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Lauren Michelle Willis, Student

Dr. Heather Erwin, Major Professor

Dr. Margaret Bausch, Director of Graduate Studies

THE EFFECT OF INCREASED PHYSICAL ACTIVITY ON ACADEMIC PERFORMANCE

DISSERTATION

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the College of Education at the University of Kentucky

By

Lauren Michelle Willis

Lexington, Kentucky

Director: Dr. Heather Erwin, Professor of Kinesiology and Health Promotion

Lexington, Kentucky

2019

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ABSTRACT OF DISSERTATION

THE EFFECT OF INCREASED PHYSICAL ACTIVITY ON ACADEMIC PERFORMANCE

Increased levels of obesity, particularly among American youth, have consistently been cause for concern over the last few decades. Additionally, the amount of time youth spend being active throughout the day has consistently decreased. Physical activity levels among school-aged children in America are effected by any number of reasons, but this study points to the possibility of time spent being physically active during the school day having the greatest effect on a student's overall level of physical activity. Increased pressures from different entities on local schools to improve student performance on standardized test scores have contributed to a decline in students' time spent being active during the school day. The inverse relationship that exists between levels of obesity and amount of time spent being active is a call to action and cause for more research in this area if a solution is to be reached with the obesity epidemic in America.

The purpose of this study was to investigate the effects of increased physical activity on the academic performance of elementary students in a rural, Central Kentucky community. Academic performance is an overarching term that encompasses academic achievement through standardized testing, academic behavior, and cognitive skills and abilities. Ninety students in 4^{th} and 5^{th} grade with an average age of 10 from one elementary school participated in the study.

After obtaining parental consent and students' verbal consent, students were divided into two intervention groups and one control group. Each intervention group received extra physical activity for three days a week for four weeks. Activity for students was measured with an EKHO MVPA accelerometer for the duration of each activity session during their respective intervention weeks. Standardized test scores were obtained through the school's measure of academic progress (MAP) assessment. Student behavior was assessed through direct systematic observation and teacher-based questionnaires. Finally, the STROOP color word test was used to measure student's cognitive processes and executive functioning skills.

The results from the STROOP color word test provided evidence of a significant relationship between physical activity and cognitive skills (t_{test1}=2.63, $p < .01$, t_{test2}=7.14, $p < .001$). Additionally, the teacher-based questionnaire demonstrated a significantly positive relationship between physical activity and student behavior (t = -2.65, $p < .01$). Boys were significantly more active than girls (t_{female} = -2.71, p <.01). There were also significant correlations between females and the teacher-based questionnaires, the white race and the STROOP color word test, and the white race and on-task behavior. No significant relationships were found between physical activity and overall academic performance or academic achievement.

KEYWORDS: Physical activity, academic performance, academic achievement, cognitive skills, academic behavior

Lauren Willis

4/17/2019

THE EFFECT OF INCREASED PHYSICAL ACTIVITY ON ACADEMIC PERFORMANCE

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Date

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CHAPTER ONE

INTRODUCTION

Over the course of the last few decades, the prevalence of obesity in America has consistently increased, even in pediatric populations. National reports indicate that obesity levels have tripled among elementary children since 1976 (Barros, Silver & Stein, 2009; Fedewa & Ahn, 2011; Fedewa, Ahn, Erwin & Davis, 2015; Ling, King, Speck, Kim & Wu, 2014). The National Health and Nutrition Examination Survey (NHNES) conducted in 2013 and 2014 revealed that 16.2% of United States children and adolescents are overweight, and 17.2% are obese (Fryar, Carroll & Ogden, 2016). Research also shows that percentages of overweight and obese children and adolescents from Kentucky are higher than the national average (2016). In fact, 33.5% of children and adolescents in Kentucky are considered overweight or obese (State of Obesity, 2016). Kentucky's child and adolescent population ranks at 14th overall in the nation as the most overweight or obese group (State of Obesity, 2016). These numbers are alarming and cause for concern when considering the present and future for the youth of Kentucky and America as a whole.

Obesity has been associated with several health risks, including premature death, stroke, cardiovascular disease, diabetes, and mental health issues (Ahamed, Macdonald, Reed, Naylor, Liu-Ambrose & McKay, 2006; Fedewa et al., 2015; Haapala, 2012; Martin & Murtagh, 2015; Ogden, Carroll, Fryar & Flegal, 2015; Stone, McKenzie, Welk & Booth, 1998; Office of Disease Prevention and Health Promotion (ODPHP), 2014). High levels of obesity among children could have several negative implications for them now and in the future, as problems associated can become more extensive in adulthood. If

children are obese, they are likely to stay obese in adolescence and continue the habit as an adult. This notion is confirmed by looking at obesity levels in Kentucky with the total adult population at 34.2%, increasing slightly from the adolescent percentage of obesity mentioned previously (State of Obesity, 2016). Further, in Taylor County, Kentucky, as much as 40% of the adult population is considered obese, which is the location of this study (County Health Rankings, 2018). Therefore, intervening during childhood will likely help reduce the odds of obesity in adulthood.

Health disparities such as hypertension and diabetes have previously been found to be connected to obesity in adults (ODPHP, 2014). These two diseases are more widespread in Taylor County than the average for the rest of Kentucky (Foundation for a Healthy Kentucky, 2008). Considering these diseases are directly related to obesity, which is directly related to inactivity, this fact is not surprising when one considers that close to 39% of the Taylor County population is completely sedentary (County Health Rankings, 2018). Preventable diseases and causes of death are exactly that - preventable. The question then becomes, what could be done to slow down and potentially eliminate the continuing obesity epidemic in America?

The United States Department of Health and Human Services and the Centers for Disease Control (CDC) and Prevention suggest that daily physical activity could be the solution. In 2008, a detailed document was released to serve as a guide for physical activity, and it included recommendations for both adults and children. Research showed that regular physical activity reduces the risk of many negative health implications and the benefits of engaging in physical activity outweighs the potential negative outcomes (ODPHP, 2014; U.S. Department for Health and Human Services, 2008). Obesity-related

diseases can be prevented by targeting the fundamental issue of obesity. To combat obesity, physical activity and a nutritious diet must occur consistently. The importance of being active and pursuing a healthy lifestyle must be instilled in children at a young age if there is any hope of reversing the ever-increasing rise of obesity percentages in America.

Purpose of the Study

The purpose of this study was to investigate the effects of increased physical activity on the academic performance of elementary students in a rural, Central Kentucky community. In the context of this study, academic performance is a general term that will be assessed by academic achievement, cognitive skills and attitudes, and academic behavior in elementary-aged students.

Research Questions

1. How does physical activity affect academic performance as a whole?
2. How does physical activity affect academic achievement?
3. How does physical activity affect cognitive skills?
4. How does physical activity affect classroom behavior?
5. What variables affect student behavior?

Hypotheses

1. Overall, as physical activity levels increase in children, their academic performance will improve.
2. Over the next 8 weeks, as physical activity levels increase, academic achievement will improve and reflect through increased standardized assessment scores.
3. Immediately following the physical activity intervention, students' concentration, memory, and speed (executive functioning skills) will improve.

4. Immediately following physical activity, classroom behavior will improve.
5. Over the next 8 weeks, as physical activity levels increase, on-task behavior will also increase.

Significance of the Study

There have been several studies conducted over the last 30 plus years attempting to establish a relationship between physical activity and academic performance in school-aged children and adolescents. The method of intervention used within each study varied. Some studies investigated the effects of classroom-based physical activity on student performance (Fedewa et al., 2015; Ma, Mare & Gurd, 2014; Mahar, Murphy, Rowe, Golden, Shields & Raedeke, 2006). Others examined the effects of increased time spent in physical education class on performance (Carlson, Fulton, Lee, Maynard, Brown, Kohl & Dietz, 2008; Coe, Pivarnik, Womack, Reeves & Malina, 2006; Sacchetti, Ceciliani, Garulli, Dallolio, Beltrami & Leoni, 2013). One study further examined the effects of increased physical education and an increase in the level of intensity of activity during that time (Ardoy, Fernandez-Rodriguez, Pavon, Castillo, Ruiz & Ortega, 2014). More looked at the impact of recess (Barros et al., 2009) and other "activity breaks" spread throughout the school day on school performance and brain development (Bunketorp, Malmgren, Olsson, Linden & Nilsson, 2015). Others explored the effects of an afterschool intervention on students' target heart zone and cognitive performance (Castelli, Hillman, Hirsch, Hirsch & Drollette, 2011). This is by no means an exhaustive list of the existing studies available on this topic, but it does provide a brief summary of previous research related to physical activity and academic performance.

This study is similar to some mentioned previously because the efforts are still the same: investigate the effects of physical activity as an intervention on academic performance. However, there were no previous studies found that used physical activity as a specific method of intervention for classroom behavior. The participants in the intervention group within this study have a previously documented behavior issue and used this intervention as an RTI (Response to Intervention) for their school behavior plan. The physical activity intervention was in addition to physical education, recess, and any extracurricular activities, and will have a focus of promoting respectful and responsible behaviors. Furthermore, many studies simply looked at the effects of physical activity on classroom behavior (Mahar et al., 2006), academic achievement (Carlson et al., 2008), cognitive skills (Castelli et al., 2011), or more than one of these areas (Fedewa & Ahn, 2011; Wright, Duquesnay, Anzman-Frasca, Chomitz, Chui, Economos, Langevin, Nelson & Sacheck, 2016). However, according to the Centers for Disease Control, academic performance includes all three components: academic achievement, cognitive skills, and academic behavior (CDC, 2010). Without exploring the effects of physical activity on all three facets of academic performance, the visual is incomplete. Therefore, this study sought to establish a clearer image of what academic performance is and how it can be affected by physical activity.

Additionally, this study took place in a small, rural farming community in Central Kentucky (Ratcliffe, Burd, Holder & Fields, 2016). While the obesity epidemic seems to be global, the issue is more prevalent in rural communities and in Kentucky. According to one study, 15.6% of Kentucky children aged 2-5 and 37.1% of children aged 10-17 were overweight or obese compared to the national averages of 12.4% and 31.6%

respectively (Ling et al., 2014). The county where this study took place ranked at 68 of 120 counties in Kentucky on overall health outcomes when considering healthy days, premature death, obesity, inactivity, and other risk factors (County Health Rankings, 2018). While not the worst ranking health county in Kentucky, it is far from the best in a state where obesity is more predominant than the rest of the nation. Moreover, 30.1% of the county is categorized as persons living in poverty where the average for Kentucky is 18.5% (U.S. Census Bureau, 2016). More investigations on the effects of physical activity are needed to further establish an association between physical activity and academic performance, and it is needed in rural Central Kentucky.

Definitions

Academic Performance: This is a general term used to describe three different factors (academic behavior, academic achievement, and cognitive skills and attitudes) that impact success in school (CDC, 2010).

Academic Achievement: Academic achievement includes formal assessments or standardized test scores in Mathematics, Reading, and Language Arts (CDC, 2010). For the purposes of this study, academic achievement will be assessed using MAP (Measures of Academic Progress), a formal standardized assessment in the areas of Mathematics, Reading, Language Arts, and Science.

Body Mass Index (BMI): This is a calculation of weight in kilograms divided by height in meters squared and is used to express weight adjusted for height (Ogden & Flegal, 2010).

Cognitive Attitudes: Cognitive beliefs that impact student performance such as motivation, self-concept, and school connectedness (CDC, 2010).

Cognitive Skills: This includes basic cognitive abilities of executive function, which is memory, selective attention, and information processing (CDC, 2010).

METs: This refers to metabolic equivalent where one MET is the rate of energy expenditure while at rest. The intensity of physical activity is often measured by noting the METs of an activity (USDHHS, 2008).

Moderate-to-Vigorous Intensity: The level of physical activity intensity at or above 3 METS (Donnelly & Lambourne, 2011).

Obese: BMI for age >= 95^{th} percentile (Ogden & Flegal, 2010).

Off-Task Behavior: Any type of motor, noise, passive, or other off-task behaviors that breaks the class rules or disrupts the learning environment (Mahar et al., 2006).

On-Task Behavior: Any type of verbal or motor behavior that follows the class rules and is appropriate to the learning situation (Mahar, Murphy, Rowe, Golden, Shields & Raedeke, 2006).

Overweight: BMI for age 85^{th} – 95^{th} percentile (Ogden & Flegal, 2010).

Physical Activity: Any bodily movement produced by the contraction of a skeletal muscle that increases energy expenditure to above a resting level (CDC, 2010).

Rural Region: A less dense, sparse population that is not built up and at a reasonable distance from urban areas (Ratcliffe et al., 2016).

CHAPTER TWO

REVIEW OF LITERATURE

The following information provides a brief review of literature related to the current studies of academic performance, physical activity, and student behavior. More specifically, this review will investigate all aspects of academic performance including academic achievement, cognitive skills and attitudes, and academic behavior and how it relates to physical activity as well as the variables that impact student behavior.

Physical Activity Recommendations

Daily physical activity could be the simple solution to the growing issue of overweight and obese Americans as it improves one's overall well-being. Daily guidelines for children and adolescents were released in a document from the CDC in detail (ODPHP, 2014). According to the 2008 guidelines, children are to receive at least 60 minutes of daily physical activity (U.S. Department for Health and Human Services, 2008). Specifically, it was determined that most of the 60 minutes should include at least a moderate-intensity level of activity and at least three days of vigorous-intensity level of activity, including muscle and bone strengthening activities (Sallis, Prochaska & Taylor, 2000; U.S. Department for Health and Human Services, 2008). While the importance of physical activity is recognized, the reality is these recommendations are not being met by the majority of youth in America and around the globe (Fedewa et al., 2015; Ling et al., 2014; Stone et al., 1998; Trost, 2009; Watson, Timperio, Brown, Best & Hesketh, 2017; Wright et al., 2016). Further, the physical activity levels of children in Kentucky reflect the national average, but once those children reach adolescence, they are significantly

less active than the rest of America (2016). Something must be done, especially in Kentucky, to combat the increasing decline in physical activity levels.

Some activity is indeed better than no activity at all, so at least a moderate-intensity level of physical activity is positive, but it is still not meeting the recommendations set forth by the United States government (ODPHP, 2014). With a rise in technology and more sedentary behaviors among American youth, physical activity has fallen even further down the "to-do" list of most children (Davis & Cooper, 2011; Hillman, Erikson & Kramer, 2008). Therefore, action is needed at the individual and community levels to promote the benefits of physical activity (Stone et al., 1998; U.S. Department for Health and Human Services, 2008). Most children will not simply make the most beneficial decision; they must be encouraged and given the opportunity to engage in activity by those that surround them. To meet the set recommendations, children typically will need to engage in both free play and structured activities (Carlson, Engelberg, Cain, Conway, Mignano, Bonilla, Geremia & Sallis, 2015; U.S. Department for Health and Human Services, 2008). When children spend most of their time in a classroom at school, 60 minutes of daily physical activity can be daunting and unrealistic unless measures are taken at the school and community level to help students achieve the goal.

Based on this information, the CDC released a national action guide to help direct states and communities to support children in achieving the 60-minute recommendation (ODPHP, 2014). Potential action items from this document included enhancing community parks and other facilities, forging community partnerships with schools to permit activity in and on their facilities beyond regular school hours, increasing time in

physical education, adopting guidelines for physical education times in each grade level, implementing timed recess, improving quality of physical education, supporting bicycle and pedestrian transportation initiatives, and supporting physical activity and health unit in state public health departments (CDC, 2010). Clearly, there are many areas for improvement to help children and adolescents achieve their daily physical activity goal. This is the case in other parts of the world such as Canada and Australia as well as the U.S., reflecting similar recommendations with an addition of limiting non-active time by reducing time with technology (Janssen & LeBlanc, 2010; Sacchetti et al., 2013). This further supports the need for adults, parents, and teachers to reduce students' screen time in favor of genuine activity.

The daily recommendation cannot be achieved, especially in children and adolescents, by simply changing one factor or another. Many things need to be done to help pave the way for children to increase their activity levels. American children have access to a compulsory education system and are required to attend elementary school so this seems like the best place to start (Wilson, Olds, Lushington, Petkov & Dollman, 2015). Children who live a healthier, active lifestyle are less likely to be unhealthy as adults (Stone et al., 1998; U.S. Department for Health and Human Services, 2008). Schools are an ideal location to begin to provide more opportunities for physical activity and encourage overall healthy behaviors (Ardoy et al., 2014; Bunketorp et al., 2015; Fedewa et al., 2015; Kibbe, Hackett, Hurley, McFarland, Schubert, Schultz & Harris, 2011; Mahar, Murphy, Rowe, Golden, Shields & Raedeke, 2006; Martin & Murtagh, 2015; Rasberry, Lee, Robin, Laris, Russell, Coyle & Nihiser, 2011; Resaland, Moe, Aadland, Steene-Johannessen, Glosvik, Andersen, Kvalheim, McKay & Anderssen,

2015; Sallis, McKenzie, Alcaraz, Kolody, Faucette & Hovell, 1997; Wright et al., 2016). While there are many variables that can be impacted on the school level, starting anywhere could go a long way and make a tremendous difference in students' health both now and for many years to come.

Physical Activity as an Intervention

Studies have shown that physical activity levels decline consistently through childhood, adolescence and into adulthood (Bartholomew & Jowers, 2011; Bunketorp et al., 2015; Carlson et al., 2008; Fedewa & Ahn, 2011; Lee, Burgeson, Fulton & Spain, 2007; Sibley & Etnier, 2003; Stone et al., 1998). For the first time in United States history, younger generations might live a less healthy lifestyle than their parents (Hillman et al., 2008; Lees & Hopkins, 2013) and have a shorter lifespan (Olshansky, Passaro, Hershow, Layden, Carnes, Brody & Ludwig, 2005). While it is common knowledge and has already been validated through research that physical activity benefits children in a number of ways, children are simply not as active as they once were. A 2002 study revealed that more than 60% of elementary-aged children did not participate in any type of organized physical activity outside the school day (Ling et al., 2014). In 2011, it was found that a mere 28.7% of adolescents participated in 60 minutes of physical activity each day (Ling et al., 2014). This means that most students will not meet the daily recommendation for physical activity unless it is accomplished during the school day. Some of these numbers could be attributed to a student's lack of ability or access to activity resources, especially in rural communities (Ling et al., 2014; Trost, Pate, Saunders, Ward, Dowda & Felton, 1997). Creating opportunities for students to meet the national guideline within the school day could be the best option for reducing childhood

obesity (Donnelly & Lambourne, 2011; Strong, Malina, Blimkie, Daniels, Dishman, Gutin, Hergenroeder, Must, Nixon, Pivarnik, Rowland, Trost, & Trudeau, 2005). However, it is obvious that the regulations and guidelines currently in place at schools across the nation are simply not getting the job done because another recent population survey indicated that guidelines are not being met among the adolescent population (Castelli et al., 2011; Ma et al., 2014; Mahar et al., 2006; Sallis et al., 2000). More physical activity interventions are needed if children and adolescents have any sort of hope in achieving the guidelines set forth by the CDC.

In public schools, physical activity opportunities have steadily declined since the 1970s, promoting a sedentary lifestyle among students (Donnelly & Lambourne, 2011; Sacchetti et al., 2013). One study noted that this decline has continued because time given for physical activity during the school day is less than it was even in the early 2000s as a result of increased focus on students' standardized test results in the spring (Fedewa & Ahn, 2011). These findings are sobering considering the need for more time dedicated to physical activity rather than less. Public school systems are going in the wrong direction in this area despite the knowledge that physical activity is valuable and necessary in the school setting. One must begin to ask why this trend began, and further, why it is continuing down this path of reduction.

Many believe that this reduction in time dedicated to physical activity during the school day is due to growing pressures from government entities for increased instruction time (Fedewa & Ahn, 2011; Ma et al., 2014). Increased stress to improve standardized test scores has school districts across the nation making the decision to eliminate or reduce the amount of time spent in enrichment programs, such as physical education, in

favor of more instruction time in tested areas, regardless of the known benefits of physical activity on students' overall health and wellbeing (Bunketorp et al., 2015; Fedewa & Ahn, 2011; Martin & Murtagh, 2015; Taras, 2005). The increased emphasis on improving academic achievement through standardized test scores has caused administrators to review their processes and create new ways to improve their schools' performance on the end-of-year exams. Logically, administrators assume that test scores will increase in tested subject areas if the time dedicated to those subjects are increased (Wilkins, Graham, Parker, Westfall, Fraser & Tembo, 2003). Therefore, time spent in non-tested subject areas must be reduced or eliminated to create more time in the school day for tested subject areas, such as English and Math (Ardoy et al., 2014; Marttinen, McLoughlin, Fredrick & Novak, 2017; Rasberry, Lee, Robin, Laris, Russell, Coyle & Nihiser, 2011; Seymour & Garrison, 2015). However, simply increasing students' time spent in tested subject areas does not ensure improvement on standardized test scores (Ahamed et al., 2006; Trost, 2009; Wilkins et al., 2003).

The recent shift toward a decrease in physical education time in favor of increasing time spent in the classroom is counterproductive, considering the benefits of increased physical activity on one's physical and mental health (Bunketorp et al., 2015; Ma et al., 2014; Mahar, 2011; Singh, Uijtdewilligen, Twisk, Mechelen & Chinapaw, 2012; Taras, 2005). Unfortunately, administrators know increased physical activity levels can be linked to improved academic performance yet choose to eliminate or reduce physical education requirements for their students (Donnelly, Hillman, Castelli, Etnier, Lee, Tomporowski, & Szabo-Reed, 2016). If it has been previously established that most students are not meeting the daily physical activity recommendation outside of school,

one can assume if school-based opportunities are not available, students will not achieve a healthy fitness level. Eliminating a student's opportunity to engage in physical activity on a regular basis may have negative repercussions for years to come.

The potential solution for improving students' overall academic performance is to increase the amount of time spent in daily physical activity (Trudeau & Shephard, 2008). This can be done in an elementary setting by combining recess, structured activity time, and activity breaks within the classroom (Carlson et al., 2015; Kibbe et al., 2011; Mahar, 2011; Naylor, Nettleford, Race, Hoy, Ashe, Higgins & McKay, 2015; Strong et al., 2005; Wright et al., 2016). Most elementary schools already have a rotation of some sort for structured activity time in physical education and a short recess time, assuming nothing prevents the students from participating. However, a recent study concluded that no more than 16% of school districts require regular physical activity breaks outside of recess and physical education (Kibbe et al., 2011). Recess and physical education are wonderful tools for aiding students in reaching the recommended goal and in teaching lifelong cooperative learning skills, but additional opportunities are needed within the school day to support these programs that are already in place (Singh et al., 2012). Further intervention is needed to supplement physical education and allow for more ways to apply physical activity knowledge and skills (Lee et al., 2007). Sending students to physical education once a week is not a stand-alone solution. Increased time and variety of methods of intervention are necessary to achieve the daily physical activity recommendations.

Physical Activity & Cognition

Various studies have been conducted with the aim of investigating the effects of physical activity on children's cognitive function. Twelve out of the most recent 15 studies conducted in this area found significant effects on motor skills and cognitive development while none of the 15 reported negative effects (Gao, Chen, Sun, Wen, & Xiang, 2018; Zeng, Ayyub, Sun, Wen, Xiang & Gao, 2017). The authors concluded that there was a positive association between physical activity and certain cognitive skills such as working memory, attention, academic achievement, and language learning (Gao et al., 2018; Haapala, 2012; Hillman et al., 2008; Roig, Skriver, Lundbye-Jensen, Kiens & Nielsen, 2012). While a positive relationship has been established, more research is necessary to further investigate this connection and provide evidence as to why this relationship exists.

Physical activity causes a change in the human brain when one begins moving actively through an increase in oxygen, blood flow, hormones, and oxygen levels (McPherson, Mackay, Kunkel, & Duncan, 2018; Roig et al., 2012). Progress has been made in connecting physical activity to brain structure and development, and research shows that an increase in physical activity can cause an increase in brain-deprived neurotrophic factor (BDNF) which facilitates learning (Roig et al., 2012; Zeng et al., 2017). BDNF facilitates learning by improving synaptic plasticity and increasing brain circulation (Singh & Staines, 2015; Zeng et al., 2017). When a person is sedentary, much needed increases in blood flow and oxygen to the brain and the rest of the body does not occur. The body must be in motion, causing the heart rate to increase, in order to pump more blood to the brain.

A single bout of exercise can increase cortical excitability which improves performance on specific tasks with executive functioning (Haapala, 2012; Singh & Staines, 2015). Additionally, one study found acute aerobic exercise has a positive effect on the primary motor cortex (Singh & Staines, 2015). Other studies confirmed these findings, but also provided evidence that exercise promotes an increase in brain activation and brain volume in the hippocampus, frontal, and parietal cortices (Haapala, 2012; Hillman et al., 2008; Roig et al., 2012). Movement is particularly important in children as their brain and cognitive function is still developing (McPherson et al., 2018; Zeng et al., 2017). Higher levels of physical activity in school-aged children have been previously associated with physical and cognitive health across the entire lifespan (Zeng et al., 2017). However, recent trends show a decline in physical health among children (Hillman et al., 2008). The importance of a child moving throughout the school day is far beyond that of student achievement on standardized tests. Providing opportunities for them to move throughout the day while they are still in crucial cognitive and physical development stages can make an impact on their health for the rest of their life.

Students moving throughout the day is beneficial, but structured activity with a physical education specialist is also valuable to ensure correct motor skill development. Some believe a positive relationship between motor skills and cognition exists because they have several consistent underlying processes such as planning and sequencing involved (Zeng et al., 2017). General movement is important, but the most effective physical activity interventions should include instruction for motor skills to ensure the students are developing these skills while also receiving positive health benefits during movement. Children today are showing limited motor skill abilities and need guidance in

this area (Zeng et al., 2017). Schools are failing their students if they do not promote opportunities to develop these abilities correctly because they have the means and opportunity to provide physical education services to all children.

Physical Activity & Rural Communities

The benefits of physical activity are plentiful, yet, as mentioned previously, many choose to remain sedentary despite the known benefits of staying active. Individuals might choose a sedentary life for various reasons, some controllable and some uncontrollable. Where a child lives would be considered an uncontrollable variable for them and one study notes that living in a rural environment creates more barriers and obstacles for being active than other communities (Seguin, Connor, Nelson, LaCroix & Eldridge, 2014). Noted barriers include limited access to recreation centers, weather, and resources to be active in the community (Seguin et al., 2014). These barriers could be attributing to the fact that physical inactivity is even more prevalent in rural areas than other regions (Park, Eyler, Tabak, Valko & Brownson, 2017). The current study was set in a small, rural community so this variable must be taken into consideration moving forward.

Living in a rural community has been connected with an overall poorer quality of life as a result of increased poverty levels, inferior health, and a lack of opportunities (Kristjansson, Elliot, Bulger, Jones, Taliaferro & Neal, 2015). A child with a lower socioeconomic status, fewer opportunities, limited access, and insufficient health is going to be less likely to be active than a child with none of these barriers to face. Regardless of a child's background or opportunities at home, all children are given similar opportunities in a public school system. What a child experiences outside the walls of the school cannot

be easily controlled or anticipated in many cases. One study found that individuals in rural communities are aware of the dangers of being sedentary, have an interest in physical activity, and pointed to the schools' facilities as the solution to increasing physical activity for children (Kristjansson et al., 2015). School facilities create a means for activity that might otherwise be nonexistent in a rural area. Providing students with opportunities to be active and teaching them how to make healthy choices is a responsibility that lies with the school system in all demographics but is even more valuable in a rural community.

Another substantial barrier for those living in rural communities is that more and more children are watching TV and playing video games. One study found that 40% of children watch at least 3 hours of TV per day and 43% of children play video games for at least 3 hours per day among 5th graders (Kristjansson et al., 2015). Perhaps the increase in technology use is taking the place of physical activity because watching TV is so much more accessible than being active. The same study found that a third of the boys and an even smaller number of girls in the same age group meet the minimum required daily physical activity recommendations (Kristjansson et al., 2015). As technology has improved and increased in society, children's activity levels have decreased, especially in rural areas.

Fun and innovative physical activity opportunities are needed in schools to get children excited about being active again. If students can become engaged in activity at school, it might pour over at home to where they seek out opportunities to be active rather than choosing to watch another hour of TV or play another round on their video game. On the other hand, if children do not choose to remain active outside the school,

providing physical activity opportunities within the confines of the school day is even more vital to ensure they have a fighting chance to meet the daily recommendations.

Academic Performance

There are many known health-related benefits to daily physical activity, but studies are also showing that there is a positive association between physical activity and academic achievement in children and adolescents (Ardoy et al., 2014; Hillman et al., 2008; Lees & Hopkins, 2013; Rasberry et al., 2011; Sibley & Etnier, 2003). While a positive association is a step in the right direction, this is a rather vague statement about the association that exists between the two variables because causation has yet to be established due to study limitations, effect size, or measurement error (Bunketorp et al., 2015; Resaland et al., 2015; Sallis et al., 2000; Sibley & Etnier, 2003). Therefore, further investigation is needed in this area to provide validity for the importance of physical activity and its connection to academic performance (Castelli, Hillman, Buck & Erwin, 2007; Taras, 2005). To really understand the association, one must first define both *physical activity* and *academic achievement*. Moving forward, *physical activity* will be recognized as any type of bodily movement that increases energy expenditure beyond what is required at rest (CDC, 2010; Lees & Hopkins, 2013; Rasberry et al., 2011; Trudeau & Shephard, 2010). Although sometimes used interchangeably with academic performance, *academic achievement* is strictly based on results from formal and standardized assessments, including grade point average (GPA) (CDC, 2010; Rasberry et al., 2011). It seems that many studies have only looked at a portion of the overall picture of the relationship between physical activity and academics because academic achievement is only a piece of the puzzle that is academic performance.

Academic performance is a general term referring to a student's overall performance in school and includes three separate components: academic achievement (defined earlier), academic behavior, and cognitive skills (CDC, 2010). Academic achievement is of course a critical factor, but one must not overlook two other key areas: academic behavior and cognitive skills and attitudes. *Academic behaviors* include on-task behaviors, being punctual, and organized, all of which are critical to student success (CDC, 2010; Rasberry et al., 2011). *Cognitive skills* and attitudes include traits such as attention, memory, and motivation (CDC, 2010; Rasberry et al., 2011). The picture of the existing association is incomplete without looking at all three components of academic performance in greater detail.

Academic Achievement

Many studies have been conducted over the last couple decades striving to get a better representation of the relationship that exists between increased physical activity and academic achievement (Ardoy et al., 2014; Bunketorp et al., 2015; Castelli et al., 2011; Haapala, 2012; Tomporowski, Davis, Miller & Naglieri, 2008; Trudeau & Shephard, 2008). While school performance has always been a priority for many, the last few decades have pushed for a greater emphasis on academic achievement as it pertains to high-stakes standardized tests (Wilkins et al., 2003). Perhaps this push has caused many to equate academic achievement on tests to academic success. There is no doubt that standardized assessment scores signify where an entire school or grade might fall in relation to others, but it is not the only indicator of academic success. In fact, academic achievement and standardized tests have so many other variables that are involved in the

equation, it has been difficult to find a strong correlation between physical activity and academic achievement.

A few studies demonstrated that increasing physical activity has no negative implications on academic performance (Ahamed et al., 2006; Carlson et al., 2008; Donnelly & Lambourne, 2011; Hillman et al., 2008; Sallis, McKenzie, Kolody, Lewis, Marshall & Rosengard, 1999; Sibley & Etnier, 2003; Trost, 2009; Trudeau & Shephard, 2010; Watson et al., 2017; Wilkins et al., 2003). If there are no negative implications, even when reducing classroom time to increase time dedicated to physical activity, one must wonder why the notion to reduce physical activity and increase classroom time continues. Many administrators and educators consider physical education to be a "lower status" subject and opt to dedicate more time to important "academic" subjects such as science and mathematics (Fedewa & Ahn, 2011; Sallis et al., 1999; Sibley & Etnier, 2003). Rather, the subject areas that are assessed at the end of the academic school year.

Several studies have established a positive relationship exists between increased physical activity and academic achievement (Ardoy et al., 2014; Hillman et al., 2008; Lees & Hopkins, 2013; Rasberry et al., 2011; Sibley & Etnier, 2003; Trost, 2009; Trudeau & Shephard, 2008). Therefore, increasing students' activity time will support the efforts of educators to increase performance on standardized assessments over time. Reducing activity time in favor of more class time promotes more sedentary behaviors which has been found to be associated with increased obesity levels and a decrease in academic performance (Haapala, 2012). School systems that are consciously choosing to compromise activity time are working against their own goals. Evidence is mounting that supports students with high levels of physical fitness are associated with higher levels of

academic performance (Trost, 2009). This evidence further supports the notion that increasing activity time will aid in improving one's overall physical fitness and thereby improving academic achievement.

Academic Behavior

Behavior is a complex topic that helps represent an individual's unique personality. Academic behaviors are specific traits that may have an impact on academic performance (CDC, 2010; Ma et al., 2014). These behaviors, or indicators, have been tracked by several different academic studies across all school-aged children. It was found that the following indicators may have a direct impact on academic performance: on-task behavior, organization, planning, attendance, scheduling, and impulse control (CDC, 2010). These are valuable qualities for any individual in school or even in a workplace environment. If a student is on-task often, they will likely have more success both in the classroom and on state assessments than their peers who spend more time off-task than on-task (Davis & Cooper, 2011; Goh, Hannon, Webster, Podlog & Newton, 2016; Mahar et al., 2006; Trudeau & Shephard, 2010). The same predictive statements could be made for the other indicators as well; take organization for an additional example. A student who attends class with their folders and assignments organized by assignments' due dates will likely have their assignments submitted on time. However, a student who has a few papers crumbled into a backpack in a disheveled fashion might not remember or even realize when their assignments are due.

While all these indicators are important to describe academic behavior, on-task behavior and attention are the most objective to consistently observe (Wilson et al., 2015). Therefore, most of the available research on academic behavior specifically

examines on-task behaviors (Ma et al., 2015; Mahar et al., 2006). There are likely many definitions or descriptions from educators on what on-task behaviors look like in their classrooms. However, one study went so far as to define both on-task and off-task behaviors so there would be more objectivity to their study. In this investigation, on-task behaviors were defined as "verbal and motor behaviors that followed class rules and were appropriate to the learning environment or activity" (Mahar et al., 2006). Examples of on-task behaviors would be working on assignments at their desk, involved in group discussion, answering teacher prompts, and overall engagement in the classroom environment (Mahar et al., 2006). In general, on-task behaviors are any type of behavior that represents attentiveness to the teacher, learning environment, and their peers.

Off-task behaviors were broken down into several different categories. Motor off-task behaviors are any type of gross response that disrupts the learning environment such as, leaving one's seat without permission or even aggressive behaviors such as slapping, throwing, or taking someone's property (Mahar et al., 2006). Noise off-task behaviors included both object and voice noise that interrupts the learning situation such as, yelling, laughing, rapping a desk, or slamming books (Mahar et al., 2006). The final category is passive, or other off-task behaviors, when the students are not involved when they are expected to be such as daydreaming or playing with their hair (Mahar et al., 2006). Students that display these types of behaviors make it more difficult to learn because of the environment they create for themselves (Wilson et al., 2015). These behaviors would be disruptive or at the very least, unacceptable, in any learning environment.

Most educators would likely agree that students that spend more time on-task are easier to teach and more likely to learn (Trudeau & Shephard, 2010). Further, they would

likely agree that off-task behaviors displayed by students are frustrating and difficult to overcome both from a teaching and learning standpoint (Sullivan, Johnson, Owens & Conway, 2014). If students that display on-task behaviors more consistently are more successful academically, one can assume that efforts to increase on-task behaviors would be appreciated. Studies have shown that increases in physical activity have a positive association with on-task classroom behaviors (; Barros et al., 2009; Carlson et al., 2015; Goh et al., 2016; Ma et al., 2014; Mahar et al., 2006; Trudeau & Shephard, 2010; Wilson et al., 2015). In contrast, students that spend long periods of time in classrooms for academic instruction are more fidgety and struggle to concentrate (Goh et al., 2016; Ma et al., 2014; Mahar et al., 2006; Trudeau & Shephard, 2010). Therefore, a student that is more active during the school day is more likely to be on-task and thereby have a higher probability for academic success.

Cognitive Skills and Attitudes

Several traits separate a successful student from an unsuccessful one. Too often, a student's success has been decided or understood by simply reviewing GPAs and test scores because they are considered "formal" assessment tools (CDC, 2010; Rasberry et al., 2011). However, the qualities that truly set one student apart from another are unique to them and can be categorized as cognitive skills and attitudes. Cognition is a broad term that represents several mental processes including executive function, control processing, visuospatial processing, and speed processing (Rasberry et al., 2011; Tomporowski et al., 2008; Watson et al., 2017). Executive function includes skills such as memory and planning and the other three processing systems include reaction time, perceptual learning, and automatization of response (Rasberry et al., 2011; Tomporowski et al.,

2008). Most would agree that a student that lacks any number of these qualities would be at a disadvantage in school-based learning activities.

Recent studies in cognition and mental processing have found that healthier children, as well as those receiving acute bouts of exercise as an intervention, perform better on cognitive assessments than their peers, supporting the findings from adult assessments (Castelli et al., 2007; Castelli et al., 2011; Davis & Cooper, 2011; Donnelly & Lambourne, 2011; Fedewa & Ahn, 2011; Fedewa et al., 2015; Lees & Hopkins, 2013; Tomporowski et al., 2008;). This finding means that students, who are more sedentary, will tend to perform slower and not as well on cognitive assessments (Davis & Cooper, 2011). Since cognitive skills and abilities are integral to academic performance, one can assume that students that are more sedentary will tend to have a poorer performance on standardized assessments. However, more information is needed on this topic because there is clearly a connection between exercise and cognition, but much is still unknown (; Fedewa & Ahn, 2011; Rasbery et al., 2011; Sibley, Etnier & Masurier, 2006; Tomporowski et al., 2008; Wilson et al., 2015). Further investigation is needed to determine a proper time and type of exercise needed to experience a positive outcome for cognitive skills (Castelli et al., 2011; Fedewa et al., 2015; Hillman et al., 2008; Rasberry et al., 2011; Watson et al., 2017). The connection has been found, but the specifics of the dose-response relationship as it relates to exercise and cognition is still unknown.

Several investigations have provided evidence that children experience an improvement in executive function when involved in an exercise program (Ardoy et al., 2014; Davis, Tomporowski, McDowell, Austin, Miller, Yanasak, Allison & Naglieri, 2011; Ma et al., 2014; Sibley & Etnier, 2003). One study sought to investigate this

relationship more specifically by examining the effects of intensity of physical activity on executive functions. Their results suggest that simply adding time spent in physical activity is not enough to make a difference on a student's executive function; the intensity must be increased as well (Ardoy et al., 2014; Davis et al., 2011; Ma et al., 2015). This theory might be further supported through a meta-analysis that indicated short bouts of classroom activity did not have a clear effect on cognitive functioning (Davis et al., 2011; Watson et al., 2017;). However, other studies found that increasing activity was enough to improve executive function, but not overall academic achievement (Castelli et al., 2011; Haapala, 2012; Hill, Williams, Aucott, Thomson & Mon-Williams, 2011). While classroom-based activity is a great way to help students achieve the daily recommendation for physical activity, more intense bouts are necessary to have a positive and significant impact on cognitive skills and abilities.

Variables Impacting Student Behavior

Academic behavior is a strong component of the total picture of academic performance. Often, student and academic behavior are used interchangeably. However, there are several variables acting with student behavior that create the outcome of one's overall academic behavior. A student's demographics, family background, peer influence, and fitness are only the tip of the iceberg of factors that play a role in how a student carries themselves during the school day, or student disposition. One study identified a "learning ecosystem" claiming that productive learning and teaching is synonymous with productive behaviors (Sullivan et al., 2014). Productive behaviors are integral to student learning and overall academic performance.

A student's demographics are most certainly out of their control; nevertheless, they play a role in behavior and academic success. For example, "male dominant" behaviors are more common in school-aged boys while avoidance and withdrawal behaviors are more common in girls (McDermott & Schaefer, 1996). Preadolescent children are also more prone to Attention-Deficit/Hyperactivity Disorder (ADHD) than adolescent children who are more prone to Avoidant Syndrome where students display aloof behaviors (McDermott & Schaefer, 1996). This finding affirms that age is a factor in the method and type of misbehaviors displayed by school-aged children. Delinquent and avoidant-type behaviors are also more common in less educated parents (McDermott & Schaefer, 1996). This suggests that socioeconomic status or social class through level of education completed is an additional reason for poor behavior, including anger outbursts associated with externalizing problems (Pitzer et al., 2009). A student's ethnicity might also influence behavior, but there is not a great deal of research that investigates this aspect of a student's demographic (McDermott & Schaefer, 1996). Some studies note that both low socioeconomic status and ethnic minorities are unreasonably inactive by age 11 (Bartholomew & Jowers, 2011; Davis et al., 2011). Many uncontrollable variables do play a role in student behavior that educators and investigators alike need to keep in mind moving forward.

Another large factor in student behavior is the development of one's personality. Studies have demonstrated that there are several variables that impact personality development including the mother-child relationship, temperament, and stress (Bates, Maslin & Frankel, 1985). Within the constructs of the mother-child relationship, warmness, involvement, control, and educative behaviors the mother displays to her

children early in their life could impact their behavior in the future (Bates et al., 1985; Caspi, Henry, McGee, Moffitt & Silva, 1995). A child's temperament is mostly biological and unique to them including traits such as sociability or extraversion but is also impacted by their activity levels (Bates et al., 1985; Pekdogan & Kanak, 2016). The stress that a child experiences is typically attributed to their family environment, including divorce or marital discord (Bates et al., 1985). A child's personality could be one of the single most valid predictors for behavior that is somewhat uncontrollable.

Impulse control is an additional factor that impacts student behavior through internalizing and externalizing problems (Eisenberg, Sadovsky, Spinrad, Fabes, Losoya, Valiente, Reiser, Cumberland & Shepard, 2005). When a student externalizes their problems, one might act out through anger or hostility, but when problems are internalized depression and anxiety might be observed (Eisenberg et al., 2005; Pitzer, Esser, Schmidt & Laucht, 2009). Children that internalize their problems are likely to experience social issues because they tend to be more withdrawn, creating more anxiety for the child (Eisenberg et al., 2005). However, children that externalize their problems through anger, also identified as the difficult child concept, are more likely to have issues with academic work and struggle with friendships that can result in physical outbursts such as hitting (Eisenberg et al., 2005; Pitzer et al., 2009). If teachers are unable to discover the root of the child's off-task or negative behaviors, their reaction might have an even greater negative impact on the child, resulting in more negative behaviors in school.

Each student's situation is unique and often it is unknown what they experience outside the walls of the school building. An increasing number of children are growing

up in single-parent families due to divorce and unwed mothers, especially in economically disadvantaged families (Ackerman, D'Eramo, Umylny, Schultz & Izard, 2001). Typically, students from single-parent households experience a variety of problem behaviors and difficulty in school (Ackerman et al., 2001). There is conjecture on why this association exists, but many researchers claim that the added stress of a single income, economic job demands, and the lack of an adult male role model plays a major role in their child's behavior issues (Ackerman et al., 2001). Interestingly, the lack of an adult male role model is more likely to have a negative impact on boys than girls (Ackerman et al., 2001). This seems like a logical conclusion to be found because with the absence of an adult male, the boy has no one to admire or aspire to be as they mature. Additionally, poor parenting practices or overall family disfunction have a different effect on girls than boys (Pitzer et al., 2009). The same issues are found in families that cohabitate because it brings a level of uncertainty to the children in the home, another trait that is more prevalent in economically disadvantaged families (Ackerman et al., 2001). The untraditional structure of a child's home plays a major role in problematic behavior patterns.

There are several factors influencing student behavior that are both within and outside a student's control. Social relationships or social competence impact student behavior (Pekdogan & Kanak, 2016). Being accepted or rejected by a friend group is important to children and congruently studies show that being accepted aids in child development while being rejected is considered a risk factor (Hartup, 1996). However, more research is needed on this topic to strengthen this finding (Hartup, 1996). Making and keeping friends can be equated to being socially skilled, but it depends on the child

and the relationship that is developed as to whether this bodes well for the child's future (Hartup, 1996). Some children are respectful, outgoing, and all-around good children and will most likely have a positive impact on their friendships. However, children that are disposed to getting into trouble may tend to have a negative impact on friendships. Therefore, simply making and keeping friends is not always an indicator for a promising future (Hartup, 1996). Children must be able to choose their friends wisely because they will be impacted by the behaviors of their peers. One can assume if their friends are prone to get into trouble, it will only be a matter of time before the child will also find themselves in trouble.

In addition to the relationships developed among peers, a recent study points to the significance of the parent-child relationship and its impact on several behavior patterns in children (Tarver, Daley, Sayal, 2015). A child's relationship with their parent is the first they come to know and logically this relationship could be the foundation to all others the child will establish. Parents are the gatekeepers for their children and what they allow, encourage, or establish will have a lasting impact on their child. One study noted that parenting interventions and attempts to establish a positive parent-child relationship may have influences on a child's disruptive behavior and academic functioning (Tarver et al., 2015). Establishing a positive relationship between parent and child is vital to the child's development. Everything that a parent does or does not do has an inevitable influence on their child, including helping their child make decisions about their health and wellness by setting the example and promoting healthy eating choices and providing opportunities for their child to be active.

One of the most controllable factors is the level of a child's health or frequency of engaging in physical activity. Studies show that students that are more fit, are more likely to display good behavior, including attentiveness in the classroom (Davis & Cooper, 2011) At the same time, students with lower levels of fitness demonstrated more off-task behaviors in classroom settings (Davis & Cooper, 2011). Another study found that even a 15-minute activity break can result in better group behavior (Barros et al., 2009). Even more studies have supported that increasing physical activity also increased students' on-task classroom behavior and decreases off-task behavior (Watson et al., 2017). Obesity is more common in students with documented Attention Deficit Hyperactivity Disorder (ADHD), which has also been associated with more off-task behaviors than their peers (Davis & Cooper, 2011; Ma, Mare & Gurd, 2015). ADHD has become more common with 3-7% of school-aged children diagnosed and increases in physical activity could help students manage this disorder (Gapin, Labban & Etnier, 2011). Additionally, one study points to a positive parent-relationship intervention plan aiding in negative behaviors for students with ADHD (Tarver et al., 2015). An aspect of this relationship could be encouraging healthy behavior patterns and possibly establishing opportunities for families to be healthy and active together (Sallis et al., 2000). Establishing an emphasis on health and wellness at home could be a difference-maker for students' attitudes and perceptions about being active both at home and at school. Perhaps this disease related to attention issues becoming more common over the same time that physical activity levels have decreased is a coincidence, but the two could be related.

CHAPTER THREE

METHODOLOGY

The following section provides information about the participants that were involved in the study. Additionally, there is information regarding the instruments used to assess student activity levels, academic achievement, cognitive skills and attitudes, and academic behavior. The procedures that were used for the study were included as well as the data analysis of the findings.

Participants

The participants for this study were recruited from seven 4th and 5th grade classes from one elementary school in a rural county in Central Kentucky. The primary investigator participated in the school's open house day the first week in August to promote the study, distribute consent to parents and assent forms to students. Additional forms were left for classroom teachers to place in their "Wednesday Folders", a folder the teachers use each week to send valuable information home information to students' parents. The students who returned both permission forms and agreed to participate in the study received a cloth drawstring backpack from the University of Kentucky Pediatric Exercise Physiology Laboratory Endowment fund.

Ninety students (M_{age} = 9.84 +/- 0.60) returned the parent consent form, and they were randomly assigned into intervention and control groups. More students from 4th grade returned forms than those in 5th grade causing the average age to be lower than anticipated. Due to having a limited number of accelerometers, the intervention group was divided into two different groups. The respective numbers were 30 control students, 28 I1 (intervention one) students, and 32 I2 (Intervention 2) students with each

intervention group receiving four weeks of the intervention. The students in the control group received their regular physical education time and any other activity breaks that their teachers allowed. The intervention group received a total of 60 minutes per week of additional activity through the intervention. Of the 90 students who agreed to participate in the study, only two were withdrawn. One of the students chose not to participate after a couple weeks of the intervention, and the other moved to another school district and was removed.

Student demographics, including sex, ethnicity, and age were comparable between the intervention and control groups. Overall, there were 51 boys and 37 girls in the study. Thirty-seven of the total number of students were in 5^{th} grades while 51 were in 4^{th} grade. According to the Kentucky Department of Education (KDE), the school is 55.4% female and 44.6% male with a total enrollment of around 400 students (KDE, 2017). Other demographics of the school include 69.7% White Non-Hispanic, 7.7% Black Non-Hispanic, 4.9% Hispanic, 1% Asian, and 16.2% are students with more than one race. In the study, 72% were White Non-Hispanic, 15% were Black Non-Hispanic, 2% were Hispanic, and 11% identified with more than one race. 83.3% qualify for the free lunch program in Kentucky (KDE, 2017). Diversity is not prevalent in this rural farming community of Central Kentucky with the entire community reflecting similar statistics among races at 88% White Non-Hispanic, but equal representation of all races was sought in both groups of participants (Ratcliffe et al., 2016; U.S. Census Bureau, 2016). Overall, the county is considered below average in household income with a median yearly income of $26,733 compared to the state median yearly income of $44,811

(U.S. Census Bureau, 2016). As many as 37% of the children from this county are living in poverty (County Health Rankings, 2018).

Instruments

Considering the number of variables involved in this study, there were several different measures taken throughout the 8-week intervention. These include physical activity, academic achievement, academic performance, classroom behavior , and cognitive skills.

Accelerometer. First, an objective actigraphy device EKHO MVPA H206G accelerometer was used to count students' steps during the physical activity intervention time for those in the intervention groups. Each intervention group received extra physical activity for 20 minutes, 3 days a week, for 4 weeks in addition to their regular activity breaks and physical education class. The control group did not wear the device during their regular physical education time. Steps were only recorded for those who received the intervention to see how much extra physical activity they received during the 20 minutes they were in the gym. Since the control group did not wear the accelerometers, it was understood that the level and type of activity during physical education, recess, and other activity breaks would be comparable to that of the intervention group. Although this was a limitation of the study, the lack of resources for the accelerometers only allowed the intervention group to be measured with this device to determine the amount of activity beyond the average amount during the normal activity times throughout the day. This device has been identified as a reliable method for objectively counting steps compared to competing devices such as the pedometer (Bailey & DiPerna, 2015; Carlson et al., 2015; Hart, Brusseau, Kulinna, McClain & Tudor-Locke, 2011; Lees & Hopkins,

2013; Martin & Murtagh, 2014; Resaland et al., 2015; Sibley et al., 2006; Troiano, Berrigan, Dodd, Masse, Tilert & McDowell, 2007). Some studies are citing the need to use accelerometers in future studies due to their higher levels of accuracy (Hart et al., 2011; Mahar et al., 2006). The accelerometers were distributed prior to the activity times and students were instructed each time to clip the device onto the right side of their waistband or belt directly in line with their right knee cap. The devices also have a security clip that the students were instructed to clip to their shirt for further stability during activity. After the activity time was completed, the students returned their devices to a storage container that was labeled according to the number listed on each device.

Measures of Academic Progress Assessment. The first component of academic performance that must be assessed is academic achievement. The MAP (Measures of Academic Progress) is a national standardized test used to prepare students for future tests and provide indicators for educators by making projections as to how their students will score on future standardized tests in Reading, Language Arts, Science, and Mathematics (Fedewa et al., 2015; NWEA, 2017). The school had a pre-determined scheduled "practice" MAP tests given at three different points in the year with the purpose of preparing their students for the end-of-year state assessments (E. Rhodes, personal communication, March 9, 2018). The students took the first of three tests in August and the second test in December (E. Rhodes, personal communication, March 9, 2018). The September test served as the baseline score for academic achievement and signified the starting point of the study. The school released the raw scores for each student involved in the study. The second assessment was the post-test and slated to be the conclusion of the study. However, outside circumstances forced this assessment to be

administered six weeks after the final week of the intervention. The students' results were compared from the first to the second assessment to determine whether the physical activity intervention effected their performance on the standardized test compared to the control group.

Stroop Test. Next, the students' cognitive skills were assessed through a digital Stroop Test that was administered two times to each student immediately prior to and following their intervention time (Memarmoghaddam, Torbati, Sohrabi, Mashhadi & Kashi, 2016). The Stroop Test measures specific components of high levels of executive function such as selective attention, response inhibition, self-control, and mental speed (Castelli et al., 2011; Kvalø, Bru, Brønnick, & Dyrstad, 2017; Resaland et al., 2015; Sibley et al., 2006; Wright et al., 2016). The students were given a list of words that represent the color they are (the word red will be colored red) and be asked to read the words aloud while being timed. Then, the students were given a second set of words that had conflicting words and colors (the word black might be colored green) and were asked to read the color of the word aloud while being timed. If the student missed a word or responded incorrectly, the investigators paused and pointed to the missed word for the student to correct their response before moving on to the next word in the series. This was a short, simple test that has been used in previous studies as a representation of level of executive function as it relates to cognitive skills.

Student Behavior Questionnaire. Classroom behavior was assessed in two different ways to increase the accuracy and validity of this measure. First, the students were assessed using one component of a teacher-based questionnaire adopted from a previous study (Carlson et al., 2015). The teachers were asked to complete an 11-question

survey that assessed the general behavior and performance of all the students in each of their classes involved in the study (Carlson et al., 2015). The questionnaire was a subjective measure completed during the first and last weeks of each intervention of the study to investigate the effects of the physical activity intervention on general performance or behavior in the classroom. The classroom teachers completed these surveys for the control and I1 students in the first and fourth weeks and then the I2 students in the fifth and eighth weeks of the study.

Systematic Behavior Observations. The students were also assessed objectively using direct, systematic observations immediately following their activity times during the first and last weeks of each intervention. Again, the control and I1 students were observed in weeks one and four and the I2 students were observed in weeks five and eight. The observations were made using partial interval recording at five seconds of observations and five seconds to record (Ma et al., 2015; Mahar, 2011). Partial recording means that if a behavior is present at any point during the 5-second observation, the behavior is recorded on the data sheet (Mahar, 2011). The behaviors being observed were on-task behaviors, motor off-task behaviors, noise off-task behaviors, and other/passive off-task behaviors as used in a previous study (Mahar et al., 2006). For the purposes of inter-rater reliability, a secondary observer observed about 40% of the sessions split between the first and last week of each intervention in the study (Goh et al., 2016). The secondary observer was trained prior to the study and had two opportunities to practice with the primary observer before the study began.

Procedures

Before the study could begin, approval from the University of Kentucky Non-Medical Office of Research Integrity, administrators, and educators was sought. Once approval was received, recruitment of participants began by attending the school's open house in August to discuss the study with students and parents alike. The consent and assent forms were distributed on this night as well through the student welcome packets that were handed out during registration for the event. The students were given instruction to return the forms within two weeks to their homeroom teacher to be considered for participation in the study. Once the forms were returned, they were organized and randomly chosen for the three different groups and then given an ID number for privacy and showed reference to their chosen group. The ID numbers were created to help identify the student and provide confidentiality. Each student was assigned a letter based on their homeroom teacher's last name, their group number (C – Control, I1 – Intervention 1, or I2 – Intervention 2), a number based on their grade (4 or 5), and a number based on their student number from the class rosters. For example, WC4-4 would mean student 4 in 4th grade from homeroom "W" in the control group.

Once the groups were chosen, they were brought together in the gymnasium to further discuss the study. The students were given an accelerometer number (based on their ID number), instructed on the distribution and collection process for the devices, and taught how to attach the device to their clothing. The students were told of the scheduled intervention times and also were reminded of the classroom observations in the hopes of avoiding issues of distraction on the days they were observed. There was also a short time to answer any questions the students had about the study. The meeting took

place during school hours, so parents were encouraged to contact the investigator or one of the teachers to ask questions, if they had any, about their child's involvement in the study.

In August, the students were administered the MAP test for the first time. Results from that assessment were collected, entered into Microsoft Excel, and stored on a password protected flash drive for the remainder of the study. Teacher-based questionnaires were distributed during the first day of MAP testing and asked to be completed by the end of the week. On the last day of MAP testing, the questionnaires were gathered, and the results were entered into a Microsoft Excel file and stored on a flash drive. Once all the students finished each component of the assessment, the physical activity intervention began.

All students gathered in the gym as they arrived to school for the day. The intervention group was asked to remain the gymnasium every Monday, Wednesday, and Thursday morning when the rest of the students were dismissed to go to their regular classes. The first group participated in the physical activity intervention from 8:00-8:20am for four weeks and then the second group participated for four weeks while the first group went on to class as usual. Upon arrival, students were given accelerometers according to student number and reminded of placement of the device. At the end of each activity time, the accelerometers were returned, and the step counts were documented in a Microsoft Excel file. After all the accelerometers were securely placed on each student, and instructions were given for the activity, the students were asked to participate as fully as possible for the entire 20 minutes.

Physical Activity Intervention. The students participated in a variety of pre-planned activities with the goal of increasing steps, heart rate, and teaching social and responsible cooperative learning skills (Martinek & Hellison, 2016; Parker & Hellison, 2001). This physical activity model has been used previously to target low-income youth, who might be more prone to certain struggles due to their economic status, to teach respectful behavior and general cooperation (Martinek & Hellison, 2016). The activities were two-fold because the level of intensity increased their overall time spent being active, but the underlying purpose of the activities also taught the students valuable skills aimed at improving their overall behavior. Considering some of these students were previously identified by administrators as displaying issues with classroom behavior, this model of intervention seemed to be the most appropriate and beneficial.

Each day of the first week of each intervention, direct observations took place until each student had been observed. The students were observed based on classroom teachers each day in an effort to reduce disruptions throughout the observation period. Two classrooms were observed each day on Monday, Wednesday, and three on Thursday with any makeup observations on Thursday or the following Monday. The secondary observer performed direct observations in three of the seven homeroom classes to ensure interrater reliability. The study included the final round of direct observations mirroring the first weeks of each intervention during the last week of each intervention. The students were observed those three days in each of the weeks immediately following the intervention time until all the students had been observed. Both the intervention and control groups were observed during these weeks at 5-second partial interval observation and recording.

Throughout the 8-week study, the Stroop Test was administered on the intervention groups to detect the effect of the physical activity intervention on students' executive functioning. Three students were tested before and immediately after the intervention session until each student in the group had been assessed. The students were asked to complete two phases of the Stroop Test. First, students read the word while the color reflected the word and then the students said the color of the word while the color contradicted the written word. The students were timed on both phases of the assessment before and after the intervention session. Four total times for each student will be recorded on location and entered into a Microsoft Excel file to be stored on a flash drive throughout the study.

At the conclusion of the 8-week intervention time, students were administered the MAP test once again. The raw score for each student were collected and recorded in a Microsoft Excel file and compared to the baseline scores from the first test. Additionally, teachers were again given the questionnaire and asked to return it by the end of the week. The results from the teacher-based questionnaire was collected and entered into Microsoft Excel to compare to the results from the first week of each intervention. The questionnaires were administered a total of four times throughout the eight weeks with the control and I1 groups being completed in weeks 1 and 4 and the I2 group in weeks 5 and 8, signifying the beginning and end of their respective interventions. Once all the data was collected from the direct observations, teacher-based questionnaires, MAP tests, Stroop Test, and accelerometers data analysis began.

Data Analysis

The current study sought to determine the effects of extra physical activity on student academic performance by breaking down the components of academic performance into three sections: academic achievement, academic behavior, and cognitive skills. The students were evaluated through MAP scores, classroom observations and teacher-based questionnaires, and a two-phase Stroop test. Each group was randomized, and each variable was tested before and after the intervention period. The only variables tested exclusively within the intervention groups was students' cognitive skills through the Stroop test and step counts with the MVPA accelerometers. This was because Stroop was intended to measure how the activity intervention effected the students' cognitive skills and abilities so without the intervention, this measure was impossible to assess (i.e. control group). Additionally, the accelerometers were used to determine how many steps were actually gained through the extra time spent in the intervention activity, making this measure unnecessary for collection in the control group.

Data were collected and entered into Microsoft Excel throughout the study. Once all the data had been collected, it was analyzed using the data analysis function in Microsoft Excel and transferred into SPSS (version 24.0) for additional analysis. The amount of physical activity served as the independent variable and MAP scores, Stroop Test times, Teacher-Based Questionnaire, and direct systematic observations served as the dependent variables. Linear regression was run to determine descriptive statistics, test for significance of the variables, and determine variance. To test for significance of the dependent variables, a two-tailed T-Test at the 95% confidence interval and .05

significance level ($p < .05$) was conducted on each individual variable as it was associated with physical activity. The Coefficient of Determination (R^2) was used as well to determine the amount of variance explained by each dependent variable involved in the study.

CHAPTER FOUR

RESULTS

A total of 90 students with parental consent in seven 4th and 5th grade classes (four 5th grade, three 4th grade) participated in this study. The total number of students dropped to 88 due to two being withdrawn from the study for varying reasons. Of the 88 students remaining, 32 were female and 56 were male. Additionally, 64 considered themselves Caucasian while the remaining 24 students identified with a different race. The average age of the participants was 10 years old. The total numbers in each group were Control (C) = 30, Intervention 1 (I1) = 28, and Intervention 2 (I2) = 32. The participants in the intervention groups averaged slightly over 1,000 steps each day of the intervention during the 20-minute activity period (M_{I1} = 1,141.65 +/- 684.48 steps, M_{I2} = 1,061.83 =/- 675.98 steps).

Physical Activity and Overall Academic Performance

Hypothesis 1 predicted that as students' physical activity levels increased, their overall academic performance would improve. In order to determine whether an individual's academic performance improved, each score was normalized into an index score based on where a student's score fell within a predetermined range of scores. Each aspect of academic performance (academic achievement, cognitive skills, and classroom behavior) was quantified into one holistic unit. The MAP scores represented students' academic achievement and ranged from 165-265. The index scores ranged from 1-10 and were assigned systematically based on each student's earned score on the MAP test. See Table 1 below for the exact scale explanation of the index scores.

The STROOP test scores were given an index score as well but could not be used in the final calculation of students' overall academic performance index because this assessment was not given to the control students. Without an index number on the STROOP assessment for the control group, including this number in the total count would cause the numbers to be skewed in favor of the intervention group. Therefore, this index value was left out of the total index calculation. However, this means that the data analyzed for academic performance is missing the cognitive skills and executive function skills of students which will be taken into consideration during the discussion of results.

Classroom behavior as measured by teacher questionnaires was given an index from 1-10 based on the range of possible scores from 24-44. The range and indexes assigned based on the scores from the teacher questionnaire measure can be further explained by referring to Table 1 below. Classroom behavior was also assessed through direct systematic observations. Students' on-task behavior marks ranged from 0-18 and were also assigned an index number ranging from 1-10. See Table 1 below for further explanation of the systematic on-task behavior index.

Table 4.1 – Index Scores

Index Scores			
Index Score	MAP Score Range	Teacher Questionnaire Range	On-Task Behavior Range
0	165 and below	24 and below	8 and Below
1	166-175	25-26	9
2	176-185	27-28	10
3	186-195	29-30	11
4	196-205	31-32	12
5	206-215	33-34	13
6	216-225	35-36	14
7	226-235	37-38	15
8	236-245	39-40	16
9	246-255	41-42	17
10	256-265	43-44	18

Once the scores for each student were given an index number based on where each student's scores fell in the pre-determined range, they were combined into one overall index score. The index from MAP Reading, MAP Math, Teacher Questionnaires, and On-Task Classroom Behavior were summed for each student. The results of a two-tailed two sample *t*-test assuming equal variances did not support the hypothesis that as physical activity increased, overall academic performance would improve, (t=1.99, p>.05). The results of this analysis are presented in Table 2 below.

Table 4.2 – Two Sample *T*-Test

t-Test: Two-Sample Assuming Equal Variances	
	Overall Index
Mean	23
Variance	27.76
Observations	26
Pooled Variance	28.76648
Hypothesized Mean Difference	0
df	77
t Stat	-0.44077
P(T<=t) one-tail	0.330307
t Critical one-tail	1.664885
P(T<=t) two-tail	0.660614
t Critical two-tail	1.991254

Physical Activity and Academic Achievement

Hypothesis 2 predicted that as physical activity increased for students receiving the activity intervention, academic achievement would improve, as reflected by results on the MAP assessment. A two-tailed paired samples *t*-test supported the hypothesis that scores would improve from before the intervention to after the intervention ($t_{Reading}$=3.33, $p < .01$, t_{Math}=2.09, $p < .05$). However, to analyze whether this increase was a direct result

of the intervention a two-tailed *t*-test assuming equal variances was conducted on the December scores as compared to the control and intervention groups. This test did not support the hypothesis that academic achievement would improve as a result of increased physical activity for those in the intervention group ($t_{Reading}$=0.40, $p > .05$, t_{Math}=-0.10, $p > .05$). See tables 3-6 below for further explanation of these analyses.

Table 4.3 – Difference in Reading Scores

Regression Statistics				
Multiple R	0.354545			
R Square	0.125702			
Adjusted R Square	0.114348			
Standard Error	14.55194			
Observations	79			
ANOVA				
	df	*SS*	*MS*	*F*
Regression	1	2344.318	2344.318	11.0707
Residual	77	16305.43	211.7588	
Total	78	18649.75		
	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	202.908	1.706241	118.9211	5.04E-89
Diff Reading	0.701501	0.210834	3.327266	0.001347

Table 4.4 – Difference in Math Scores

Regression Statistics				
Multiple R	0.232047			
R Square	0.053846			
Adjusted R Square	0.041558			
Standard Error	13.76365			
Observations	79			
ANOVA				
	df	*SS*	*MS*	*F*
Regression	1	830.1329	830.1329	4.382082
Residual	77	14586.73	189.438	
Total	78	15416.86		
	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	207.5899	1.721575	120.5814	1.74E-89
Diff Math	0.63148	0.301661	2.093342	0.039611

Table 4.5 – Difference in Reading Scores Intervention to Control

t-Test: Two-Sample Assuming Equal Variances		
	Reading - Dec	*206*
Mean	205.52	204
Variance	245.5933	244.5
Observations	25	53
Pooled Variance	244.8453	
Hypothesized Mean Difference	0	
df	76	
t Stat	0.400367	
P(T<=t) one-tail	0.345005	
t Critical one-tail	1.665151	
P(T<=t) two-tail	0.690009	
t Critical two-tail	1.991673	

Table 4.6 – Difference in Math Intervention to Control

t-Test: Two-Sample Assuming Equal Variances		
	Math - Dec	*210*
Mean	208.92	209.2642
Variance	206.2433333	201.2366
Observations	25	53
Pooled Variance	202.8176564	
Hypothesized Mean Difference	0	
df	76	
t Stat	-0.0995994	
P(T<=t) one-tail	0.460462313	
t Critical one-tail	1.665151353	
P(T<=t) two-tail	0.920924626	
t Critical two-tail	1.99167261	

Physical Activity and Cognitive Skills

Hypothesis 3 predicted that the students receiving the intervention will improve their times on both phases of the Stroop Test after the additional activity. The results of a two-tailed paired samples *t*-test supported this hypothesis, (t_{test1}=2.63, $p < .01$, t_{test2}=7.14, $p < .001$). Participants were faster on the Stroop Test after activity than they were before activity. Additionally, the participants' results demonstrated a greater level of

significance on the more difficult (phase two) test than the easier (phase one) test of the Stroop. The results of these analyses are presented in Tables 7 and 8.

Table 4.7 – Stroop Test Results: Phase 1

STROOP Test 1:	*Test 1-before PA*	*Test 1- after PA*
Mean	24.88672414	23.15672414
Variance	55.91349961	27.5325382
Observations	58	58
Pearson Correlation	0.743196664	
Hypothesized Mean Difference	0	
df	57	
t Stat	2.628423976	
P(T<=t) one-tail	0.005502344	
t Critical one-tail	1.672028888	
P(T<=t) two-tail	0.011004688	
t Critical two-tail	2.002465459	

Table 4.8 – Stroop Test Results: Phase 2

STROOP Test 2	*Test 2- before PA*	*Test 2- after PA*
Mean	75.91413793	63.11637931
Variance	325.0514598	185.9737568
Observations	58	58
Pearson Correlation	0.660592829	
Hypothesized Mean Difference	0	
df	57	
t Stat	7.142858307	
P(T<=t) one-tail	9.19572E-10	
t Critical one-tail	1.672028888	
P(T<=t) two-tail	1.83914E-09	
t Critical two-tail	2.002465459	

Physical Activity and Classroom Behavior

Hypothesis 4 predicted that students receiving the intervention would have better behavior after activity than the control students that had received no physical activity. On-task student behavior tallies were used to determine whether the students' behaviors in the intervention group were better than those in the control. A complete linear regression was run on the data collected during systematic classroom observations. To test the relationship between physical activity and classroom behavior, linear regressions were performed. The results of these analyses did not support the hypothesis that the

physical activity intervention would increase students' on-task classroom behavior ($t_{\text{Intervention}} = 0.22$, $p > .05$). However, the results did show that the participants' classroom teacher is a significant variable for on-task classroom behavior ($t_{\text{T}} = 2.79$, $p < .01$). The results of these analyses are presented in Tables 9 and 10.

Table 4.9 – On-Task Observations Regression Statistics

Regression Statistics	
Multiple R	0.320278
R Square	0.102578
Adjusted R Square	0.025969
Standard Error	3.779028
Observations	90

Table 4.10 – T-Test Results

On-Task Observations	*Coefficients*	*Standard Error*	*t Stat*	*P-value*
Intercept	-1.32059	1.296282	-1.01875	0.311316
Intervention	0.190813	0.849911	0.22451	0.822919
Class 1	1.443643	1.467073	0.984029	0.327996
Class 2	1.687022	1.418756	1.189086	0.237838
Class 3	1.876907	1.480536	1.267722	0.208485
Class 4	1.287022	1.651339	0.779381	0.437999
Class 5	5.360049	1.918621	2.793699	0.006485
Class 6	3.106104	1.654715	1.877122	0.064058

Additionally, student classroom behavior was assessed using a teacher-based questionnaire. This second assessment of the same variable was conducted because the systematic observations only take place two times during each intervention. The systematic nature of the questionnaires could cause a misrepresentation of students' actual classroom behavior. Therefore, the classroom teachers were asked to reflect on the participants' classroom behavior prior to the intervention for the first round of questionnaires and then the second questionnaire should be answered based on teachers' observations of student behavior after the intervention. To continue to test the relationship between physical activity and classroom behavior, a complete linear regression was run on the data collected from all teacher-based questionnaires. The results of this analysis supported the hypothesis that the physical activity intervention would improve participants' classroom behavior ($t = -2.65$, $p < .01$). The results of these analyses are presented in Table 11.

Table 4.11 – Regression of Teacher-Based Questionnaires

Teacher Questionnaires	*Post New Score*	*New Score*
Mean	35.61363636	36.69318182
Variance	48.30877743	46.16914838
Observations	88	88
Pearson Correlation	0.845897234	
Hypothesized Mean Difference	0	
df	87	
t Stat	-2.652200706	
P(T<=t) one-tail	0.004751545	
t Critical one-tail	1.662557349	
P(T<=t) two-tail	0.009503091	
t Critical two-tail	1.987608282	

Hypothesis 5 stated that over the course of the intervention, classroom behavior would improve. This hypothesis addressed the question of what variables impacted student behavior. The hypothesis stated that the intervention would be the only significant variable of student classroom behavior. However, based on the data already discussed, this is decidedly untrue. The regression analysis conducted on systematic classroom observations provided evidence that the intervention was not a statistically significant variable on classroom behavior. However, the regression results from the teacher-based questionnaires did demonstrate a significant correlation between the

intervention and classroom behavior. The teacher-based questionnaire and systematic observations were both measures of classroom behavior, yet the regression results were contradicting. Additionally, as shown in Table 10, the classroom teacher is a significant variable for classroom behavior. There are several other extraneous variables that could influence students' classroom behavior but were not measured within this study.

Significant Relationships

In addition to running a regression analysis on the data, correlations were conducted on each variable in the study using SPSS to determine what relationships existed within the data. The results can be seen in Table 12. There was a strong positive correlation between reading and math scores $r = 0.801$, $p < .01$, teacher questionnaire results and reading scores $r = 0.253$, $p < .05$, reading scores and STROOP results $r = 0.274$, $p < .05$ and math scores and STROOP results $r = 0.295$, $p < .05$. A regression analysis also revealed a significantly positive relationship between the male gender and level of activity ($t_{female} = -2.71$, $p < .01$). The results of this analysis are presented in Table 13.

Table 4.12 - Correlations of Variables

	Dec - Reading	Dec - Math
Dec - Math	Pearson Correlation – 0.801** Sig. (2-tailed) – p < .01	1
Teacher Questionnaires	Pearson Correlation – 0.253* Sig. (2-tailed) – p < .05	Pearson Correlation – 0.211 Sig. (2-tailed) – p > .05
STROOP 2 Index	Pearson Correlation – 0.274* Sig. (2-tailed) – p < .05	Pearson Correlation – 0.295* Sig. (2-tailed) – p < .05
Systematic Observations Index	Pearson Correlation – -0.164 Sig. (2-tailed) – p > .05	Pearson Correlation – -0.031 Sig. (2-tailed) – p > .05

Table 4.13 – Regression of Steps by Gender

Regression Statistics				
Multiple R	0.352654391			
R Square	0.12436512			
Adjusted R Square	0.092523851			
Standard Error	338.0751837			
Observations	58			
	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	1212.000798	83.83809654	14.4564446	2.21E-20
Female	-254.4150445	93.81531377	-2.711871168	0.008911

CHAPTER FIVE

DISCUSSION

Since the inception of the physical activity intervention implemented in this study, the CDC released new physical activity guidelines for Americans (United States Department of Health and Human Services [USDHHS], 2018). These guidelines will be taken into consideration as new findings, but this study was designed and conducted based on the 1st edition of the guidelines released in 2008. However, even in the new guidelines, the recommendations for children to receive a minimum of 60 minutes each day of moderate to vigorous physical activity remains the same (USDHHS, 2018). More valuable evidence was released in the new addition on the positive relationship between physical activity and overall brain health (USDHHS, 2018). This additional finding supports the hypotheses made at the beginning of this study and provides further explanation for the connection that exists between these two variables. Based on the hypotheses stated, there are several anticipated findings that were confirmed and others that were not. The results, limitations of the study, and suggestions for future research will be discussed in greater detail now.

Academic Performance

Academic performance is a broad term used to take into consideration all factors that have an influence on a child's academics (Rasberry, et al., 2011). This study sought to investigate each aspect of academic performance as it relates to physical activity. The students in the intervention group received their normal physical education time and all physical activity breaks that the control students received throughout the school day. In addition, the intervention groups received 60 minutes of additional physical activity each

week for 4 weeks. To determine whether the physical activity intervention had a positive effect on academic performance, data were collected on students' MAP scores (academic achievement), Teacher Questionnaires (classroom behavior), Direct Systematic Observations (classroom behavior), and STROOP test (cognitive skills and attitudes). These results were combined into one overall score and the analysis showed that there was no significant relationship between physical activity and one's overall academic performance. This finding is conflicting with a recent study that investigated the same relationship and found the association between academic performance and physical activity to be significantly positive (McPherson et al., 2018).

The lack of significance could be due to several factors that existed within the study. First, the total index score calculated for academic performance did not include the results from the STROOP test as originally intended. The STROOP test was used to investigate the effects of the physical activity intervention on students' cognitive skills through executive function. As such, this assessment was only given to the students involved in the intervention. Therefore, this index could not be included in the overall index for academic performance due to the control students not having a score range for this category. The analysis run on the STROOP test results for the intervention students demonstrated that STROOP (i.e., cognitive skill) was the most significant variable in the entire study. Not having this score for the control students was a limitation of the study because without this score it is impossible to get a true picture of the relationship between overall academic performance and physical activity. Cognitive skills are a vital piece of the puzzle for academic performance. While the results calculated did not show a significant relationship between the two variables, this is truly an inconclusive result due

to the lack of one of the most crucial aspects of academic performance. In future studies, cognitive skills should be assessed in both groups in order to make a true connection between academic performance and physical activity.

The length of the intervention could have possibly been too short to find any lasting effects on one's overall academic performance. However, a recent systematic review found that as many as 10 studies implemented a physical activity intervention that ranged in time from immediately to no more than 3 months (Rasberry et al., 2011; Sibley & Etnier, 2003). One study noted a specific 8-week intervention to investigate on-task classroom behavior (Goh et al., 2016). Therefore, a two-month intervention was set for this study to remain consistent with the design used in similar investigations. Originally, the intervention was set to be 8 weeks for 30 students. However, due to the high level of student interest, the sample size grew dramatically, and the overall expected participation tripled in size. In order to accommodate the large numbers, a trade-off had to be made to make two intervention groups over 8 weeks. The larger number of participants was a positive for the study design because lower participation numbers can sometimes be considered a limitation to a study. However, there were only 32 accelerometers available for student use and the host school only permitted 20 minutes a day, 3 days a week, for 8 weeks for students to participate in the physical activity intervention. Comparable studies implemented an intervention for 20 minutes or less per day and found no negative effects on academic performance so 20-minute intervention times were established in this study (Ahamed et al., 2011; Bailey & DiPerna, 2015; Haapala, 2012; Hill et al., 2011). Therefore, the change had to be made to two intervention groups with 28 and 32 participants, respectively for two consecutive 4-week periods.

As a result, participants were randomly placed in a control and one of two intervention groups. Intervention Group 1 participated in the activity for the first 4 weeks and Intervention Group 2 participated in the activity for the second 4 weeks. While more students were able to experience the intervention, their time with the intervention was cut in half. A total of 240 minutes of extra physical activity might not be enough time to make an impact on students' overall academic performance. The length of the intervention was a limitation of the study because the brief nature of the time spent in activity was possibly not significant enough to make a true difference. Other studies conducted over a much longer timeline found significant results on students' academic achievement after a physical activity intervention (Kibbe et al., 2011; Lees & Hopkins, 2013; Singh et al., 2012; Trudeau & Shephard, 2008). Future investigators should take this into consideration and create a longer intervention either by longer times in activity or over the course of more weeks.

Academic Achievement

Student academic achievement as investigated through MAP scores did improve, as expected, from the pre-test which was administered in August to the post-test taken in December. This improvement from August to December was a significant improvement for all students in the study. A previous study demonstrated similar results with all students demonstrating an improvement from the pre to the post assessment when investigating academic achievement (Ardoy et al., 2013; Taras, 2005). When comparing students in the control group to those that received one of the two interventions, the improvement was not significant. This finding was consistent with another study that found some aspects of the academic achievement scores to not be a significant

improvement in the intervention group (Bunketorp et al., 2015). However, a more recent study found the improvement in the intervention group to be significant (McPherson et al., 2018). The intervention groups did not have a significant improvement from August to December as compared to the control groups; the improvements were equally significant. This means that the improvement cannot be attributed to the physical activity intervention because the control group made the same advance on the assessment. However, this finding also supports the notion that reducing students' time in the classroom to opt for more time being physically active did not have a negative implication on their achievement scores (Ahamed et al., 2011; Carlson et al., 2008; Donnelly & Lambourne, 2011).

The lack of significance with physical activity and academic achievement could be attributed to a few different variables that were unexpected in the study. First, as already stated, the intervention time was shorter than planned. Previous findings have pointed to an increase in activity alone might not be enough to have a significant impact on academic achievement but could also need an increase in volume and intensity of activity (Ardoy et al., 2011). The intervention group that received the activity first was finished by the end of September and they did not take the post-test until the first week of December. It is possible that any effects they experienced in the intervention were gone by the time they were administered the assessment. It is also equally plausible that the length of the intervention was not long enough to see any significant impact on the academic achievement test. The length of the study has been previously identified as a limitation, but the timing of the intervention as compared to when the academic achievement assessment was administered is also a limitation of the study. Due to the

larger sample sizes, the first intervention group had a longer break between the end of the intervention and the assessment given than the second intervention group. Even so, the second intervention group had a longer wait time than expected when receiving the academic achievement assessment as well.

The restrictions that exist when conducting a study in a school setting is part of this limitation. When using academic achievement assessments conducted by the school, the research is at the mercy of the school's timeline. In future studies, considerations should be made to create or implement an existing academic achievement assessment as the researcher. When using the school's assessments, this will continue to be a limitation in future studies as a result of the nature of the school's schedule. Much of the timing of testing administration cannot be tampered with and the school is at the mercy of the testing agencies and board offices. The timing of the pre-test was moved up from when previously expected which hurried the beginning of the intervention and left a longer gap of time at the conclusion of the intervention before the assessment was administered again in December. As in previous studies, the pre-test and post-test varied based on when this was issued by the school system and is typically over the course of an entire academic year (Tomporowski et al., 2007). However, in the case with this study, the timeline was shorter because the approved intervention was for 8 weeks. Therefore, the intervention was administered between the first and second assessment of MAP testing given by the school system in August and December. This was a limitation that was not expected and could not be helped in this study but can be avoided in the future by implementing an assessment as the researcher rather than using the school's resources.

One expected limitation of using MAP scores to detect student academic achievement improvement is the nature of standardized testing. This is a limitation that has previously been accepted because there does not seem to be a better way to get a true picture of where a student is academically when they return from summer break. Logically, a student will lose some of the information they gained in the previous school year during the long summer break. When they return to school, scores are expected to be lower. After several weeks of reviewing and seeking a deeper understanding in their new grade's content, it is expected that students' assessment scores would improve. However, it is difficult to pinpoint the factors that make an impact on this improvement. It could be simple exposure to the content, a specific teacher, practice through more homework, or any number of interventions the school might be implementing on any given student, subject, or grade. The lack of significance of the improvement in scores from control to intervention groups could be due to any or all of these limitations. However, the MAP test was chosen, as in previous studies, because of the strength that exists within standardized assessments by eliminating rater bias had a different instrument been used (Carlson et al., 2008). While certain restrictions do exist within the realm of standardized testing, utilizing the exact instrument used by students to measure academic success provides the most accurate picture of validity for academic achievement in this study.

Cognitive Skills

Executive function skills including concentration, memory, and speed were investigated using the STROOP Color Word Test (Rasberry et al., 2011; Tomporowski et al., 2008). The STROOP Effect is a test to assess selective attention, self-control, and mental speed (Kvalø et al., 2017). The hypothesis that immediately following the

physical activity intervention, students' executive functioning skills would improve was supported by the evidence found in this study. In fact, this result was the most significant in the entire study. Students were administered a digital STROOP test where they were asked to take two tests which the first being easier than the second. The students were given the same instructions for both tests, "say aloud the color you see and not the word you read". The students could ask questions of clarification and were asked to begin when the start button had been clicked. Each student in the intervention group took this assessment before and immediately after the activity one time throughout the duration of the intervention. Almost every student made an improvement on the assessment from pre- to post-intervention.

The first phase of the STROOP test was easier for the students because the instructions might have been the same when given both tests, but on the first test, the colors shown reflected the word that was written. However, the second phase of the STROOP test had written words that were contradictory to the font color used. As stated previously, the students improved from before the intervention to after. The result was anticipated because earlier studies supported the hypothesis that STROOP test results would improve immediately following activity (Castelli et al., 2011; Trudeau & Shephard, 2009). However, the more difficult test had more significant improvements in student times than the easier assessment. This was not expected but begs the question of whether physical activity has a more significant impact on more difficult cognitive skill assessments. This result could support the previous notion that early intervention of physical activity in life could be vital for maintenance and improvement for cognitive

health (Hillman et al., 2008). In theory, this finding could also imply that the more difficult the cognitive test, the more impactful physical activity is on the outcome.

The design of this assessment was sufficient to determine the relationship between physical activity and cognitive skills. However, since the control group was not administered this assessment simultaneously with the intervention groups, the findings were limited in how they could be used to calculate the effects of physical activity on students' overall academic performance. Previous research that administered the STROOP test to both the control and intervention group found the intervention results to be more significant than the control (Memarmoghaddam et al., 2016). Other studies that used a different assessment tool to determine students' cognitive skills found the same result with the intervention students improving more significantly than the control (Gao et al., 2018). As a result, future researchers should consider administering this assessment to both the control and intervention groups at the same time in the day to see if the improvements were a direct result of the physical activity intervention or if some of the improvement was the result of practicing the test. It is possible that some of the improvement in students' cognitive skills were a result of taking the same test two times over a short (25 minute) time period. However, in a previous study where the STROOP test was administered at different points over a longer time period, the results were still significant (Wright et al., 2016). This conjecture is supported by a previous study that administered the STROOP Color Word Test to both the intervention and control groups finding that a significant improvement was found on this test for both groups (Kvalø et al., 2017). While plausible, this assumption cannot be supported due to the lack of assessment of the control students. If the assessment was given to the control group and

improvements were made as well, it could be attributed to more exposure of the same test. However, this remains to be unseen at this time.

Classroom Behavior

Student classroom behavior was thought to be a more significant variable in students' academic performance due to its impact on overall classroom group behavior (Barros et al., 2009; Davis & Cooper, 2011). Therefore, this variable was measured using two different instruments. First, classroom teachers were asked to complete a questionnaire the week before and the week after the intervention time for each group of students (Carlson et al., 2015). Teachers were asked to consider each student's behavior in the homeroom classes before the intervention and complete the questionnaire. At the end of the intervention period, the teachers were given the same questionnaire and asked to respond with students' behavior in mind since the intervention had begun. After analyzing their responses, it was determined that a high number on some questions were considered positive while a lower number on certain questions would be positive feedback. As a result, these scores were normalized and rescaled so the higher the number, the more positive the observed behavior. The results from this assessment were significant which supported previous findings and the hypothesis that student classroom behavior would improve (Barros et al., 2009). However, a study that used a similar teacher-based questionnaire found that behaviors were trending to be better for those that received a classroom-based activity intervention, but the improvement was not significant (Carlson et al., 2015). This finding could mean that a more active physical education-oriented intervention would be more impactful on student classroom behavior.

Students were also observed directly through systematic observations. Observations were considered systematic partial interval recording where students were observed for 5 seconds and any behavior displayed during that time was noted (Mahar, 2011). The observer(s) had 5 seconds to make marks and notes on that interval and would observe the same student for their remaining intervals. Each student was observed 6 times before moving on to the next student. Observations occurred for each student's full 6 intervals before moving back to the original student to continue observations. A secondary observer was utilized 35% of the time to ensure inter-rater reliability. Both observers underwent detailed training on what constituted as on-task and off-task behavior prior to observing students in the classroom setting (Ma et al., 2014; Wilson et al., 2015). After comparing the primary to secondary observer observations, results showed an inter-rater reliability of 71%.

When analyses were run on this measure, they were not found to be significant and did not support the hypothesis that classroom behavior would improve immediately following the intervention. Interestingly, this finding was consistent with one study that found off-task behaviors to show no significant improvement after receiving a short activity break outside the classroom (Wilson et al., 2015). This was contradictory to the results found using teacher questionnaires which was a different instrument measuring the same variable. This finding was conflicting with a previous study that found on-task behaviors to be significantly better after receiving a classroom-based physical activity intervention (Goh et al., 2016). Another study found that off-task behaviors significantly decreased after receiving an activity intervention (Ma et al., 2014). More studies revealed that immediate effects of activity on classroom behavior were significant, but over time

the results typically became consistent with those not receiving activity (Watson et al., 2017. However, more long-term research is needed to determine the lasting effects of physical activity on classroom behavior.

There are a few reasons this discrepancy could have occurred as noted in a previous study that used both systematic observation and teacher questionnaires to assess classroom behavior (DiPerna, Lei, Bellinger & Cheng, 2016). First, the classroom teachers have much more exposure to the students and would have a better grasp on the effectiveness of the intervention on their regular classroom behavior. According to the teacher questionnaire results, behavior change after the intervention was significantly better. It is feasible to consider that partial interval recording does not give a complete picture of student behavior. The classroom teachers know the students and their behavior better than anyone else, so their opinion should carry more weight on the effectiveness of the study than systematic recording. The questionnaire also took more into consideration than on-task behaviors in the classroom. Questions referred to demeanor, tentativeness in class, being punctual, responsible, and many other qualities that are valuable for a good student to possess. It is also possible that the physical activity intervention made a lasting impact on students' overall on-task behavior which would support the finding that questionnaire results were significant while systematic observations were not. Additionally, based on previous findings, one might reason that classroom-based physical activity breaks might be more impactful for immediate on-task behavior (Goh et al., 2016). Perhaps, the intervention was effective for overall behavior, but more frequent and continuous activity breaks are necessary for students to maintain on-task behavior throughout the school day.

The systematic observations were limited to investigating students' on-task behavior. The final hypothesis stated that as physical activity levels increase, on-task behavior would also increase. Based on the results from the analysis of students' on-task behaviors through direct systematic observation, this hypothesis was not supported, and the results were not found to be significant. As stated previously, the nature of partial recording is flawed when gaining a true picture of good behavior and bad behavior. Additionally, the observer's nature and opinion can skew the results. This can be seen by looking at the inter-rater reliability numbers because the reliability percentage should be at least 80% compatible (Mahar et al., 2006). There were times that the observers would differ on the *type* of off-task or even whether the student was on-task during observations. Often, the differences would be when determining if a student was on-task or passively off-task.

Additionally, partial recording forces the observer to note off-task behavior even if it occurs for one of the five seconds of the observation time period. This can be difficult to observe consistently when the off-task behavior is of a passive nature. One study took this into consideration and the observer indicated the type, nature, and duration of the student's off-task behaviors to investigate this issue further (Ma et al., 2014). However, another researcher noted the importance of shorter partial recording techniques when using systematic observations in elementary school children (Mahar, 2011). Therefore, partial recording was decidedly used within this study. Human error can occur here because one observer might notice an off-task behavior, but due to the position or line of site of the other observer this behavior was not noticed and therefore not recorded.

The direct observation instrument used in this study cited blatant off-task behaviors such as noisy outbursts that would clearly be disruptive in a classroom setting. However, certain passive off-task behaviors such as day dreaming or losing focus on the teacher might not be considered disruptive. Teachers have a large responsibility in teaching students, monitoring behavior and progress, and handling disruptions in their classrooms. Certain passive off-task behaviors that the systematic observations noted might not be seen by classroom teachers as negative behavior or could be overlooked entirely because they experience these every day and have learned to accept these types of behaviors as the norm (Sullivan et al., 2014). The interval recoding instrument did exactly what it was designed to do in observing students' on-task behavior immediately following activity. However, there were instances that appeared to be passive off-task behavior as it related to the recording device that might not have been off-task at all. Some students could be looking away or lightly tapping their pencil on the desk *while* listening to everything the teacher is saying, and others could be ignoring the lesson entirely. There is no perfect, full-proof way, to know whether a student is truly on-task when they are not focused completely on the teacher. However, it is also unrealistic to expect a student of any age to stare at their teacher for an entire class period.

There was not a significant relationship found between the physical activity intervention and the other variables measured in the study. This lack of significance could be due to any number of reasons, but the short length of the intervention is clear. The intervention time was not over a long enough period to assess any real impact on academic performance and therefore had an insignificant relationship with the other variables. In future studies, the intervention should be over the course of at least a

semester to get a truer picture of the effect of physical activity on all aspects of academic performance.

However, there were several significant relationships among the other variables that should be noted. Students' results on the MAP reading and math scores from December had a significant positive relationship indicating that students tend to score comparably on the two assessments. The conclusion can also be drawn that students that were successful in reading were also successful in math. This finding is supported by a previous study that claimed reading skills can be a predictor for both reading and math achievement (Rabiner, Godwin, & Dodge, 2016). Students that scored well on the MAP Reading test from December also tended to have positive results on the teacher-based questionnaires. This relationship suggests that students demonstrating positive behaviors in the classroom performed better on the reading assessment. This finding is supported by previous studies that cited a positive relationship between classroom behavior and academic achievement (Davis & Cooper, 2011) and another that cited on-task behaviors are predicative of good academic performance (Stapp & Karr, 2018; Walker & Berthelsen, 2017).

The STROOP cognitive assessment had a strong positive relationship with MAP reading and math results from December. This relationship suggests that the tool used to assess executive function and cognitive processes is closely related to standardized assessment outcomes. This finding also supports previous studies that point to a connection between executive functioning skills and academic achievement (Lawson & Farah, 2017). Lastly, male students were found to be significantly more active than their female peers. This finding was not surprising because the male students were visibly

more active during each intervention session than the female students. Through a quick observation of each intervention period, a clear difference could be seen between the two groups in the intensity of their activity as well as their continuous level of activity. In a previous study, boys were also found to engage in a more intense amount of physical activity than girls (Patnode, Lytle, Erickson, Sirard, Barr-Anderson, & Story, 2010). This finding was expected because it has been a persistent behavior in previous studies and one study also cited that the gap between girls and boys could be closed in the future if underlying causes for girls being inactive were investigated further (Telford, Telford, Olive, Cochrane, & Davey, 2016).

Limitations and Future Research

While there were several limitations within the study, valuable information was gained in this area of research. Many of the issues that were considered to be limitations of the study can easily be rectified by future research. Academic achievement did improve, but to determine whether this was a result of the physical activity intervention, more research needs to be conducted with a longer intervention time period.

On-task classroom behaviors did improve for both groups, but to determine whether the improvement was correlated with physical activity, further research is necessary. This limitation can be helped by lengthening the study, providing more observer training prior to the study, or using a different measure for this variable altogether. The inter-rater reliability was not as accurate as anticipated. More thorough training and practice is needed to ensure precise observations.

Additionally, classroom behavior was already measured quantitatively with teacher questionnaires that did show a significant improvement of on-task classroom

behavior due to the intervention. In order to get a more complete picture of the effectiveness of the intervention, future researchers should consider implementing a qualitative interview with students involved in the study. This would provide the opportunity to investigate their thoughts on the impact of the intervention on their own behavior and performance in the classroom.

The STROOP test did prove to be an effective measure of executive function with students' cognitive skills and abilities. However, to truly investigate the relationship between physical activity and overall academic performance, the cognitive assessment should be measured with both the intervention and control groups in future studies.

Conclusion

In many cases in this study, physical activity had a significantly positive relationship with academic performance. Due to limitations in the current study, more investigation and research is needed to clarify the significance of this positive relationship. In general, reducing students' time in a classroom to increase their time engaging in physical activity did not have a negative implication on their overall academic performance. The assumption by many that reducing time in the classroom will hinder performance has shown to be false when the reduction equates to an increase in activity. Students need physical activity as an important part of their daily life. While, academic performance as a whole might not show significant improvement, this study has demonstrated the significantly positive effects of a physical activity intervention on cognition, executive functioning, and certain aspects of academic behavior.

Children and adolescents that are physically active experience clear health benefits, including improved brain health, an extremely important aspect of academic

performance (USDHHS, 2018). There is a mountain of research that supports the benefits of physical activity and this study furthers that cause. The whole child approach to learning that has now been adopted across the United States places value on students' health (ASCD, 2015). The purpose of each school in each community should be to challenge and encourage their students (ASCD, 2015). It is time that schools use their time and influence to make a lasting impact on their students' lives by providing opportunities for all students to better themselves through prioritizing daily physical activity and health in each school, in each community.

Appendix A

Physical Activity Intervention

Standards:

2.31 Students demonstrate the knowledge and skills they need to remain physically healthy and to accept responsibility for their own physical well-being.

2.34 Students perform physical movement's skills effectively in a variety of settings.

2.35 Students demonstrate knowledge and skills that promote physical activity and involvement in physical activity throughout lives.

3.1 Students demonstrate positive growth in self-concept through appropriate tasks or projects

4.1 Students effectively use interpersonal skills.

4.2 Students use productive team membership skills.

4.3 Students individually demonstrate consistent, responsive and caring behavior

4.4 Students demonstrate the ability to accept the rights and responsibilities for self and others.

Objectives:

SWBAT respect themselves and others during team and individual games.

SWBAT perform different movement patterns during a variety of game situations.

SWBAT perform manipulative, locomotor, and non-locomotor movements proficiently in a variety of settings.

SWBAT work together with others to accomplish various tasks.

SWBAT choose appropriate defensive and offensive strategies in a variety of game situations.

SWBAT demonstrate personal and social responsibility in various situations.

Protocol:

Arrival – When students arrive in the gymnasium they will line up along the baseline as they enter the door. The students will be assigned color groups by poly spots, so I will call out colors at random and when their color group is called they will walk to their assigned color poly spot that will be scattered throughout the gym.
Departure – When it is time for students to leave the gym, I will ask them to line up on the same baseline that they came in on, request a "0" noise level, and lead them back to their respective classrooms.
Discipline - Any arguments or disputes are initially settled using rock, paper, and scissors. If this does not solve the issue, I will pull the student aside during the game to explain their options (display good sportsmanship & participate or sit out of the activity).

If there are continuing issues, the student will sit out of the activity for 5 minutes. If issues persist, the student will be removed from the activity for the remainder of the day. If the same student continues to have issues for more than 6 sessions in row, they will be dismissed from the activity time and will remain in their regular class.
Grouping – Students will be grouped using the toe to toe method. If I need two groups, one will raise their hand and split, if I need pairs they will remain with their partner, etc. If several groups are needed for a game, they will be grouped based on their color groups.

Activity: Handshake Game
Resource: PE Central

Supplies: Activity cards, gymnasium
Procedures: Students will be asked to walk around the gymnasium and when I say "go" they will perform a specific greeting that I give them with as many people as they can until I ask them to continue walking. The following "greetings" will be used: regular handshake, high five, fist bump, foot shake, and shoulder taps. After we make it through all of those greetings, the students will draw 3 activity cards from a box that will have random actions or body parts on them. They will be grouped together into 2 or 3 students and will create their own secret handshake or greeting using the 3 activity cards they drew within their handshake. After several minutes of working on their handshake, each group will present their secret handshake to the rest of the class.
Topic Addressed: Teamwork, cooperation, listening skills, creativity

Activity: Respect Tag
Resource: Human Kinetics -
http://www.humankinetics.com/excerpts/excerpts/sample-game-respect-tag

Supplies: Dice, Tag Cards, 6 balls, goals, 3 bean bags, gymnasium
Procedures: Students are scattered with one or two taggers. Remind them to show respect for the rules by being honest. If they fall down, crash, or go out of bounds, they must send themselves to the "show respect, get back in" area or if they are tagged, they will automatically go to the show respect area. When in the "show respect, get back in" area, students roll the dice and follow the directions to re-enter the game:
Rules: Be honest. Throw three balls into the target without stepping over the line.
Equipment: Put it away and do not play. Pick up three beanbags and put them away.
Self: Be active and be safe. Do 10 jumping jacks without hitting anyone.
People: Be a friend. Give two people a high five.
Every Child: Include every child and don't go wild. Safely find a person you do not play with often and tell him something nice.
Teacher: Listen to her and follow directions. Tell the teacher what each letter in the word respect stands for (the chant from the dance): rules, equipment, self, people, every child, and the teacher.
Topics Addressed: Following directions, respect, honesty, sportsmanship, cardio

Activity: Peaks & Valleys
Resource: Campbellsville University HP Department

Supplies: 20 Cones, gymnasium
Procedures: The students will be divided into 2 equal groups and cones will be spread out across the entire activity area with 10 cones standing upright and 10 cones laying on their side. The cones that are upright are considered "peaks" and those on their side are "valleys". Each group of students will also be titled peaks and the other valleys. The students that are "peaks" have the objective of standing all of the cones in an upright position while the students that are "valleys" have the objective of laying the cones on the side. The students must squat and turn the cones each time and may not kick, hit, or throw the cones. Play will go for a specified time and the team with the most peaks or valleys wins then the students switch roles.
Topics Addressed: cardio, fitness, teamwork

Activity: Parachute Activities
Resource: Dynamic Physical Education book

Supplies: Parachute, bean bags, gymnasium
Procedures: The students will engage in a variety of parachute activities. First, the students will get used to operating the parachute and attempt to make a dome. Once they can successfully work together to do this they will perform various fitness activities with the chute: toe touches, abdominal curl-ups, and backward pull. Next, students will perform a dome activity called number exchange where each student will be assigned a number and I will call out various numbers. When their number is called, they must perform a locomotor movement under the parachute before it returns to the ground. Lastly, student will perform a parachute activity using equipment with bean bags on the top of the chute attempting to make it like popcorn popping.
Topics Addressed: Teamwork, cooperation

Activity: Pig Ball
Resource: Dynamic Physical Education book

Supplies: Rubber Pig, gymnasium
Procedures: Students will be divided into two equal teams and will stand heel to two in a straight line with their teammates facing the opposing team. The student in the front of the line for Team A will throw the pig into the playing area and then begin running around his team. Each time he makes a successful lap around his team, they receive a point. Team B will hustle to the pig, remaining in their line, and must pass the pig from the front of the line to the back of the line going "over then under". When the pig reaches the back person in the line, they will run to the front of the line, yell "PIG", and then throw the pig for the opposing team to hustle to the pig. The student running laps in the first group must stop once "PIG" has been yelled out. The team that threw the pig will be required to perform a variety of locomotor movements throughout the activity.
Topics Addressed: Cooperation & teamwork, cardio, coordination

Activity: Attached at the…
Resource: Dynamic Physical Education book

Supplies: 15 balls, gymnasium
Procedures: Students will be partnered up and will work together to navigate from one point in the gym to the other while attached at the hip, back, elbow, and ankle while walking, sliding, skipping, and galloping. After they have made it through all of these attachments, the students will attempt to navigate while attached at all of these positions with a ball between their attached body parts. If the students seem to be having success with this, I will make the task more difficult with different locomotor movements and obstacles in the gym, forcing them to change direction with their partner.
Topics Addressed: Teamwork, cooperation, cardio

Activity: Noodle Games
Resource: Pinterest

Supplies: Pool Noodles, balls, bins, gymnasium
Procedures: Students will perform a few different skills with the pool noodles. First, they must move around the gym performing different locomotor movements while "attached" to a partner with the noodle. Next, students will partner up and attempt to lift a ball off the ground on one end of the gym and carry it to the other end of the gym without dropping the ball. The group that gets to the other end first wins. Last, students will get into groups of 4 and work together to pick up balls off the ground and place them into a bin. The group with the most balls in their bin at the end of the time limit wins.
Topics Addressed: Responsible personal & social behavior, teamwork, cooperation, cardio

Activity: Castaways
Resource: Focus on FUNdamentals

Supplies: 4 bowling pins per group, 1 mat per group, 2 scooters per group, 3 fleece balls per group
Procedures: Participants will be divided into equal groups of 4 – 6 and placed on an "island" or mat to protect their 4 bowling pins with 2 "rafts" or scooters on the outside of the island. The castaways will throw "cannonballs" or fleece balls at their opponents' islands to try to knock down their pins. Those assigned to guard the pins must remain on the mat and if they fall into the ocean, they must run to the sideline to perform a specified fitness activity before returning to guard their pins. If a pin gets knocked down, it must stay down and once all 4 pins have been knocked down, the whole team must run a lap around the gym before returning to setup their 4 pins. The students on the "rafts" must use them throughout the game to collect "cannonballs" for their team. The team with the most original pins standing at the end wins the game!
Topics Addressed: throwing skills, strategy, core skills, fitness, cooperation, teamwork

Activity: Leap, Stop, & Throw
Resource: Focus on FUNdamentals

Supplies: Hurdles, cones, poly-spots, rubber animals, bins, baskets, targets, balls, and any other equipment available to the students in the supply closet.

Procedures: Students will be divided into equal groups and given 5 different types of equipment. They will be given a designated area in the gymnasium and instructed to build their own obstacle course. Be as creative as you can be! Students can choose which locomotor movement students must use when getting through their course. After 5 minutes, the students will move through their course in a relay format against the other groups. Once everyone in their group has completed their obstacle course, they will move in a clockwise motion to another group's course until each group has made it through every group's course.
Topics Addressed: PA is FUN, cardio, creativity, locomotor movements, teamwork

Activity: Tic Tac Toe
Resource: KAHPERD

Supplies: 18 Hula-hoops, 12 bean bags, gymnasium
Procedures: Hula-hoops will be placed together in a 3x3 format between half court and the 3-point line on a gym floor. Students will line up on the blocks and will perform different locomotor movements from the block to the free throw line. Once they reach the free throw line they will toss their bean bag into a hoop with the goal of playing tic tac toe. The will perform the same locomotor movement back to the block and before the next person can go they will perform a fitness movement. Once all 3 bags have been tossed, the student will perform their movement all the way to the hoops, choose a bag, and re-toss the bag in an effort to win tic tac toe by getting 3 in a row or blocking their opponent. The following locomotor movements will be used (walk, jog, gallop, skip, & lateral slides). The following fitness activities will be used (3 squats, 3 push-ups, 3 sit-ups, 3 jumping jacks, & 3 arm circles).
Topic Addressed: Tactical strategies & foundational fitness skills

Activity: Bombs Away
Resource: Campbellsville University HP Dept.

Supplies: 2 bins, 20 foam/yarn balls, gymnasium
Procedures: Students will be divided into two even groups with half on each side of the gymnasium. Each side will begin with 10 balls and the object is to collect the most balls by the end of the specified time period. Students are attempting to throw their balls into an open area of the court in hopes of keeping their ball in play. Students without a ball are attempting to catch any ball that comes to their side and place it in the bin that is on their side of the court. Once a ball has been caught, it is no longer in play and counts as a point for the team that retrieved it. At the end of play, the team with the most balls in their bin (points) wins the game.
Topics Addressed: All Physical Activity is good Physical Activity, overarm throw, catching

Activity: Ball Toss

Supplies: At least 10 foam balls, gymnasium

Procedures: Students will be divided into two even groups and separated by the half court line. The students will form a circle and begin with one foam ball tossing it around the circle. The only rule is that students cannot throw the ball to the same person they just received it from; they have to find someone new. After they get comfortable controlling the ball, they will have the rule added that the ball cannot touch the ground. The team with the most consecutive catches in 2 minutes wins. Next they will begin the same way as the previous game, but after 1 minute passes, I will throw in an additional ball that they must keep off the ground. The team with the most balls going at the end of the 5 minute time frame, wins.
Topics Addressed: Teamwork, throwing, catching, coordination

Activity: Frisbee Bowling
Resource: Campbellsville University HP Department

Supplies: Frisbee bowling set, gymnasium
Procedures: Students will be divided into 4 equal groups (or the number of Frisbee bowling sets available) and be designated a color. Each group will receive Frisbee bowling pins which look a lot like regular bowling pins but are much thinner and lighter and Frisbee. The teams will start out 10 feet from pins and will be spaced out further if a greater difficulty level is needed after the first round of play. Each person on the team will receive one throw each time with the objective of knocking down as many pins as they can. If the team knocks down all the pins on the first throw they receive 5 points, on the second throw 3 points, and after three or more throws 1 point. After all of the pins have been knocked down the team must work together to setup their pins again and start over. The team with the most points at the end of the time limit wins.
Topics addressed: Backhand throw, targeting & aiming, teamwork, cardio

Activity: Ultimate Frisbee or Modified Handball (depending on skill level)

Supplies: Frisbee or play yard ball, cones, gymnasium
Procedures: Students will be divided into 2 equal teams and have the goal of scoring the most points by the end of the time limit. Students may use a Frisbee, or if their skill level throwing a Frisbee is not proficient, a play yard ball. Students must make 5 throws before attempting to score. Once a Frisbee or ball has been caught, the student only has 2 steps before they must make a throw. Students may score after 5 successful throws and crossing the cones on their opponent's side of the floor. If the ball or Frisbee is dropped, it is considered a turnover and the opposing team will take possession from that same spot. If a ball is used, no dribbling will be allowed. The team with the most points at the end wins.
Topics Addressed: overarm or backhand throw, offensive & defensive strategy, moving without the ball, teamwork, integrity

Activity: Bokwale
Resource: Campbellsville University HP Dept.

Supplies: 30 Hula-hoops, at least 60 small items (balls, rubber critters, bean bags, etc.), gymnasium
Procedures: Students will each stand at their own "home" hoop with at least 2 items in their hoop. The purpose is to "visit" each hoop and take one item to bring back to their home hoop. Each student must visit each hoop before returning to the same hoop and must always go from one hoop back to their home to return the item. The person at the end with the most items in their home hoop wins the game.
Topics Addressed: Cardiovascular Fitness, taking care of their "home", best effort

Activity: Hoarders
Resource: Dynamic Physical Education textbook

Supplies: 20 Rubber Critters, 10 hula-hoops, gymnasium
Procedures: Students will be divided into groups of 3 with each set of students assigned to a hula-hoop. Each hula-hoop will contain two rubber critters that two of the three students must defend. One student in each group will be designated as an attacker and will attempt to steal other critters to bring back to their home hoop. If one of the defenders tags the attacker, they must return to their home hoop before attempting to steal another critter. If an attacker makes it into the hula-hoop safe zone, they can no longer be tagged and can bring the critter back to their home hoop before making additional steal attempts.
Topics Addressed: Offensive strategy, defensive strategy, responsibility

Activity: Guard the Pins
Resource: Focus on FUNdamentals

Supplies: Hula hoop & bowling pin for each participant, 10 play yard balls, gymnasium
Procedures: Each participant will be assigned a hula-hoop with a bowling pin in the center of it. Their responsibility is to guard their pin from outside the hoop and keep others from knocking down their pin. The balls will be scattered throughout the play area and students can choose to leave their pin to get a ball and attempt to knock down someone's pin. Once a student has a pin, they must stay stationary in that spot, but will be allowed to pivot or use other non-locomotor movements to better position themselves to knock down someone's pin. If someone's pin gets knocked down they must pick up their pin and move it inside the hoop of the person that knocked down their pin and they will work together to defend both pins. If any of the pins in a group get knocked down, the entire group must move their pins to the person's hoop that knocked a pin down. The game continues until all the pins are united into one group.
Topics Addressed: Teamwork, strategy, rolling, throwing, defense, integrity, locomotor & non-locomotor movements

Activity: Targets Away
Resource: www.playsport.net

Supplies: 8 Hula-hoops, 8 bowling pins, 4 small kick balls, gymnasium

Procedures: Hula-hoops will be placed horizontally on the gym floor with a bowing pin in the center of each hoop and 2 hoops directly across from one another in the form of goals. Teams will be divided into 2 v 2 or 3 v 3 teams, depending on numbers, with two teams playing each other on each "court". The goal is for the teams to defend their bowling pin by staying outside the hoop and attack the other team's pin by throwing the kick ball in an attempt to knock down the pin. The teams will play "full court" and will determine who goes first by playing rock, paper, scissors. The losing team will throw off and begin play. In the first modification, each team must make at least 3 passes before attempting to knock down the opponent's pin (Ultimate Frisbee rules). They must move without the ball and will not be permitted to dribble the ball. If they drop the ball, it's a turnover where it's at going to the other team. The second modification will allow them to dribble, but they still must make at least 3 passes before attempting to score (Basketball rules apply). The third and final modification is in the case of a dropped ball, it becomes a ground rule and must be played on the ground through the possession (Soccer rules apply).
Topics Addressed: Offensive strategy, defensive strategy, kicking, passing (by hand & foot), dribbling (by hand & foot), overarm throw, sportsmanship

Activity: Can't Touch This
Resource: www.playsport.net

Supplies: 2 play yard balls, 8 cones, gymnasium
Procedures: Students will be divided into 4 even groups and play horizontally on both ends of the court so there will be two games going on at one time. The playing court will be outlined used 4 cones on each end. The purpose of the game is for the students to focus on invasion/territory strategies, moving with and without the ball, and making good passes/catches. Teams that make 5 successful passes without dropping the ball or turning it over receive 1 point. After points or turnovers, the ball changes possession to the opposite team. The team with the most points at the end of the game wins.
Topics Addressed: Teamwork, Cooperation, Cardio, passing, catching, defensive/offensive strategies

Activity: Healthy Habits
Resource: Focus on FUNdamentals

Supplies: 8 cones, 8 poly-spots, 10 bean bags, 10 foam balls, 2 hula hoops, gymnasium
Procedures: Students will be divided into 2 equal groups, 1 group on each side of the court. The cones will be spread across half court to help visualize the dividing line and the poly-spots will be spread around the perimeter of the court. A hula hoop will be in the middle of each team's area and contains that teams bean bags. The foam balls will be spread out evenly on both sides of the floor. The objective is for the opposing teams to collect each other's "healthy food" or bean bags by crossing the line into their territory. At the same time, each team is trying to get rid of their "junk food" or the balls by rolling them over to the other team's area. If someone is tagged while in the opposing team's zone they must hustle to a poly-spot on the sideline and perform a specific fitness activity

before returning to their side and getting back in the game. The team with the most healthy foods and least junk foods in their area at the end of the time wins the game.
Topics Addressed: Nutrition, cardio, dodging, cutting, fitness, strategy, defense, teamwork

Activity: Flip the Disc
Resource: www.playsport.net

Supplies: 20 Hula-hoops, 20 numbered poly spots, gymnasium
Procedures: Hula-hoops will be spread out with 10 on each side of the gym. Poly spots will be placed in the middle of each hoop with varying point values (5, 4, 3, 2, and 1) on the bottom of the spots. The objective is for each team to invade the other team's space and "flip the discs" while also defending their discs from being flipped over. Each team will have designated defenders, attackers, and one healer that will be allowed to flip the discs back over, saving their team's points. The team with the most points at the end of the time limit wins. After the first game, I will modify the rules to no healer and the team with all the discs flipped over wins. In the final game, the teams will have to strategize together for 90 seconds, designate who and how many attackers, defenders, and healers they want before playing again.
Topics Addressed: Offensive strategy, defensive strategy, cooperation, addition, offensive

Activity: Castle Protectors
Resource: Focus on FUNdamentals

Supplies: 30 cones, 30 bean bags or tennis balls, play yard balls, gymnasium
Procedures: The students will be divided into two equal teams with 15 "castles" on each side. A castle is a cone with a bean bag or tennis ball on top. The purpose of the game is to throw balls from one side in an attempt to knock over the other team's castles. Once a castle has been knocked down, the person that knocked it down has to run over to the other team's side and pick up the castle to set it up on their own side. The side with the most castles standing at the end of the time frame wins.
Topics Addressed: throwing skills, cardio, territory/invasion lead-up skills, honesty, sportsmanship

Activity: Continuous Kickball
Resource: Focus on FUNdamentals

Supplies: 10 kick balls, 1 bin, 3 cones, 1 poly-spot, gymnasium
Procedures: Setup a baseball diamond with 1-3rd base and home plate. The students will be divided into two groups: fielders & batters. One of the fielders will be designated as the pitcher and have the bin of balls next to them. The pitcher will roll the ball to the batter who will kick and run to the base. Immediately, the pitcher rolls the ball to the next batter who will kick and run to the base. There are no outs and nobody stays on base. The goal for the fielders is to retrieve the balls that are kicked and return them to the bin trying to prevent the container from being empty. If the bin does empty, the batters are

awarded 500 points and then switch roles with the fielders. If the fielders return all the balls to the bin before the last batter kicks, they receive 500 points. First team to a 1000 points wins.
Topics Addressed: cardio, constant activity, kicking skills, sportsmanship

Activity: Capture Kickball
Resource: Focus on FUNdamentals

Supplies: 5 poly-spots, 4 cones, 4 flags, 1 kickball, gymnasium
Procedures: The poly-spots will be used to create a kickball area with 1-3rd bases, pitcher's mound, and home plate. 4 cones will be placed in the outfield side by side with flags on top of the cones. Students will be divided into 2 equal teams and designated as "kickers" and "fielders". The fielders will be in the outfield and 1 on the pitcher's mound while the kickers will line up behind home plate. Once a fielder rolls to a kicker, they kick and run to 1st base. The fielders are trying to get the runner out by touching with the ball before they get to the base, just as in baseball. When the second kicker kicks, the runner on first can decide whether to run to 2nd base or run to grab a flag from one of the cones. If they choose to grab a flag, they must run straight back to home without getting tagged by a fielder. Runners can also choose to grab a flag when running to any of the other bases. 1 point is awarded for each run scored and 5 points is awarded for each flag stolen. After 3 outs, fielders and kickers change position. The game is over once all the flags are collected.
Topics Addressed: Cardio, teamwork, strategy, kicking skills, rolling skills, dodging

Appendix B

Intervention Protocol Schedule

Intervention 1 Protocol		
Days	Activity	Topic
1	Handshake Game	Teamwork, cooperation, listening skills, creativity
2	Respect Tag	Following directions, respect, honesty, sportsmanship, cardio
3	Peaks & Valleys	Cardio, fitness, teamwork
4	Parachute Activities	Teamwork, cooperation
5	Pig Ball	Cooperation & teamwork, cardio, coordination
6	Attached at the…	Cooperation & teamwork, cardio
7	Noodle Games	Responsible personal & social behavior, teamwork, cooperation, cardio
8	Castaways	Throwing skills, strategy, core skills, fitness, cooperation, teamwork
9	Leap, Stop & Throw	PA is FUN, cardio, creativity, locomotor movements, teamwork
10	Tic, Tac, Toe	Tactical strategies & foundational fitness skills
11	Bombs Away	All Physical Activity is good Physical Activity, overarm throw, catching

Intervention 2 Protocol		
Days	Activity	Topic
1	Handshake Game	Teamwork, cooperation, listening skills, creativity
2	Tic, Tac, Toe	Tactical strategies & foundational fitness skills
3	Peaks & Valleys	Cardio, fitness, teamwork
4	Bombs Away	All Physical Activity is good Physical Activity, overarm throw, catching
5	Guard the Pins	Teamwork, strategy, rolling, throwing, defense, integrity, locomotor & non-locomotor movements
6	Targets Away	Offensive strategy, defensive strategy, kicking, passing (by hand & foot), dribbling (by hand & foot), overarm throw, sportsmanship
7	Flip the Disc	Offensive strategy, defensive strategy, cooperation, addition
8	Castaways	Throwing skills, strategy, core skills, fitness, cooperation, teamwork
9	Castle Protectors	throwing skills, cardio, territory/invasion lead-up skills, honesty, sportsmanship
10	Can't Touch This	Teamwork, Cooperation, Cardio, passing, catching, defensive/offensive strategies
11	Leap, Stop & Throw	PA is FUN, cardio, creativity, locomotor movements, teamwork

Appendix C

Teacher Questionnaire Form

Classroom Behavior	1 – Never	2 – Seldom	3 – Sometimes	4 - Often
1. Pay attention in class				
2. Cooperate with peers, ability to work with others				
3. Have a positive, cheerful attitude				
4. Produce work and assignments that are high quality				
5. Are defiant or noncompliant				
6. Lack effort or motivation or give up easily				
7. Have excessive movement or are out of seat often				
8. Are off task or inattentive during class time				
9. Are unable to change activities or make transitions smoothly				
10. Are unhappy, sad or depressed				
11. Need to be talked to about problem behaviors				
Totals				

Classroom Behavior Following Activity				
Classroom Behavior	1 – Terrible	2 – Same as Before	3 – Some improvement	4 – Total behavior change
12. Classroom behavior immediately following bouts of physical activity				
13. Classroom behavior immediately following intervention				
14. Classroom behavior immediately following PE time				
15. Classroom behavior immediately following recess or some other form of physical activity break				
Totals				

Appendix D

Systematic Classroom Observations Form

Observer ______________________________ Teacher _______________________________

Reliability Observer _______________________ Grade or Subject ______ Date ______________

No. in Class or Group _____________________ Time: Start _________ End _______________

General Activity __________________________ Page ___________of ___________

Observation Interval **__5 sec__** Record Interval **__5 sec__**

STUDENT	TIME	ACTIVITY CODE	INTERVALS						COMMENTS
			1	2	3	4	5	6	
ID:	1		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	2		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	3		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	

STUDENT	TIME	ACTIVITY CODE	INTERVALS						COMMENTS
			1	2	3	4	5	6	
ID:	1		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	2		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	3		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	

STUDENT	TIME	ACTIVITY CODE	INTERVALS						COMMENTS
			1	2	3	4	5	6	
ID:	1		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	2		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	3		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	

STUDENT	TIME	ACTIVITY CODE	INTERVALS						COMMENTS
			1	2	3	4	5	6	
ID:	1		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	2		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	3		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	

STUDENT	TIME	ACTIVITY CODE	INTERVALS						COMMENTS
			1	2	3	4	5	6	
ID:	1		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	2		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	3		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	

STUDENT	TIME	ACTIVITY CODE	INTERVALS						COMMENTS
			1	2	3	4	5	6	
ID:	1		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	2		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	3		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	

STUDENT	TIME	ACTIVITY CODE	INTERVALS						COMMENTS
			1	2	3	4	5	6	
ID:	1		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	2		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	3		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	

STUDENT	TIME	ACTIVITY CODE	INTERVALS						COMMENTS
			1	2	3	4	5	6	
ID:	1		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	2		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	3		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	

STUDENT	TIME	ACTIVITY CODE	INTERVALS						COMMENTS
			1	2	3	4	5	6	
ID:	1		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	2		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	
	3		+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	+ N M O	

Appendix E

Systematic Classroom Observations Definitions

On-Task Behavior – On-task behavior includes verbal and motor behavior that follows the class rules and is appropriate to the learning situation. On-task behavior is defined with reference to both the rules of the classroom and the teacher designated academic activity. If a student is working on the appropriate academic activity and is obeying the rules of the classroom, then the student's behavior is recorded as being on-task. Examples of on-task behavior might include sitting at one's desk while working, engaging in group games when appropriate, responding to teacher questions (whether the answer is correct or incorrect), walking to the chalkboard when asked, demonstrating activity to others when expected to do so, or talking during class discussion.

Motor Off-Task Behavior – Motor off-task behavior is any gross motor response that breaks the rules and/or interrupts the learning situation. Gross motor behaviors may include getting or being out of one's seat, turning around at least 90°, running, turning cartwheels, walking around the room, and/or waving arms. Another area of inappropriate gross motor behavior includes behaviors generally labeled as aggressive, such as hitting, kicking, pushing, pinching, slapping, striking another person with objects, grabbing another's property, and throwing objects. Some motor behaviors are inappropriate during certain classroom periods, but not always at other times.

Noise Off-Task Behavior – Noise off-task behavior includes both verbal noise and object noise. Verbal noise is any oral response that breaks the class rules and/or

interrupts the learning situation. This category may include inappropriate talking, yelling, blurting out, whistling, humming, screaming, singing, and laughing. Simply seeing the student's lips move is not enough. If a child responds to a teacher's questions or instruction, then the student is on-task. Further examples of verbal off-task behavior include blurting out an answer instead of raising one's hand (if this breaks the class rules; based on the teacher's reaction), talking to a neighbor instead of working on materials, and singing during discussion. Object noise is any audible noise resulting from any behavior on the part of the child that may cause other children to be off-task, such as slamming books, kicking furniture, or rapping a desk.

Other or Passive Off-Task Behavior – Other or passive off-task behavior refers to times when the student is involved in no interaction or is doing nothing when expected to be involved. Behaviors in this category include daydreaming and staring into space. The student must be engaged in no gross motor or verbal activity for this category to be recorded. It is important to remember that there are times when doing nothing is appropriate, for example when an assignment is completed and nothing has been assigned. This is very rare, however, as most teachers have activities for all students when one assignment is completed. This category also includes minor motor behaviors, such as thumb sucking, fingernail biting, fiddling with hair, finger twiddling, chewing on a pencil or other object, or playing with one's pencil when not appropriate. Minor motor behaviors are only recorded when attention is not directed toward the student's learning work. If, however, the student is engaged in appropriate activities while he exhibits these small motor behaviors, then his or her behavior is recorded as being on-task.

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