies suggested that increased physical activity had an impact on the quality of time students are spending in their learning environment.

A next step in action research was reflected in Malek and Mitchell's (1997) study. The effects of aerobic exercise on the self-stimulatory behaviors and academic performance of adolescents with autism in addition to assessing the effects of aerobic exercise on task performance in a community-based workshop situation were the purposes assessed (Malek & Mitchell, 1997). Will exercise reduce self-stimulatory behaviors of persons with autism (Malek & Mitchell, 1997)?

Five adolescent males diagnosed as students with autism had a mean age of 14.88 years old. The average IQ scores were 42.2, while an average IQ for a 14-year-old male is a score of 77-135 according to WebMD. All of the boys attended the same special education class located in an urban public school and participated in a community-based workshop program (Malek & Mitchell, 1997). The results of the research showed the subjects' total number of correct answers were greater after exercise was completed than after an academic period. Subjects' correct responding increased significantly. Self-stimulation was measured by the number of times a student elicited individualized self-stimulatory behaviors such as: rotation of eyes, finger distortion, body rocking, picking fingers, biting self constantly, and touching eyeglasses (Malek & Mitchell, 1997). Self-stimulatory behaviors after aerobic precondition vs. academic precondition were lower. Boys completed a greater number of tasks after the exercise precondition.

This study had a reliability measure which was for the self-stimulatory behaviors during both academic and workshop periods. Two observers were recording and an average percent of agreement was taken. An observation result of this research was noticing that few teachers included exercise into daily routines. This study supported that movement will impact students' ability to process information and engage more consistently. Physical activity impacted students of varying intellectual and behavioral needs (Malek & Mitchell, 1997).

Impact on academic achievement. "School-age youth should participate daily in 60 minutes or more of moderate to vigorous physical activity that is developmentally appropriate, enjoyable, and involves a variety of activities" (Strong et al., 2005, p.732). Studies showed that under 50 percent of children ages 6-11 are achieving this goal (Troiano et al., 2008). A pilot study focused on student academic performance outcomes of a classroom physical activity intervention aimed to evaluate whether the implementation affected students' performance in reading or math achievement (Erwin, Fedewa, & Ahn, 2012). Over a twenty-week intervention period, two groups of third grade students divided down from 29 were assigned to an intervention group (16 students) or a control group (13 students). Curriculum-based reading and mathematical fluency assessments in addition to the standard grading system, scores from the Test of Primary Reading Outcomes (T-PRO), the Standardized Test and Reading (STAR) assessment, and the Discovery Education Assessment, which measures reading/language arts and mathematics were the tools for measuring academic progress. Students wore pedometers for the duration of the school day. One teacher conducted physical activity breaks for twenty or more minutes per day. The breaks were logged related to students'

names, duration of integrated breaks, and how it related to the math or reading content taught. The other class did not receive those breaks. All students had thirty minutes of physical education time. The results suggest that the embedded physical activity significantly affected the students' CBM reading and math scores. In both content areas, the group receiving the physical activity doubled the scores of students who did not. The strengths of this study supported the results because of the use of valid assessment measures, effective baseline data used, and the cross-checking of more than one assessment.

The prior study was done with a sample of students from the same school while the next reviewed literature used the Massachusetts Comprehensive Assessment System (MCAS) to statistically analyze the standardized test scores from a base of fourth graders out of two different schools (Tremarche, Robinson, & Graham, 2007). School one provided students with 28 hours of physical education each year and the second school provided 56 hours of physical education each academic year. The test results showed that school one had an overall average of 43 percent students proficient in the English Language Arts (ELA). School two's test results were that of 61 percent of students proficient in the ELA section. With no additional support to the Physical Education departments at the schools or any change to intervention or curricular work, this is evidence that the hours do have an impact on students' academic successes.

The aerobic capacity, body composition, and academic achievement of fourth and fifth grade students was studied with the purpose to examine these relationships in Hispanic elementary school children (Santiago, Roper, Disch, & Morales, 2013). With consent from parents, 155 students broken down into a group of 84 boys and 71 girls

aged 9-13 from an urban school located in southeast Texas were the subjects for the research. One hundred eight students were in the fifth grade and 57 were enrolled in fourth grade. The school enrollment was 982 students of which 49 percent were girls and 51 percent were boys. The racial demographic of the school included 9 percent African American, 3 percent Asian/Pacific Islander, 86 percent Hispanic and 1 percent Caucasian. A total of ninety-nine percent of the students in the school qualified for free and reduced lunch program. The students' aerobic capacity was measured following the FITNESSGRAM Testing guidelines developed from The Cooper Institute in 2007. Academic achievement was based on reading and math final classroom grades. There is a relationship trend between aerobic capacity and academic achievement for girls. The results of this study were the girls participating in the greater quantity of physical education time scored higher in math.

Focusing on evaluating the relationship between physical fitness and academic achievement, Grissom (2005) attempted to address some of the weaknesses of earlier studies. Is Physical Education a vital component in students' academic success (Grissom, 2005)? Using district Standardized Testing and Reporting Program (STAR) four achievement tests were given: California Standards Tests (CST), a standardized norm-referenced test which was the Standford Achievement Test 9th edition (SAT/9), a Spanish assessment of basic skills, and the California Alternative Performance Assessment, all students enrolled in grades 2-11 were assessed in the spring. FITNESSGRAM was administered to determine a students' Healthy Fitness Zone (HFZ). The test administration processes for both the STAR and Physical Fitness Test (PFT) collected students' birthdates and gender. The testing results from 2001 evaluated

634,112 students and in 2002, 884,715 students' data was evaluated. This study reported on the 2002 results because the sample size was larger. Using the academic test score on the SAT/9 for reading and math scores combined with the PFT score ranging from zero to six students had a matched file to analyze the relationship between academic performance and physical fitness levels. The average SAT/9 reading and math scores were calculated in normal curve equivalent units (NCE). The analyses revealed as overall PFT scores increased, mean achievement scores also increased. For example, students achieving zero fitness standards, the mean SAT/9 NCE score was 37 for reading and 42 for math. Students with six achieved fitness standards, the SAT/9 NCE mean scores equaled 52 for reading and 60 for math. There was a statistically significant positive linear relationship between fitness and achievement (Grissom, 2005). It was also observed that as PFT scores increased, the average achievement scores increased at a higher rate for females than males. The relationships were shown statistically and measured consistently. A consideration is that socioeconomic status (SES) was not mediated in this study and on average, higher SES is reflected in achievement.

Another study supporting previous literature reviews examined the influence of physical education in US elementary schools on direct measures of academic achievement in math and reading from kindergarten to fifth grade (Carlson, Fulton, Lee, Maynard, Brown, Kohl, & Dietz, 2008). In an analytic sample, data from the Early Childhood Longitudinal Study for the kindergarten class of 1998-1999 (ECLS-K) was analyzed. ECLS-K employed a multistage probability sample design to select the nationally representative sample (Carlson et al., 2008). In the baseline year, one hundred primary sampling units were geographic areas consisting of countries or groups of

countries. The second stage units were schools within the geographic areas and the third stage units were students within schools. The target number of students sampled at schools were twenty-four and the data was analyzed in the fall of kindergarten, spring of kindergarten and first grade, and the spring of third and fifth grade. Overall 9,796 students (51.1 percent of baseline) completed a portion of the direct child assessment at all five time points. Any students missing any information were excluded. Classroom teachers reported the number of times throughout the week and the minutes per day students participated in physical education (P.E.). The minutes of P.E. were estimated by multiplying the median frequency by median duration (Carlson et al., 2008). Academic achievement was measured from the data collected from math and reading tests administered to students. Data on control variables were collected during a telephone interview with a parent. Categories were constructed from family income and the child's race/ethnicity. The analytic sample was 52.1 percent girls and the majority of the sample was non-Hispanic white (69.2 percent). Consistently girls of all ages who categorically were in the low physical education group also scored lowest in math and reading. Kindergarten showed most significant difference. Fifth grade differences were only significant in reading. No real associations between physical education and reading and math for the male students were noted. Girls in the highest exposure to P.E. which was 70-300 minutes the lowest exposure 0-35 minutes per week exhibited a small academic benefit for math and reading (Carlson et al., 2008). On average they scored 2.4 points higher on the IRT reading scale and on average 1.5 points higher on the IRT math scale. This study examined P.E. in a nationally representative sample of kindergartners.

The main purpose of the study by Hobbs (2014) was to evaluate whether students in 5th grade meeting the healthy fitness zone (HFZ) for aerobic capacity on the fall 2013 FITNESSGRAM Test scored higher on the math portion of the 2013 fall Measures of Academic Progress (MAP) test than students failing to reach the HFZ on the fall FITNESSGRAM test. Ninety-six fifth grade students in regular education from a public school in Greenville, South Carolina were chosen from convenience sampling (Hobbs, 2014). Meeting the HFZ for aerobic capacity measures were 79 students of the 96 participants. The data for participants in the study included gender and ethnicity. There were fifty-three male participants of which forty-one were Caucasian, seven African American, and five others. Forty-three female participants included twenty-eight Caucasian students, ten African American, and five others. Academic performance was determined by students' MAP Math RIT (Rasch Unit scale used to measure a student's level of achievement in a certain subject) score and aerobic capacity was determined by using the FITNESSGRAM 15-meter PACER test (Hobbs, 2014). All groups of students who met the HFZ had higher MAP scores. The average score for the students that met the HFZ was 226.9, while the average score for students not meeting HFZ for aerobic capacity was 218.4. The results of the subgroups followed the trends of this finding. The National Association for Sport and Physical Education suggested that 150 minutes of class time per week are needed for a quality physical education program. Mark Hobbs "strongly recommends that school districts allocate sufficient funds, resources, personnel, and facilities in order to provide students with quality physical education at the elementary level" (Hobbs, 2014, p. 38).

Chomitz et al. (2009) designed their research to determine relationships between physical fitness and academic achievement in diverse, urban public-school children. Examining the relationship between standardized requirements for both fitness and academic achievement and adjusting for important demographic variables known to influence academic achievement using a large cohort of diverse urban students from fourth to eighth grade motivated their research design (Chomitz et al., 2009). Can the level of physical fitness be directly linked to students' academic performance on a standardized achievement test (Chomitz et al., 2009)?

Chomitz et al. (2009) assessed a large sample size of 2,127 students' grades in fourth grade through eighth during the 2004-2005 school year in the Cambridge Public School Department, a final sample size of 1,841 students were included in the results. FITNESSGRAM data was used along with BMI (body mass index), ethnicity, gender, grade, and socioeconomic status based off of school lunch enrollment. Sixty-five percent of the students were non-white and 45 percent were of low income households. Of the sample, 39.3 percent of the students were overweight. On average, students passed 3.6 fitness tests and 72 percent and 89 percent of students passed the math and English tests (Chomitz et al., 2009). The results of the research supported positive relationships between fitness and math and English academic achievement. This study showed a correlation between fitness and math achievement (Chomitz et al., 2009). The more fitness tests passed, the higher the academic scores were for students in both math and English. For example, in math a student who passed zero fitness tests had an average MCAS (Massachusetts Comprehensive Assessment System) score of 30. When passing five fitness tests, the percent passed on the math MCAS was 80. The question

unanswered is why students who are more fit performed better on their standardized assessments. It may reflect better overall health including both physical and mental. The findings cannot be ignored by our current educational system.

Increasing Physical Activity

Budget cuts and programming alterations inspired from standardized testing has altered the time accessible to schedules for physical activity within the school day. Researchers have invested time into implementation of curriculums and programs to analyze what strategies are or are not working for teachers, students, and families. Not all students have access to physical activity outside of school due to socioeconomic challenges. The literature review in this section will reflect studies using new curriculum, grants, and intervention techniques to look at relationships between physical activity and academic outcomes.

Policies and Programming Strategies

Loukaitou-Sideris (2015) completed an evaluation of the effectiveness of the Sound Body Sound Mind Foundation (SBSM) curriculum. As a Los Angeles nonprofit, the SBSM introduced a special P.E. curriculum into five inner city Los Angeles schools with the goal of determining its effectiveness of fitness among the participating students. Can the SBSM curriculum increase the quality of children's physical activity or fitness (Sideris, 2015)? Between January and April 2013, five inner city Los Angeles schools were chosen as participants. Three hundred sixteen female students and three hundred fourteen male students participated in the age ranges of seventh to tenth grade. The demographics of the subjects were as follows: 77 percent Latino, 13.5 percent Asian American (Korean-American), 3.1 percent African American, and 2 percent white.

Students were chosen to participate if they were attending Physical Education class from any of the eight teachers who were trained in the SBSM curriculum and going to administer it in class.

Participating students and their parents and teachers were asked to respond to pretest and posttest questionnaires. This included a 17-item pretest survey and a 26-item posttest survey. The goal of the surveys was to gather information on perceptions and confidence levels towards P.E., fitness, and exercise. Parents received a written survey and teachers completed a face-to-face interview.

Receiving a total of 640 pretest and 584 posttest student surveys back, the study generated a total of 389 participants with matched pre/posttests and FITNESSGRAM tests (Loukaitou-Sideris, 2015). The eight participating teachers interviewed were diverse by both gender and race. Five of the teachers were male and three females; three teachers identified as Latinos, two African American, two Asian American, and one Caucasian. The range was 5 to 28 years of teaching experience. All eight teachers had positive perceptions about the curriculum but expected challenges such as students' lack of motivation or interest, too short of class periods, or lack of space for equipment. All teachers assessed the curriculum as "highly effective" (Loukaitou-Sideris, 2015, p.172). Participation was noted as higher as they saw all students able to participate and have opportunities to do the various exercises.

Moreover, the parent perspective was that physical activity is highly important for their child. Most parents found that the amount of physical education their child is receiving at school is the right amount. When asked about the SBSM curriculum 58.5 percent of the parents did not see a change in his or her child's fitness. The student report

indicated that 49.4 percent enjoyed P.E. a lot during the pre-curriculum survey and this percentage increased to 55.3 percent in the post-curriculum survey (Loukaitou-Sideris, 2015). In the post-test survey, 57 percent of the students reported being more knowledgeable about fitness after learning through the SBSM curriculum tool. The data from FITNESSGRAM testing showed a 20.4 percent increase on the PACER after the curriculum. The most significant area of physical fitness growth was in curl-ups. In the pretest, the average was 40.2 and in the post that increased to 58.3, which is a 45 percent change (Loukaitou-Sideris, 2015, p.174). After the completion of the SBSM curriculum, 60.7 percent of participating seventh-graders and 61.2 percent of participating ninth-graders at the five schools passed the FITNESSGRAM test, which compared to the state statistics was above the 55 percent of seventh-graders and 59.4 percent of ninth-graders statewide p.175. Further research is needed to measure the effectiveness of the intervention of the SBSM curriculum, more testing-points need to be assessed throughout implementation in order for the data to be strengthened. The SBSM curriculum's objective effected both students' mind and body.

Another tool tested was the Fit and Vaardig op School (F&V), which is an active academic intervention. A series of lessons is used with embedded physical exercise when teaching math and language in Dutch elementary schools. The purpose of the study was to further investigate the effects of the F&V program on the reading, spelling, and math performance of children (Mullender-Wijnsma et al., 2016). Five elementary school boards in the northern Netherlands of 46 schools found twelve of the 46 to agree to participate and use the intervention. Requirements to be included were chosen schools had to be mainstream schools, and only second and third grade classes were eligible to

participate. Randomly assigned to the intervention were both the second and third grade classes (249 students) group, or the control group of 250 students. The average age of the 499 participating children was 8.1 adding or taking away 0.7 years. The randomization was done by the Netherlands Central Plan Bureau for Economic Policy (Mullender-Wijnsma et al., 2016). Participating schools had to have written consent from principals. Parents were given the option to withdraw their permission for their child to participate.

After one year of implementing the program, there was no significant effect on reading scores. The results of the spelling test showed significant effect on scores after the second year of using the intervention and that was the same with math scores. After two intervention years, four months more learning gains were made by the intervention group compared with the control group. This intervention shows effects of direct integration of physical activity into lessons.

In a study to determine if standardized math test scores improve by administering different types of exercise during math instruction, Mead, Scibora, Gardner, and Dun (2016) asked the question: Do stability balls have an effect on student academic performance? EXPO Elementary in St. Paul, MN is in an urban location and was chosen because of its diversity. EXPO was provided the funding to get exercise equipment for students to use during math instruction. Parental consent and child assent was collected. Using three sixth grade math classes, students were assigned intervention sections at random. In the sample size of classes there were no students with special needs. One class used stability balls, one class use activity breaks, and one class was sedentary. To measure the academic progress this study used the fall Minnesota Academic Progress (MAP) assessment and the spring Minnesota Comprehensive Assessment (MCA) tool.

In one of the math classes, a five minutes activity break was used immediately following the math message, which came before the math lesson. Right before students went off to independent work time at their seats another activity break was implemented. Five minutes was chosen off of research indicating that children should be active for five to ten minutes following a 60-min period of inactivity (Mead, Scibora, Gardner, & Dun, 2016). In the stability ball section, the teacher took all of the chairs and replaced them with appropriate-sized stability balls so that all students would sit on a ball with a straight back, bent knees and hips at 90 degrees, and feet flat on the floor. No other physical activity was used in class. In the sedentary section, the teacher taught without any physical activity used at any time during the math instructional period. In order to determine effectiveness of the interventions on standardized math test scores, a one-way ANOVA was used based off of pretest and posttest data using MAP and MCA scores. Among the three classes the fall MAP scores, or the pretest, did not result in any significant score differences. The posttest showed that the class that using stability balls when compared to the sedentary class had a difference between one another and this was 11.6 to 5.5. The section with stability balls also had higher results when compared to the class receiving activity breaks: 11.6 to 8.4). “Short physical activity breaks during class time were not effective in improving math scores but continuous low intensity posturing and positioning activities in the classroom using a stability ball were effective” (Mead, Scibora, Gardner, & Dun, 2016, p. 444). This study had strength from the use of state standardized achievement tests as well as common curriculum and teacher experience. An interesting note is that the class getting activity breaks did not show the highest gain

of achievement; however, students did have a higher gain than the sedentary class even though they lost ten minutes of instruction every day due to the activity breaks.

Limitations and barriers. Adkins, Bice, Bartee, and Heelan (2015) had the goal of identifying specific instructional constructs that limit movement time. In the study, physical education and physical activity were both defined. The objectives of the two are different. Physical activity is defined as "any bodily movement produced by skeletal muscles that results in energy expenditure" (Adkins et al., 2015, p.175). Physical education classes have the purpose of providing instruction for activities related to the state and national standards. In a physical education class, the rigor of movement and intensity is not always the daily objective. Three low socioeconomic Title I elementary schools, defined as having a school population with a poverty level determined by free and reduced-price meal counts at or above 40 percent, were selected as Mission Possible Implementation sites (Adkins et al., 2015). This decision was based off of prior research showing correlation between obesity and low-income families. Three teachers were hired to instruct the Physical Activity classes. These instructors were concluding their college courses. The school administrators and teachers creatively made time from their existing curriculum to create a twenty to twenty-five-minute physical activity class on days P.E. was not offered. Classroom management and student transition time had to be adjusted. With the adjustments, the movement time increased from 43.42 percent in week 1 to 68.62 percent in week 2. Physical activity instructors were easily able to teach lessons and educators found the inclusion of physical activity classes to be engaging to students providing increased movement for students each week.

Challenges with implementing Mission Possible centered around organizing activities and the communication between the P.E. teacher and physical activity (P.A.) instructor due to limited time and scheduling. These studies support a need for students, especially less privileged, to obtain increased amounts of movement at sustained higher intensity level throughout the school week to impact academic achievement. The literature reviewed show examples of successful interventions and programs. Investing in any population of learners in any public or private school for any amount of time will reveal the prominent barriers students, teachers, and the greater educational system face in having enough resources, time, and the programming that is going to be sustainable for our students' needs. The conclusion of the research so far is providing facts that physical activity has a positive impact on student achievement and the child both developmentally and cognitively. Further research implies that students of less socioeconomic advantage do not have the access to the same opportunities of movement as do their peers of a different socioeconomic standing. "In the United States, childhood obesity rates have more than tripled since 1980" (Loukaitou-Sideris, 2015, p.169). Referencing their research again, another finding from their study was how a contributor to childhood obesity stems from a demographic of U.S. children having limited access to free and safe space for physical activity outside of school. "For example, the city of Los Angeles has only 6.2 acres of parks per 1000 residents (Trust for Public Land, 2010), and this amount is much smaller in the high-density inner-city neighborhoods" as noted in the Trust for Public Land (2010) (as cited in Loukaitou-Sideris, 2015). On top of the logistics of land being a barrier, many of the few green spaces in urban areas are unsafe or spaces controlled by gangs. Physical education (P.E.) classes are often the only opportunity

inner-city youth have to engage in physical activity. This study shows that it is important that teachers have the necessary training and time provided so a program is consistently implemented in order to see a direct impact.

Furthermore, there is association among socioeconomic status, physical fitness, and academic performance. Greef et al. (2014) hypothesized that socioeconomically disadvantaged children have lower fitness levels compared to children without a social disadvantage. Cardiovascular fitness has been found to positively relate to both reading and math skills. There is evidence that "...exercise increases concentrations of the brain-derived neurotrophic factor, which stimulates learning and memory" (Greef et al., 2014, p.854). Budget cuts and pressure to perform well on standardized tests has made P.E. an afterthought or arguably not even an option for many school administrators. Examining the differences between socially disadvantaged children and non-socially disadvantaged children on physical fitness and academic performance was an objective of the study (Greef et al., 2014). Wondering if socially disadvantaged children have lower fitness levels? How does fitness correlate to academic performance? Does fitness and achievement correlate when looking at socially disadvantaged children and their learning progress? In an attempt to answer these questions, 544 second and third grade children were selected from sixteen schools across the Northern Netherlands. Students were selected if they were healthy and not suffering from any physical illness or injury at the time of testing. Two hundred eight-six girls and two hundred fifty-eight boys participated. The students averaged 51percent second graders and 49 percent of third graders and economic advantage was determined by the education of the primary caretaker.

Socially disadvantaged children scored lower on all domains of academic performance in comparison to non-socially disadvantaged children (Greef et al., 2014). For physical fitness, there were no prominent differences found. An association with total-cardiovascular fitness and its influence on mathematics and spelling, but not with reading was discovered. Improving cardiovascular fitness improved math. An outcome of the research shows that socially disadvantaged children have comparable physical fitness but are still behind in academic performance compared with non-socially disadvantaged children at the same school (Greef et al., 2014). The statistical control for the effects on school and class level strengthened the analysis of the data. Using a multilevel analysis showed possible trends and supported that certain students are at a disadvantage and it was not age related.

The Childhood Fitness and Academic Performance (Hobbs, 2014) results showed an impact with race. The average math MAP score for African American students who met the HFZ for aerobic capacity was 219.7 while the average score for African American student that did not meet the HFZ was 207.6 (Hobbs, 2014). This was a difference of 12.1 points, which was the largest difference between met and unmet among the subgroups in the study, which is telling of physical movement being particularly impactful with the African American student population. It is these exact subgroups who are having less and less of an opportunity to access physical activity in any capacity.

It is imperative that teachers are gleaning the researched benefits to implementing more physical activity into the academic day. As funding is less and stress on test scores increase, the educators are going to need to be the advocates for our disadvantaged

students and schools. “Schools have one of the most promising opportunities to address the global issue of physical inactivity in youth directly” (Benes, Finn, Sullivan, & Yan, 2016, p.112). Some challenges educators communicated is having the exposure to knowing how best to use movement in the classroom in addition to planning for it and getting students on board. Research by Benes, Finn, Sullivan, and Yan (2016) sought answers to the question: How does teacher perception affect the integration of movement in classrooms? Students with less access to physical activity do not possess the natural desire or passion for movement. Meaningful change for students will not likely occur until the research, materials, and professional development are available and valued for educators (Benes, Finn, Sullivan, & Yan, 2016). Examining classroom teachers’ perceptions on movement integration in the classroom is an important step as teachers consistently face the decisions on what to prioritize in their schedules and what gets eliminated.

After fifteen female and two male teachers with the averages of 39.7 years old and 11.3 years teaching experiences submitted a movement survey, researchers interviewed participants (Benes, Finn, Sullivan, & Yan, 2016). One researcher conducted all interviews, increasing consistency. The reports showed that the teachers were knowledgeable about health benefits of physical activity but reported limited knowledge related to movement and learning in the classroom (Benes et al., 2016). The age of the educator impacts knowledge with younger teachers showed a more positive attitude toward movement. The educators could not explain connections between movement and learning. That result gives some explanations as to why classrooms lack movement. If educators are unaware of the value in implementing movement to support students unable

to glean it elsewhere, the impact physical activity can have on achievement will remain absent. This study did lend itself to a sufficient amount of opinion and subjectivity and included not enough primary or intermediate educators. The information and data about how movement can affect student learning needs to be shared with educators.

This theme of how likely a teacher is to support children's participation in physical activity (Benes et al., 2016), was also researched by Sevimili-Celik and Johnson (2013) in the work to examine teachers' attitude toward preschool physical activity. One hundred forty-nine teachers working in the central region of Pennsylvania teaching children aged three to five years old were chosen for the research (Sevimili-Celik & Johnson, 2013). The ages of teachers were an encompassing range from eighteen to greater than fifty. Two hundred fifty preschool teachers were emailed consent forms explaining the rationale of the study and an electronic link. The one hundred forty-nine were the 59.6 percent who responded with a completed questionnaire. Three quarters of the teachers who participated were physically active during elementary, secondary, high school, and college. Only 12.4 percent were still participating in physical activities at the time of the study. Approximately sixty-five percent of the participating teachers had not taken any courses related to physical education in their pre-service programs (Sevimili-Celik & Johnson, 2013). Taking courses related to music, dance, and movement were done by 36 percent of the teachers. Only 28.8 percent of teachers attended an in-service training in the area of physical education or movement.

The majority of the teachers held themselves responsible for the physical activity of their students and found school to be an important setting for promoting physical activity. Teachers agreed that time allocated for daily recess or free play is insufficient

(Sevimili-Celik & Johnson, 2013). Almost 80 percent of the teachers agreed that teachers should take an in-service training in the area of physical activity. Reasons supporting teachers not implementing more resulted in feedback around not having enough safe space, working around weather and engaging children in outdoor activities, a need for appropriate clothing and not having a physical education specialist. Another barrier is uneducated parents on the benefits of movement. The overall data suggested needs for teacher training in the area of increased physical activity and provision of quality of physical activities.

To assess physical activity, how much physical activity Oregon students received was analyzed (Perera, Frei, & Bobe, 2015). Phoning 432 elementary schools listed in the 2010-2011 Oregon Public School directory, each household was called three times (Perera et al., 2015). Three hundred seventy-nine families responded to the five questions asked in the physical activity survey. Classroom teachers took a survey as well, which was used to identify classroom teachers' preference on how to increase students' physical activity levels. Two hundred ten teachers were contacted and one hundred twenty-seven returned the survey. An additional two hundred seventy-four teachers were contacted about a brain break survey of which forty-nine completed.

The results from the physical activity survey to schools indicated that 92 percent of Oregon elementary schools did not meet the recommended time of P.E. which was 30 minutes per day or 150 minutes per week (Perera et al., 2015). On average, students had P.E. two times per week for thirty minutes each. P.E. was taught by P.E. teachers in 70 percent of schools, classroom teachers in 27 percent of schools and the combination of P.E. and classroom teachers together in 3 percent of schools. One percent of schools had

teaching assistants teaching P.E. Students had an average recess time of twice a day for fifteen minutes. Eleven percent of schools were below the recommended frequency and number of minutes of recess of at least one period of at least twenty minutes.

When surveyed, 84 percent of teachers were “concerned” or “very concerned” about the students’ physical activity levels. Nearly all teachers’ perception was that regular physical activity breaks during the school day is “important” or “very important” and that regular physical activity breaks during the school day benefit students (Perea et al., 2015). Seventy-two percent of classroom teachers reported that together with parents, teachers and P.E. teachers are responsible to provide physical activity breaks to students. The barriers teachers identified included lack of times, funding, space, and teacher training.

A prior study also looked at how closely districts are following implementation of healthy children policies (Evenson, Ballard, Lee, & Ammerman, 2009). The purpose the research was to assess the Healthy Active Children Policy. Is the state policy effective or even being implemented? A survey was created by the North Carolina Department of Public Instruction to collect the data on implementation. The Healthy Active Children Policy recommended 150 minutes of physical education for elementary students and 225 minutes for middle school students (Evenson et al., 2009). Part of the policy stated that recess, physical education, or any other type of physical activity could not be used as a punishment for students by taking it away from them. The researchers created a fifty-item survey for completion by schools throughout the summer of 2007. One hundred-six of the potential one hundred-eleven respondents completed the survey. Twenty-eight percent of districts reported that elementary schools provided thirty minutes to one hour of physical

education five days per week. Forty-two percent reported providing thirty minutes to one hour of P.E. two to three days each week. Thirty percent of school districts provided sixty minutes or less of P.E. per week (Evenson et al., 2009). The challenges to implement programming at the elementary and middle schools included a deficit of time in the school day, a need for more teacher participation, and concern that the physical activity time is a takeaway from academic instruction. Even with a state policy in place, the same barriers and challenges found in prior reviews are prominent.

CHAPTER III: DISCUSSION AND CONCLUSION

Summary of Literature

A majority of students are not getting age appropriate amounts of movement, in their day. The research goal of this paper was to find implications that occur when students get adequate amounts of physical activity. Physiologically, the brain is created to learn short amounts of information and brain breaks between academic content provide the opportunity for the neurons and wiring to be stimulated for learning to occur (Jensen, 2000; Stevens-Smith, 2016). Understanding that activating the neuros that stimulate the brain is important. Mead, Scibora, Gardner, and Dun (2016) changed out chairs for stability balls. The provision of low intensity with continuous posturing and positioning activities to the class using them had testing outcomes averaging 19.7 points higher than the compared groups without the intervention. According to Stevens-Smith (2016), brain scans have shown evidence that children learn best when they are active and moving because the stimulation aids in the absorption of information, which was proven true by Mavilidi, Okely, Chandler, Cliff, and Pass (2015) when the children in their study received movement integrated into their learning task through physical exercise. Students consistently remembered two additional words per test than the children not in that group. Ten fifth grade students showed one-hundred percent engagement by the fifth math lesson after five one-hour periods were taught integrating motion with the learning tasks (Camahalan & Ipock, 2015). Snyder, Dinkel, Schaffer, Hiveley and Colpitts (2017) found a 10 percent increase of active engagement when a physical activity intervention was in place throughout a math unit. This implementation also impacted students' quantity of steps. The students averaged four hundred steps per mathematics class each day when in

the intervention group compared to the non-interventional class where students averaged one-hundred sixty steps per day. The addition of the Energizers program in a rural Northeastern school increased first grade students' daily total of steps by the largest effect size, which was over four-hundred steps (Bailey & DiPerna, 2015).

The Sound Body Sound Mind Foundation (SBSM) curriculum implementation resulted in 60.7 percent of participating seventh-graders and 61.2 percent of participating ninth-graders at the five schools in Los Angeles participating in the FITNESSGRAM test (Loukaitou-Sideris, 2015), compared to only 43.8 percent of seventh-graders and 48.5 percent of ninth-graders passing district-wide. Fit and Vaardig op School (F&V) showed after the second year of an active academic intervention implementation students had four months of learning gains by the intervention group (Mullender-Wijnsma et al., 2016). The reviewed research showed that the addition of interventions or tools to increase brain stimulation healthfully impacted student engagement and achievement. The stimulation of movement embeds new information into the brain; the results of the research indicated that academic achievement is not negatively impacted from any of the strategies.

Students have a need for movement that provides intensity. When students obtained at least twenty minutes of an aerobic activity there is a link to academic achievement. Twenty-five percent of math achievement scores were affected by physical fitness and 27 percent of reading scores affected by physical activity (Stevens, To, Stevenson, & Lochbaum, 2008). Wittberg, Cottrell, Davis, and Northrup (2010) used the PACER fitness test and students who attained their developmental threshold of fitness had average reading scores .5 points higher and math .4 points higher than students not at their developmental threshold of fitness. A higher mean average of steps (Harrington,

2013) correlated to higher reading scores as well. Students who passed had a mean of 751.84 steps while non-passing students had an average of 624.21 steps (Harrington, 2013). The survey by Wi-Young (2012) agrees with this finding as the results showed that both boys and girls who participated in vigorous physical activity twice a week, three times a week, and five or more times a week reported growth of up to forty points in math. Hall, Poston, and Harris (2015) joined Build Our Kids' Success (BOKS), and the results support Wi-Young's (2012) research survey as the discontinuation of BOKS resulted in a decrease in student engagement and concentration. Results of the Exercise Lab in 2004 in Wilson, New York, included a decrease in hyperactivity, medication dosages, student defiance, aggressiveness, and arguing (Putnam, Tette, & Wendt, 2004).

The research supported positive academic outcomes for students with intellectual disabilities when physical activity is implemented or increased. The studies done by Everhart et al., (2012) and Malek and Mitchell (1997) supported one another as work-related outcomes and academic performance outcomes consistently showed steady growth with the addition of physical activity time. Students need a minimum of eight to twenty minutes of sustained aerobic exercise that increases their heart rate and is developmentally appropriate, enjoyable, and inclusive of a variety of activities (Strong et al., 2005). As overall physical fitness test scores increased, students meeting six physical fitness standards tests scored eighteen points higher in math and fifteen points higher in reading than students meeting one physical fitness standard (Grissom, 2005).

The results when students had a minimum of thirty minutes of physical education time two to three times a week supplemented with a classroom physical activity intervention (Erwin, et al., 2012) or a maximum of one hour of physical education per

day (Coe et al., 2006) showed the increase of physical education class time affected test scores by twenty to fifty points of growth. Girls involved in more physical activity scored on average, 2.4 points higher in reading and 1.5 points higher on the math scale. Fourth grade students receiving fifty-six hours of physical education time each academic year scored 61 percent proficient on the English Language Arts section on the Massachusetts Comprehensive Assessment System (MCAS) test (Tremarche et al., 2007). While fourth grade students at a different school within the same district were only provided twenty-eight hours of physical education time each year and had 43 percent of the students proficient on the same test. Hall et al. (2015) found that the increase of physical education time at a minimum maintains academic performance (as cited in Berg, 2010) which agreed with the findings of Carlson et al. (2008) and Santiago et al. (2013).

Moreover, there are limitations that schools and teachers are experiencing that impact the opportunities students have to obtain a healthy amount of in-school movement. Knowledge on how to implement movement into the classroom resulted in younger educators having more positive attitudes toward movement and the majority of educators could not explain how movement would benefit academic outcomes (Benes et al., 2016). Adkins et al. (2015) had teachers implement a twenty-five-minute physical activity class on days P.E. was not offered; the program was under the umbrella of Mission Possible. Movement time increased by nearly twenty percent from week one to week two when the transitions were worked out; however, this created more need for communication between the P.E. teacher and the teacher implementing the physical activity and the barrier was time and scheduling. Students in Oregon Public Schools in 2015 were only getting P.E. twice weekly, and only 70 percent of the schools had

physical education teachers in charge of the class (Perera et al., 2015). Out of all Oregon public schools only eight percent of schools are implementing the physical activity amounts students should receive. The Healthy Active Children Policy recommended 150 minutes of physical education for elementary students alone. Twenty-eight percent of districts in North Carolina reported that elementary schools provided thirty minutes or more of physical education over the full school year (Evenson et al., 2009).

Cutting back programs or not having well-trained teachers may work for students who are still supplemented with opportunities outside of the school day. Students of lower socioeconomic status who are often void of extra-curricular activities, are lacking the opportunities to obtain appropriate physical fitness levels and their academic performance outcomes reflect it (Greef et. al., 2014). Stegelin et al. (2014) showed that the percentage of time students in community after school programs had to engage in direct physical activities was between twenty-five and one hundred minutes longer than compared to students in a typical elementary school setting due to the fact that in the elementary setting it was unstructured movement time. Valuing the correlation that structured physical activity has on fitness and academic outcomes is the next step for improving the overall wellness of students' education.

Limitations of the Research

Reviewing literature on physical activity and impacts on academics under the following themes: Quality of Movement; Impact on Behavior and Academics; and Increasing Physical Activity was the goal of the search process for this literature review. To locate the literature for this thesis, searches of Educator's Reference Complete, Expanded Academic ASAP, Education Journals, ERIC, Academic Search Premier, and

EBSCO MegaFILE were conducted for publications from 1991-2017. The use of Google Scholar as a search tool was also utilized to expand the variety of literature and when looking for correlating research. This list was narrowed by only reviewing published empirical studies from peer-reviewed journals that focused on impacts physical activity has on academic outcomes in math and reading and which gave strategies and program examples used that impacted academic achievement for students. The key words that were used in these searches included "physical activity," "physical movement," "academic achievement," "academic outcomes," "impacts of physical activity on math and reading," "physical activity in the classroom," "physical education programs and academic achievement."

The original search process goal was to find action research having a baseline amount of movement and the outcomes of increasing that time or type of movement. I excluded studies done with adults. It was important to me that studies measured academic growth alongside the physical activity intervention implemented. Studies without the combination were excluded with the exception of impact on behavior. The studies kept with data on behavior also included a component on the impact positive behavior has on academic growth. I excluded research that included food and nutrition variables. The pool of literature limited my research because the definition of physical activity has varying meanings for example: brain breaks, physical education, recess, aerobic exercise etc. The search widened and encompassed all definitions in order to address the research question for this literature review. The majority of the research found assessed the impact of increased movement; however, the research analyzed benefits of increasing it from the perspective of adding more physical education time or movement breaks. The research

outcomes consistently showed movement impacts students' academic outcomes positively.

Implications for Future Research

At the conclusion of my research on the impact of physical activity on academic achievement I am left hopeful that the field of research continues, especially in the area of what specific type of physical activity benefits academic achievement most. It was evident that female and male math and reading scores were affected differently from increased movement. For motivating administration to utilize funding toward physical activity interventions and programming I think it is necessary there is a narrower assessment of the type of movement and frequency of activity and how both impact achievement for each gender. The current review of literature showed that the intensity of the movement and duration matters. The amount of physical education or recess can impact students' academics if students are indeed moving during their recess and the physical education curriculum fosters a safe and active environment and students are receiving class consistently. Another next step for research is to break down movement and student achievement by race and socioeconomic status. Researchers need to look at the advantages and outcomes of fully funded schools vs. underfunded schools. If students are not able to access extracurricular physical activities and data shows that the students who are accessing those opportunities show higher gains, our system needs to look at how to better provide students with opportunities to be active. In addition to these next steps, researching the time of day students are active and how that impacts behavior or academics would be a next step in the research of this topic. Indoor movement vs. outdoor movement and the impacts behaviorally and academically are necessary along

the journey of discovering how movement and physical activity impacts students' academic achievement in math and reading.

Implications for Professional Application

The reviewed research provides evidence that more physical activity through programming, interventions, or brain breaks does have positive impacts on students and their academic achievement, specifically in math and reading. The findings show students with low socioeconomic advantages are at higher risk for not attaining appropriate amounts of movement per day or week. The literature pointed out positive effects movement had on groups of students by race. It is evident that teachers are not all trained in knowing how to best implement movement strategies or the value of combining learning with movement. Programming with an understanding from the educators on why they are implementing it is an important piece of the puzzle of having the curriculum utilized and influence students.

This research is significant to educators because it shows the need and impact of having movement in our teaching day. We need to take the research to our administrations and school boards and advocate for the time. If our students are only receiving physical education class a couple of times per week then our schedules need to allow for time to increase their movement within our schedules. Adding movement did not take away from instruction or academic achievement as shown in the research reviewed. I believe teachers need to be educated on the research and provided some professional development around the need for more physical activity. In my research process I reached out to three professional physical education teachers and within minutes of asking for resources I was given more than enough material. If teachers were

given strategies and time to use more brain breaks or movement breaks the research shows that the affects would be seen in the academic outcome of our students.

Moreover, increased physical activity is a huge need in the urban school districts. Resources for students to be involved in extracurricular activities outside of their public school are not readily available or accessible. Many of the schools continue to not meet adequate progress expected by their state. Removing movement cannot be the answer, the result of that is students sitting longer and scientifically that is having a negative impact on their brains.

Our schools and administration need to take a look at the impact of how intensity influences students and their learning. If physical education programs cannot be funded immediately students are able to move and run if teachers are given the time in their schedule to make that happen. We could be having students do movement activities such as jogging for fifteen minutes per day to start the day and then use calming methods like yoga calm to prepare their mind and bodies for the learning environment. In order to improve our craft and what we are doing the implementation does not have to cost a lot of money or be extraordinary. Our students need movement. Teachers could be using more movement in combination to teaching strategies. Equipping teachers with this mindset and habit needs to start in their pre-service courses because we know it will take time for the pendulum of teaching habits to change out in the field.

Personally, in Saint Paul Public Schools my goal is to implement a consistent, weekly physical activity intervention into the schedule. It is feasible to set up a classroom routine of having students run, jog, or skip for at least ten minutes three times a week either outside or indoors which would provide consistency as well as increase students

heart rates providing them movement at an aerobic intensity that the reviewed literature has shown, impacts academic outcomes. This literature review has inspired and empowered me to be prepared to use creativity while ensuring students in my classroom are provided adequate opportunities to be physically active. Overall if valuing movement in our schools and classrooms begins to happen the research shows that we will see decreases in negative student behaviors as well as positive results in their learning progress.

Conclusion

Students need to be receiving physical activity in a direct way whether that is through an activity break within their learning time that allows for their brain to make physiological synapsis necessary to move new information into memory, or through direct movement aligned with learning tasks. The research shows that physical education classes promoting movement requiring students to be active with an increased heart rate for a minimum of twenty minutes for at least three times per week, also impacts students' academic outcomes. Teaching with the whole student in mind is what will make lasting educational impacts. We are in a teaching era as educators where we must look at how society, economics, technology and the strive for high test scores is influencing our school programming and mindset that could actually be impacting our students in a negative manor. The changes and pressures are eliminating being able to meet the needs of the whole child that walks into our classrooms every day. Re-entering movement into the educational day will positively impact the academic outcomes we desire from each student.

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