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THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND ON-TASK BEHAVIOR IN
EARLY PRIMARY SCHOOL STUDENTS

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
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Lexington, Kentucky

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and Dr. Aaron Beighle, Associate Professor of Kinesiology and Health Promotion
Lexington, Kentucky

2015

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ABSTRACT OF DISSERTATION

THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND ON-TASK BEHAVIOR IN EARLY PRIMARY SCHOOL STUDENTS

The relationship between students' physical activity (PA) and on-task behavior in the classroom setting was examined. Given that students spend nearly half of their waking hours in school, researchers have suggested that the school environment could play a crucial role in increasing children's PA. Physical activity of 157 first- and second-grade students was assessed using ActiGraph (GT1M) accelerometers during school hours. Momentary time sampling (MTS) tracked the on-task behaviors of 72 of the 157 participants every 30 seconds. Multiple linear regressions and paired sample *t* tests were run to measure students' classroom PA steps, PA intensity levels in the classroom, and on-task behaviors. Results indicated weak, yet significant, inverse correlations between students' PA steps, PA intensity levels, and on-task behaviors ($R = .40$, $R^2 = .16$, $p = .01$). On-task behaviors and steps taken in the classroom before recess indicate a significant inverse relationship ($R = -.18$, $R^2 = .03$), indicating the pre-recess classroom steps account for 3% of the variance in on-task behavior. Steps taken in the classroom indicate a significant inverse relationship ($R = -.20$, $R^2 = .04$) with on-task behavior. The results from the linear regression analysis after recess indicate that the post-recess steps can account for approximately 4% of the variance of the on-task behavior. These overall results suggest that greater PA levels in the classroom setting were associated with less on-task behavior. Results from the *t* test indicate a significant ($t(143) = -4.32$, $p < .001$) increase in on-task behavior (3%) after recess. In conclusion, the present study demonstrated that 84% of the variance in on-task behavior is accounted for by non-PA suggesting that other variables may affect students' on-task behaviors in the classroom setting.

KEYWORDS: Physical Activity, Classroom, On-Task Behavior, Recess, Accelerometers

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THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND ON-TASK
BEHAVIOR IN EARLY PRIMARY SCHOOL STUDENTS

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DEDICATION

This dissertation is dedicated to everyone who has supported me throughout the journey of my doctorate. Most importantly, my family for supporting me during my academic career, my mentors who have led me down the correct path, and my friends for keeping me encouraged throughout the process.

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TABLE OF CONTENTS

Acknowledgments.....	iii
List of Tables	v
Definition of Terms.....	vi
Chapter One: Introduction	1
Chapter Two: Literature Review	
Benefits of Regular Physical Activity.....	4
Inadequacy of Current Physical Activity.....	4
Implementation of Physical Activity in Schools	5
Physical Education.....	8
Physical Activity Breaks.....	9
Cognitive Benefits of Physical Activity	13
Student Behavior.....	18
Chapter Three: Methodology	
Guiding and Reserach Questions.....	21
Participants.....	21
Instruments.....	22
Accelerometers.	22
Momentary Time Sampling.....	24
Procedures.....	25
Data Analysis.....	27
Chapter Four: Results	
Overall Physical Activity and On-Task Behavior	30
Pre-recess Physical Activity and On-Task Behavior	31
Post-recess Physical Activity and On-Task Behavior	32
Pre-recess Outcomes vs. Post-recess Outcomes	34
Chapter Five: Discussion	
On-Task Behavior.....	36
Physical Activity.....	39
Conclusions and Limitations.....	43
Future Research	45
Appendix A: Parent Consent	48
Appendix B: Teacher Consent.....	52
Appendix C: Child Assent	56
References.....	57
Vita.....	65

LIST OF TABLES

Table 1, Example of MTS for Student On- and Off-Task Behaviors in 30-Second Intervals.....	27
Table 2, Mean Step Counts, Time Spent in PA Intensity Classifications, and Percentage of On-Task Behavior During the (Non-recess) School Day	30
Table 3, Correlation Coefficients of the Predictors With Overall Percentage of Classroom On-Task Behavior.....	31
Table 4, Correlation Coefficients of the Predictors With Pre-recess Percentage of Classroom On-Task Behavior.....	32
Table 5, Correlation Coefficients of the Predictors With Post-recess Percentage of Classroom On-Task Behavior.....	33
Table 6, Mean Pre-recess Classroom Step Counts, Time Spent in Classroom PA Intensity Classifications, and Percentage of Classroom On-Task Behavior During the (Non-recess) Classroom Instructional Day.....	34
Table 7, Mean Post-recess Classroom Step Counts, Time Spent in Classroom PA Intensity Classifications, and Percentage of Classroom On-Task Behavior During the (Non-recess) Classroom Instructional Day.....	35

Defintion of Terms

Active engagement is participation in active movement integrations designed to teach academic content (Pellegrini & Bohn, 2005).

Activity breaks are pauses from learning in the classroom for physical activity (Let's Move, 2015). Breaks occur either in (energizers) or outside (recess) the classroom.

Classroom physical activity is any activity taken during instructional time. This can include activity engaged in during on- or off-task behaviors.

Daily physical activity any bodily movement produced during waking hours. Tudor-Locke et al. (2011) recommends that boys should take around 12,000–16,000 steps per day and girls should take approximately 10,000–13,000 steps per day.

Instructional time is any time in which the students are involved in learning academic content (i.e. math, reading, music) through various teaching strategies in the classroom. This excludes lunch, recess, restroom breaks and transitional time from subject to subject.

On-task behavior is any behavior in which a student is attentive or actively engaged in the appropriate task, as assigned by the teacher (Grieco et al., 2009). Other terms used interchangeably are classroom behavior, attention-to-task, and time-on-task.

Physical activity is any bodily movement produced by the contraction of skeletal muscle that increase energy expenditure above a basal level (U.S. Department of Health and Human Services, 2008).

Recess is usually an outdoor unstructured break from learning (Pellegrini & Smith, 1993) where the students have the freedom to choose what they would like to do.

Transition is the time spent not learning in between academic subjects.

Chapter One: Introduction

Since the passage of the No Child Left Behind Act (NCLB, 2002), classroom teachers and administrators have placed greater emphasis on closing the achievement gap in public education through the restructuring of annual testing, meeting academic progress metrics, teacher training, and additional funding changes (NCLB, 2002). The Act has been criticized for diminishing the time and resources that schools dedicate to students' physical activity (PA) because K-12 educators focus the majority of their effort on academic work and test scores, especially related to math and reading. However, educators and school districts have failed to prioritize recommendations from researchers regarding the importance of targeting childhood obesity and physical inactivity in the same way as they have with NCLB mandates.

The emotional, physical, social, and cognitive benefits of short- and long-term PA on children and youth are well documented (Centers for Disease Control and Prevention, 2010). Given that students spend nearly half (40–45%) of their waking hours in school, researchers have suggested that these institutions could play a crucial role in increasing children's PA (Fairclough, Beighle, Erwin, & Ridgers, 2012). However, schools have yet to assume that role in increasing children's PA in an active capacity. The failure to incorporate PA into schools is due not only to educators' unwillingness to act based on research, but also to their unwillingness to act based on belief. A 2002 poll by Action for Healthy Kids (2013) indicated that 72% of student educators believed that schools should make PA more of a priority. Nevertheless, few changes have been made within schools to act on that belief. Given the prevalence of research advocating for increased PA among

children and youth, the Centers for Disease Control and Prevention (2013) advocate the incorporation of PA throughout the school day.

Although students spend 6–7 hours per day and 30–35 hours per week in school, they only receive 60 minutes of physical education (PE)—at most—during the school day. Unfortunately, while PE is a likely source of PA for students within the school system, its offerings remain limited. According to the National Center for Education Statistics (2005), in the United States, PE is taught for one or two days per week in approximately 30–40 minute blocks at the elementary level. Given its low prevalence in the school curriculum, PE alone is insufficient to meet children’s daily PA needs. Other activities such as recess, movement integration in the classroom, and PA breaks must be incorporated into the school day in order to maximize children’s PA levels and optimize its benefits. To achieve this, classroom teachers and other school personnel need to be actively involved.

The trend of removing opportunities for PA in favor of alternative academic study does not align with current the relationship between PA and children’s academic performance research, one contributor of which is on-task behavior. On-task behavior that is adversely affected by the removal of PA introduces the possibility of distractions not only for the student but also other students nearby, which may lead to lower academic performance. On the contrary, minimizing students’ PA in favor of additional academic endeavors has not been shown to increase academic scores (Ahamed et al., 2007). Moreover, students’ participation in PA does not appear to lower grades (Ahamed et al., 2007). Furthermore, in a 2006 survey, the National Association for Sport and Physical Education (NASPE) found that 95% of parents with children in grades K–12 believed that daily PA helped children perform better academically. If this is the case, then the

integration of PA breaks, such as energizers and recess and the implementation of tools to provide PA in the classroom setting are essential for student success.

Existing classroom research strongly supports the value of students' participation in PA during school; however, there is limited evidence regarding the volume and intensities of PA in which students engage during the school day. It is particularly important to understand the relationship between typical classroom PA levels and on-task student behavior so teachers can recognize different student needs. By understanding different learning styles (Kolb, 1984) and students' needs, teachers can create focused environments for successful learning. This study sought to better understand on-task behavior and isolate classroom activity by removing data recorded during non-instructional time (i.e. lunch, recess, and transitional breaks). Therefore, the purpose of this study was to determine the relationship between students' PA levels and on-task behavior in the academic setting.

Chapter Two: Literature Review

Benefits of Regular Physical Activity

With the growing prevalence of research demonstrating the many benefits of being physically active, agencies, political leaders, and organizations are beginning to see the importance of integrating regular PA opportunities for children and youth (Erwin, Beighle, Carson, & Castelli, 2013). In particular, programs such as Let's Move (2015), the National Physical Activity Plan (2010), and the Comprehensive Physical Activity programs (Centers for Disease Control and Prevention, 2014) are targeted toward school-based PA opportunities to improve the health and well-being of children nationwide.

Physical activity provides positive health outcomes such as better mental health; improved function of the immune, metabolic, and endocrine systems (Spain & Franks, 2001); and a healthier musculoskeletal system (Strong et al., 2005). Additionally, Pate et al. (2006) suggested that providing children with ample PA opportunities might mitigate the metabolic consequences of obesity. Regular PA has also been noted to improve personal development and social responsibility (National Association for Sport and Physical Education, 2008) as well as social competence (Centers for Disease Control and Prevention, 2010; Pellegrini, Kato, Blatchford, & Baines, 2002).

Inadequacy of Current Physical Activity

U.S. children in general spend the majority of their time sitting or being sedentary, particularly during school activities (Sturm, 2005). In fact, the majority of U.S. children (ages 6–11) and youth (ages 12–19) attend school (Snyder, Dillow, & Hoffman, 2009), and a considerable amount of their moderate to vigorous physical activity opportunities are offered during school hours (Guinhouya, Lemdani, Vilhelm, & Hubert,

2009). However, many U.S. youth are not meeting the recommended 60 minutes of daily PA (Centers for Disease Control and Prevention, 2008). Tudor-Locke et al. (2011) stated that for the entire day, elementary boys take an average of 12,000–16,000 steps per day and girls take an average of 10,000–13,000 steps per day. Nevertheless, students spend most of their school day in classrooms where less than 5% of their daily PA occurs (600–800 steps for boys and 500–650 steps for girls; Brusseau et al., 2011). Indeed, Donnelly et al. (2009) notes that for children to receive academic lessons, students are expected to sit silently for much of the day.

Given these circumstances, increased PA for students during school hours is imperative to ensure children's health. In particular, school-based PA can prevent childhood obesity because it targets early stages of pattern development, encourages lifelong participation in PA (Webster, Monsma, & Erwin, 2010), and can account for 20–40% of children's total activity (Craig, Cameron, Russell, & Bealieu, 2001). However, U.S. schools currently lack sufficient protocols for the implementation of PA during the school day.

Implementation of Physical Activity in Schools

Given that most children attend school, educational settings are the ideal location for reaching the majority of U.S. children and providing them with PA opportunities (Wechsler, McKenna, Lee, & Dietz, 2004). Schools are particularly important as sites for PA considering that public school children spend 6.7 hours per day in the school setting (U.S. Department of Education, 2002). In fact, the majority of students in the United States attend school for 6–7 hours per day (Snyder & Dillow, 2012). For this reason,

researchers have called on schools to play a greater role in promoting PA for children and youth (Pate et al., 2006; Sallis et al., 2012).

In light of the significant amount of time that children spend in school and the recommendation that children receive 60 minutes of daily PA (Centers for Disease Control and Prevention, 2010), efforts to implement PA into the classroom setting are logical. Many different factors affect students' exact PA levels during the course of the school day. For example, according to McKenzie, Marshall, Sallis, and Conway (2000), middle school students' PA levels can vary with the different levels of instructional lesson context such as direct, experiential, independent learning, indirect, and interactive style teaching. Researchers also found that school classroom environmental characteristics including area type, size, and overall layout of the classroom environment also influence students' PA levels (Sallis et al., 2001). One component that researchers have found to increase students' PA levels is classroom PA breaks. In fact, classroom PA breaks of about 10 minutes can provide students with approximately 782 steps (Mahar et al., 2006) to 1,000 or more steps per day (Erwin, Abel, Beighle, & Beets, 2011). Moreover, Erwin, Abel, Beighle, and Noland (2012) suggested that utilizing an organized recess environment, such as providing playground markings, painted lines, or mural-type paintings (Erwin et al., 2013), serve as an incentives to increase PA (Ridgers, Stratton, Fairclough, & Twisk, 2007). Verstraete, Cardon, De Clercq, and De Bourdeaudhuij (2006), furthermore, addressed the physical equipment available to students, stating that schools must provide age-appropriate equipment such as playground balls, hoops, and Frisbees at recess to help assist in promoting PA.

In addition to its benefits to students' health, research has also demonstrated PA's positive impact on students' academic behavior, such as on-task behavior (Mahar et al., 2006). Given the multiple advantages of PA, support from school administrators and teachers is needed in order to incorporate PA opportunities for students throughout the school day. Traditionally, school-based interventions such as those mentioned above—including classroom PA breaks and PA time during recess—have been the ideal context for promoting PA (Pate et al., 2006).

With the widely acknowledged prevalence of physical inactivity among children and youth in recent years, more advocates and organizations have stressed the significance of increasing PA in and around the school setting (Centers for Disease Control and Prevention, 2010; Strong et al., 2005). To assist in integrating PA into schools, the NASPE (2008) released a comprehensive school PA program designed to provide students with a variety of school-based PA opportunities and to coordinate the program's components so that students would be fully equipped for a lifetime of PA. The program was also designed to educate students on the importance of PA for their health and well-being. Schools can adapt the PA program to best fit the needs of their own students and institution. Some PA opportunities included within the comprehensive school PA program and school day are (a) PE, (b) recess, and (c) PA during instruction, such as in the classroom (Erwin et al., 2013; Erwin, Fedewa, Beighle, & Ahn, 2012, National Association for Sport and Physical Education, 2008). The creators of this PA program indicate that by participating in schoolwide PA programs, students would become more aware of the importance of meeting PA guidelines daily.

Physical Education

Physical education remains the foundation of PA. Through PE, educators can deliver formalized instruction on health-related fitness content, movement principles and refinement, social responsibility, and other outcomes so that students can value PA for its many benefits (NASPE, 2008). Morgan, Bealieu, and Pangrazai (2007) discovered that using varied teaching approaches and practices in 30-minute PE lessons can contribute as much as 18% of children and youth's daily PA. Although recommendations from the U.S. Department of Health and Human Services (2014) state that students should be engaged in MVPA for at least 50% of a PE lesson, Fairclough and Stratton (2006) found that students were only active for approximately 34% of PE class. Due to the fact that students are not receiving the allotted recommended percentage of activity in PE, the participation of more PA throughout the remainder of the school day, including the classroom, is expected.

Research has shown that students are more active on PE days, with a 20–34% increase in overall daily step counts over non-PE days (Reznik, Wylie-Rosett, Kim, & Ozuah, 2012). This demonstrates the potential carryover from in-school to out-of-school environments. These findings support the concept that although PE may not offer students the entire 60 minutes of recommended daily PA, PE does meaningfully increase students' levels of daily PA in a short period of time.

Despite its proven benefits to children, daily PE is only provided throughout the entire school year in “3.8% of elementary schools, 7.9% of middle schools, and 2.1% of high schools” (Centers for Disease Control and Prevention, 2006, p. 1). Furthermore, only “13.7% of elementary schools, 15.2% of middle schools, and 3% of high schools

provide PE at least three days per week or its equivalent for the entire school year” (Centers for Disease Control and Prevention, 2006, p. 1). With such limited PE offerings, further research on the effects of classroom-based PA and its outcomes is warranted.

The key to incorporating additional PA throughout the school day may lie in the role of certified physical educators. Certified physical educators not only teach PE classes, but also serve as PA leaders and advocates in their schools both within and beyond the regular school day (NASPE, 2008). Moreover, a study by Sallis, Prochaska, Taylor, Hill, and Geraci (1999) showed that students who received PE instruction from a trained PE specialist demonstrated improved reading test scores over students whose PE instructor was not specially trained, which suggests the importance of staffing schools with certified physical educators. A study by Ericsson (2008) demonstrates the importance of frequent, PE instruction for motor skills and PA. During the study, PE was increased to three lessons a week, while extracurricular activities were met for twice during the school week for the intervention group. This insured that the participants had 5 school days of PA. The controlled group only had PE twice a week. Results revealed that academically math and language arts test scores improved when PA and motor skills training were utilized daily rather than participating in PA and motor skills only twice a week.

Physical Activity Breaks

Considering that students spend the most of their waking hours in the classroom (Brusseu et al., 2011), integrating movement into core curricula is an approach for improving children’s daily PA (Wechsler et al., 2004). Activity breaks are designed to provide an opportunity to eliminate long bouts of sitting in the classroom. Goals of PA

breaks are to (a) take a pause from academic rigor and reset attention on learning and (b) teach content through movement (Erwin et al., 2013). Planned PA breaks can be conducted within the teaching space and can often be connected to academic content in order to augment student learning. Examples of PA breaks in the classroom are the Take 10! and Energizer programs. These programs are planned 10-minute intervals designed to link grade-appropriate, core components to PA (Stewart, et al., 2004; Mahar et al., 2006). After incorporating the Energizer program, academic behavior in students, such as the ability to stay on-task longer improved by 20 percent for students considered less on-task, while there was an improvement of 8 percent for overall on-task behavior (Mahar et al., 2006).

Physical activity interventions in the classroom have resulted in significant increases in student PA (Erwin, Abel, Beighle, & Beets, 2009; Liu et al., 2007). Incorporating just one PA break in the classroom has achieved improvements of 5–10% toward meeting children’s daily PA recommendations (Erwin, Abel, et al., 2012; Erwin et al., 2009; Mahar et al., 2006; Stewart, Dennison, Kohl, & Doyle, 2004; President’s Council on Physical Fitness and Sports, 2003). Considering the benefits of movement integration activities on students’ PA levels and on-task behavior, it is noted that training teachers in the effective leadership of promoting PA in the classroom may promote positive changes over time. For instance, Mahar (2011) utilized training teachers on how to incorporate energizers in the classroom while Tsai, Boonpleng, McElmurry, Park, and McCreary (2009) educated teachers on how the Take10! program can assist with the promotion of PA in the classroom. While training teachers in such activities was not the primary purpose of each study, the authors from both studies recognized the importance

of having trained teachers in order to implement PA in the classrooms effectively.

Leading such physical activities will broaden the strategies available to help students with different learning styles in the classroom (Kolb, 1984).

One of these PA strategies is the concept of energizers. Energizers are physical activities designed specifically to complement academic lessons in the classroom (Action for Healthy Kids, 2013). These short, 10-minute activities are designed to be simple; they integrate learning materials designed for the grade, require no equipment to participate, and very little teacher planning (Mahar et al., 2006). According to Mahar et al. (2006), energizers should be used two to three times per day, when possible. Such energizers, or brain breaks, can range from yoga in the classroom to a wealth of warm-up activities, (i.e. running in place, jumping jacks, knee raises). To help get students excited about PA breaks, teachers can allow students to choose the daily activity in which they would like to participate.

Recess is another opportunity for students to accumulate PA within the elementary school day (Beighle, Morgan, Le Masurier, & Pangrazai, 2006; Mota et al., 2005). Providing at least one period of daily recess could enhance students' physical, social, and academic development (NASPE, 2006). Research suggests that students spend 20–50% of recess time being physically active (Beighle et al., 2006; Erwin, Abel, et al., 2012; Mota et al., 2005; Ridgers & Stratton, 2005). According to Mota et al. (2005) and Ridgers and Stratton (2005), daily recess can lead to 31–38% of students' school-day PA, which will increase their overall daily PA. Erwin et al. (2013) stated that during a 15-minute recess period, children accumulate 17–44% of their school-day PA, on average. Moreover, students also achieve 20% more PA on days with outdoor recess than on days

without recess (Reznik et al., 2012). A study of sixth-grade participants determined that students received 15–16% of recommended daily PA during outdoor recess and 8–9% of recommended daily PA during a scheduled, indoor, no free-time play recess (Tudor-Locke, Lee, Morgan, Beighle, & Pangrazai, 2006).

Students occasionally need unstructured breaks from learning and demanding cognitive tasks throughout the day. Providing breaks can improve students' focus when instruction begins again (Boice-Mallach, 2010, October). Unstructured breaks, such as allowing students to take a 5-minute walk, seem to facilitate both learning and social competence (Fairclough & Stratton, 2006; Pellegrini & Bohn, 2005). Although daily unstructured PA breaks such as recess are needed, structured PA breaks such as energizers are also optimal for allowing students to expend energy in order to refocus in the classroom (Ahamed et al., 2007).

The NASPE (2008) has made three recess recommendations: First, recess should be provided daily in all elementary schools for at least 20 minutes. Contrary to this recommendation, only nine states require daily recess at the elementary school level (NASPE, 2006). Specifically, only 58.9% of districts require and 32.4% recommend that elementary schools provide students with regularly scheduled recess (Lee, Nihiser, Fulton, Borgogna, & Zavacky, 2013). Second, recess should be unstructured free play. According to Action for Healthy Kids (2013), high levels of interactivity experiences facilitate growth of intellect and cognition. Allowing recess to be unstructured also allows the child to make a personal choice. According to Sibley and Etnier (2003), students have that choice whether they would like to participate in creative, physical, sedentary, or social options. Third, recess should be supervised. In support of this point,

Erwin et al. (2012) stated that recess supervisors are encouraged to incorporate both free play and lightly structured recess options. Active supervision and promotion of specific games have been shown to increase students' PA because children are more active in the presence of recess supervisors (Connolly & McKenzie, 2005). While recess should be supervised for 15–20 minutes, the NASPE (2008) also stated that recess should not replace PE, but should instead assist in the effort to increase children's PA in the school setting.

Cognitive Benefits of Physical Activity

An evolving body of research suggests that PA, aerobic fitness, and body weight (Castelli, Hillman, Buck, & Erwin, 2007; Kamijo et al., 2011; Sallis et al., 2012) influence cognitive performance in school-aged children (Strong et al., 2005). A few benefits of incorporating PA into the school day include increased frequency of total PA; positive learning outcomes (Erwin, Fedewa, Beighle, et al., 2012); and improved academic performance, such as increased on-task behavior (Mahar et al., 2006), comprehension skills (Della Valle et al., 2001; Fredericks, Kokot, & Krog, 2006; Uhrich & Swalm, 2007), and attention levels (Pellegrini & Bohn, 2005). Specifically, cognitive improvements in spatial mathematics and reading skills (Fredericks, Kokot, & Krog, 2006), word recognition (Della Valle et al., 2001), and reading comprehension skills (Uhrich & Swalm, 2007) have been noted after incorporating PA into the classroom. Donnelly et al. (2009) and Kamijo et al. (2011) have suggested that there may be threshold effects by which cognitive performance is improved when children are regularly engaged in PA.

Moreover, several studies have demonstrated a significant relationship between students' activity levels and concentration levels (Pellegrini & Bohn, 2005; Pellegrini & Davis, 1993). Research by Pellegrini and Davis (1993) indicated that students' concentration levels decrease after they have been sitting for long periods of time. Continuing this research two decades later, Pellegrini and Bohn (2005) found that short instructional periods followed by brief PA breaks could lead to higher attention levels in students. The Centers for Disease Control and Prevention (2010) confirmed that increased levels of PA could positively influence students' concentration levels, on-task behavior, and classroom behavior. According to Brush (1997), students learn and stay on task more when both teachers and students are actively engaged in academic tasks. This information suggests that students can be physically active at higher intensity levels and maintain a higher percentage of on-task behavior when teachers provide PA breaks.

Some academic behavior studies, such as Jarrett et al., (1998), Pellegrini and Bohn (2005), and Pellegrini and Davis (1993) focus effects recess have on the cognitive performance of students. Pellegrini and Bohn (2005) stated that when children return to class after participating in recess breaks, children appear to be more attentive and are ready to work than before the breaks. In a study from Pellegrini et al., (1995), before and after recess and children's attention to classroom tasks were coded. It was hypothesized that the children's attention to the post-recess seatwork task should be positively related to their levels of PA and social interaction at recess. Pellegrini et al. stated that recess provides children with the opportunity to engage in motivating forms of social interaction and PA. Three experiments from Pellegrini (1995) on recess and classroom behavior were studied. The first two experiments, children were observed in outdoor recess, while

the third experiment the children were observed during indoor recess. The results indicated that children were more attentive after than before recess. Pellegrini et al. (1995) also studied on-task behavior and attention but focused on differences between genders. After recess, students were read a book with a gender-specific character. Results from the Pellegrini et al. study show that when the book character was not of the same gender as the student, attention levels decreased. The differences between the present study and the Pellegrini et al. (1995) and Pellegrini et al., (1993) studies are that the present study only examined the on-task behaviors of the students before and after recess. No control variables (i.e. reading a gender specific book, required math or science class directly following recess) were conducted. The present study examined the relationship between elementary children's time engaged in PA and the percentage of time students that were labeled as on task.

Given the continuing emphasis that the educational system has placed on standardized testing, incorporating PA interventions can be challenging, especially if the PA interventions do not boost academic content (Bartholomew & Jowers, 2011; Webster, Russ, Vazou, & Erwin, 2015). With the push for academic achievement becoming more explicit, administrators may be hesitant to encourage teachers to incorporate PA into the classroom. Considering this emphasis, it is also unlikely that schools will lighten academic standards to allow teachers to promote PA during the school day (Langille & Rodgers, 2010). This may be because of a fear of losing time for teaching academic content or due to worries about behavior management issues.

However, research by Rispoli et al. (2011) found that management tasks faced by teachers, such as presenting subject material, assessing student learning, and managing

student conduct depend on the kind of activity taking place in the classroom. An expert panel from the Divisions of Nutrition and Physical Activity and Adolescent and School Health (U.S. Department of Health and Human Services, 2009) was established to study the influence of PA on many health and behavioral outcomes in youth, aged 6–18 years. Through evaluating and analyzing articles, the panel determined that additional PA in the classroom does not negatively affect academic achievement (U.S. Department of Health and Human Services, 2009). The panel also suggested that increased PA has a positive association with academic performance, physical fitness, concentration, memory, and classroom behavior (Strong et al., 2005). The Centers for Disease Control and Prevention (2010) confirmed the report that participating in PA in the classroom does not negatively affect academic achievement. Moreover, a review by Singh, Uijdewilligen, Twisk, and van Mechelen (2012) concluded that participation in PA is positively related to students' on-task behavior. Considering this research, teachers who cite a lack of time and the prioritization of academic subjects as barriers to promoting PA in schools may be more inclined to use techniques like movement integration that incorporate PA into the classroom as part of curriculum instruction to further foment students' on-task behavior.

Understanding the cognitive benefits of incorporating PA into the school day is important for teachers and administrators because it provides a solid rationale for using PA as a teaching strategy. As mentioned previously, research suggests that PA may generate improved academic performance (Catering & Polak, 1999; Coe, Pivarnik, Womack, Reeves, & Malina, 2006; Erwin et al., 2011; Mahar et al., 2006). Academic performance specifically refers to indicators of cognitive skills and attitudes (mood (Lowden, Powney, Davidson, & James, 2001) attention, memory), academic behaviors

(on-task behavior [Maeda & Randall, 2003; Mahar et al., 2006], comprehension, and attendance), and academic achievement, such as grades and test scores (Centers for Disease Control and Prevention, 2010). Improvements in standardized mathematics and English test scores (Ahamed et al., 2007), on-task engagement (Mahar et al., 2006), and cognitive skills such as attention levels (Kamijo et al., 2011) are all evidence of further academic gains from incorporating PA into the classroom.

To enhance learning outcomes, different types of PA interventions can be incorporated into the school day. Young children can learn cognitive skills through play and movement (Leppo, Davis, & Crim, 2000). Budde, Voelcker-Rehage, Pietrassyk-Kendziorra, Ribeiro, and Tidow (2008) explained that enhancing lessons with bilateral coordinative movements (i.e., catching and throwing) was more effective for students than teaching a normal PE lesson. The incorporation of bilateral coordination can indicate that both sides of the brain are communicating effectively and sharing information, ensuring strong cognitive function academically.

Short instructional periods followed by brief PA breaks can improve attention levels, as observed by Pellegrini and Bohn (2005). This is particularly important for elementary students who undergo extended periods of academic instruction and experience restlessness and become fidgety as a result, which reduces cognitive function (Pellegrini & Davis, 1993). The higher attention levels that result from PA breaks thus facilitate work on cognitive tasks. Hillman et al. (2009) and Hoffman and Rachal (1983) observed that student success increased when students were more actively engaged in learning during class time. *Active engagement* is when students participate in active movement integrations designed to teach academic content simultaneously (Pellegrini &

Bohn, 2005). Mahar (2011) noted the positive effects PA breaks have on the amount of time students were actively engaged in learning, specifically to attention-to-task. The results from this study illustrate significantly improved on-task behaviors after participating in PA in the classroom. Mahar et al. (2006) has also shown that integrating movement in the classroom can reduce off-task behavior, although the study from Mahar addressed behavior after an activity break.

Other educators have suggested that movement stimulates cognitive development in young children (Leppo et al., 2000; Pica, 1997; Sibley & Etnier, 2003). Sibley and Etnier (2003) indicated that movement and PA provide learning experiences that aid in and are necessary for proper cognitive development. Brain and cognitive health has been positively associated with physically active lifestyles during childhood (Chaddock et al., 2012). A pilot study by Erwin, Fedewa, and Ahn (2012) suggested that incorporating 20 minutes of PA breaks does not appear to diminish student performance outcomes such as cognition or learning behaviors. Research by Maeda and Randall (2003) indicates that a PA break of just five minutes can actually lead to improved learning behaviors in the classroom. Maeda and Randall also noted that when daily PA breaks were not included, instruction time decreased due to the need to focus on classroom management.

Student Behavior

Student behaviors are measured in several basic ways, including through attendance, teacher perspective of student behaviors, grades, office discipline referrals, personal-social responsibility, and whether students are in their seat and on task (Boice-Mallach, 2010, October). Systematic screenings (Walker & Severson, 1992), performance screenings (Gresham & Elliott, 2008), and progress monitoring tools such as

check-in systems (Christenson, Thurlow, Sinclair, Lehr, & Kaibel, 2008) are other examples of how student behavior is measured within the classroom.

Researchers have used a two-category system consisting of the labels *on task* and *off task* (Fedewa & Erwin, 2011; Maeda & Randall, 2003; Mahar et al., 2006). According to Mummery, Spence, and Hudec (2000), students are assumed to be on task for any given period in which they are not engaged in inappropriate behavior. Off-task behavior can be destructive to the learning process not only by taking time away from academic work, but also by creating stress for teachers and classmates (Burke, Oats, Ringle, Fichtner, & DelGaudio, 2011). Direct observation in the classroom is the often one strategy for measuring on-task behavior (Mahar, 2011). However, on-task behavior is typically difficult to measure accurately because of the cost, the burden placed on the observers, and the time required for recording the observation (Mahar, 2011). According to Roberts (2001), classroom teachers observe on- and off-task behavior by measuring; whether students are in their seats; and whether students are on task during lessons and activities are the optimal factors for assessment.

Mahar et al. (2006) suggested that classroom PA breaks such as 10-minute energizers help increase students' PA during the school day. Mahar et al.'s 12-week study tracked the PA and on-task behavior of 243 students. Mahar et al. used pedometers to track students' PA and utilized direct observational procedures to measure on-task behaviors. Mahar et al. considered on-task behavior to mean following the rules. They observed six students in each observation period. Their results suggest that incorporating PA breaks (specifically, energizers) into the classroom did, in fact, help increase students' on-task behaviors by 8% after the PA break. The same study also suggested that

incorporating a structured classroom-based PA—such as having students perform jumping jacks to the correct multiplication answer—during the school day might promote higher levels of daily PA. However, due to the additional emphasis that administrators have placed on teachers to improve students’ academic achievement, any PA breaks that may have been included in a daily classroom routine are beginning to disappear (Mahar et al., 2006).

Despite the research that has focused on PA in the classroom setting, no study exists that evaluates the levels of PA that students receive solely in the instructional setting without the integration of PA breaks and programs. Therefore, the purpose of this study was to examine the relationship between elementary children’s time engaged in PA, intensity levels of PA, and the percentage of time students that were labeled as on task in the classroom.

Chapter Three: Methodology

The study utilized a cross sectional design to explore the relationship between students' PA and on-task behaviors in the classroom. The University's Institutional Review Board (IRB) approved all procedures for this study. Parental and teacher consent as well as child assent were collected from all participants. Both parental and teacher consent forms along with the child assent forms are located in Appendix 1, 2, and 3, respectively.

Guiding Question

Is PA correlated to the percentage of time students are classified on task in the classroom?

Research Questions

1. Are students' daily PA steps and intensity levels correlated with overall on-task behaviors?
2. Are students' pre-recess PA steps and intensity levels correlated with on-task behaviors?
3. Are students' post-recess PA steps and intensity levels correlated with on-task behaviors?
4. Is there a difference between students' on-task behavior before versus after recess?

Participants

One hundred and fifty-seven first- and second-grade students were recruited from two elementary schools in the central Kentucky area to participate in the present study. No demographic information was recorded for individual students or teacher participants.

Demographic variables such as obesity and SES could affect the outcome of classroom on-task behavior, however, the study's primary objective was to assess generally the relationship between students' on-task behavior and classroom PA. Each participating school had 3 first-grade classrooms and 3 second-grade classrooms, yielding a total of 12 participating classrooms in the study. Both principals and school district review boards consented to the research prior to the investigation.

School A was located 12 miles west of Lexington, Kentucky, with a total of 519 students enrolled in kindergarten through fifth grade. The enrollment of School A consisted of 51.7% male and 48.3% female students with an ethnic demographic of 83.6% Caucasian, 10.2% Hispanic, 2.0% African American, 1.4% Asian American, and 2.9% other. School A had 43 first-grade participants (23 females, 20 males) and 38 second-grade participants (18 females, 20 males). A total of 81 subjects (41 female, 40 male) participated from School A.

School B was located 16 miles south of Lexington, Kentucky, with a total enrollment of 567 students in first through fifth grade. The enrollment of School B consisted of 52.5% male and 47.5% female students with an ethnic demographic of 88.0% Caucasian, 6.1% Asian American, 3.0% African American, 0.7% American Indian, 0.7% Hispanic, and 1.5% other. School B had 39 first-grade participants (21 females, 18 males) and 37 second-grade participants (17 females, 20 males). A total of 76 subjects (38 females, 38 males) participated from School B.

Instruments

Accelerometers. The participants' daily PA steps and intensity levels were measured by accelerometers (ActiGraph GT1M, ActiGraph, LLC; dimensions: 5.3 x 5.0

x 2.0 cm). The ActiGraph GT1M accelerometer was selected because it is considered valid and reliable in measuring PA outcomes in children and youth (Gerda, Seiler, & Mäder, 2013). Students wore the accelerometers on the right side of their midaxillary line for two school days. Accelerometer data from each day were used to measure the students' steps taken in the classroom. The test-retest reliability (Day 1 vs. Day 2 school day step counts) yielded an intraclass correlation coefficient of 0.554.

Placement of the accelerometers for the current study was standardized at the hip for accuracy in measurement (Nilsson, Ekelund, Yngve, & Sjöström, 2002). According to Nilsson, Ekelund, Yngve, and Sjöström (2002), children's PA levels may go undetected when recording long epochs if children are participating in few high levels of PA. For this reason, the GT1M was used to record PA counts in 5-second epochs from the beginning of the school day (8:00 a.m.) until the end of the school day (3:00 p.m.).

The accelerometer's output is based on a linear relationship between acceleration and PA energy expenditure, thereby deriving cut points into activity intensity levels which can be classified as *sedentary*, *light*, *moderate*, *vigorous*, and *very vigorous* (Freedson, Melanson, & Sirard, 2005). For the purpose of this study, only cut points in the sedentary, light, and moderate levels were analyzed because children rarely register vigorous or very vigorous PA intensity levels. All labeled cut points were then categorized into percentages of sedentary, light, and moderate PA intensity levels in the classroom before recess, after recess, and overall throughout the instructional school day. Using the Freedson et al. (2005) algorithm, the accelerometer collected vertical (*y*-axis) and horizontal (*x*-axis) activity throughout each school day. In this study, PA intensity level cut points established by Freedson, Melanson, and Sirard (2005) were applied to the

data: (a) 0–149 counts per minute = sedentary (Actigraph, Inc., Pensacola, FL.), (b) 150–499 counts per minute = light, and (c) ≥ 500 counts per minute were considered moderate classroom PA. Recently, researchers have demonstrated acceptable validity and reliability of the ActiGraph GT1M using these cut points with children (Troost, Loprinzi, Moore, & Pfeiffer, 2011) and adolescents (Gerda et al., 2013). Data were downloaded to ActiLife 6 software (Actigraph, Pensacola, FL). Periods greater than 1 hour with 0 values were considered nonwear time and were removed (Sebire, Jago, Fox, Edwards, & Thompason, 2013).

Momentary Time Sampling. Records of students' on- and off-task behavior were tracked using the established MTS by Rapp, Colby-Dirksen, Michalski, Carroll, and Lindenberg (2008), an Excel document that facilitates categorization of students into one of six classifications every 30 seconds. Students' on-task behaviors in the classroom were coded into previously established behavioral categories by the researcher (Fedewa & Erwin, 2011). The coded behaviors were: (a) listening to the teacher, (b) doing individual work, (c) participating in group work, (d) not doing school-related work when out of seat, (e) talking to peers not about school-related work, and (f) gazing off or distracted. These six coded behaviors were then categorized into *on-task* or *off-task* behaviors. The first three coded behaviors—(1) listening to the teacher, (2) doing individual work, and (3) participating in group work—were categorized as *on-task* behavior. The last three behaviors—(4) not doing school-related work when out of seat, (5) talking to peers not about school-related work, and (6) gazing off or distracted—were categorized as *off-task* behaviors. Mahar et al. (2006) noted that students could be out of their seats during class and yet still be considered on task. Thus, in this study, students could be out of their seats

and could be considered either *on task* or *off task* depending on what they were doing while out of their seats. A built-in stopwatch was utilized to record the classroom on-task behaviors, every 30-seconds, of each participating student. By recording the students' classroom on-task behaviors through MTS every 30-seconds, Rapp et al., (2008) states that minimizing the number of false positives have been identified.

Procedures

Before collecting data, the researcher visited each class and demonstrated the proper wearing of the accelerometers. Students were given hands-on experience in wearing the accelerometers, and the researcher verified that students had securely attached the accelerometers to their waistlines. Data collection spanned a period of 12 weeks with two days in each classroom in the fall of 2014. Weeks 1–6 were conducted at School A, yielding 12 observation days. Weeks 7–12 were conducted at School B for 12 observation days, ensuring 24 total observation days. Students were instructed to wear the accelerometers for the entire school day; continue with normal, everyday activities; and remove the accelerometers at the end of the school day, only when prompted by the teacher.

Students wore an accelerometer twice in a 1-week period, ensuring that there were two days of PA information collected per participant. During the PA data collection period, the researcher assigned an accelerometer to each student. Each accelerometer was numbered with the student's ID number. At the beginning of the school day, the researcher handed each classroom teacher a box that contained the accelerometers. When students arrived in the classroom, the participating students collected their designated accelerometers and placed the devices around their waists.

Accelerometer data were collected and summarized in 5-second epochs within a 7-hour school day. Students attached their accelerometers as soon as they entered the classroom (8:00 a.m.) and wore the accelerometers for the remainder of the school day (until approximately 3:00 p.m.). Accelerometers were initialized and programmed to collect data from 8:00 a.m. through 3:00 p.m. in 5-second epochs.

Of the 157 students who wore accelerometers, 72 total students (36 females and 36 males from each school) were randomly selected for observation of their on-task behaviors in the classroom. Proportional stratified random sampling was used in Excel 2007 to ensure equal male and female participants for the MTS observation periods. The researcher visited each classroom twice in a one-week period, ensuring there were 24 total (two for each classroom) observational days. Information from the MTS was recorded for the six randomly selected students from each classroom. The researcher also recorded information regarding classroom schedules (e.g., start and stop times for the varying content and transitional breaks). On-task behavior collection began at the beginning of the school day (8:00 a.m.) and concluded at the end of the day (3:00 p.m.) and did not include recess, lunchtime, or transitional breaks.

Six students were sampled from each of the 12 classrooms (72 total students) and were observed for on-task behavior. All 72 students were observed twice per week, ensuring 144 data points. Students' on-task behaviors in the instructional setting were observed every 30 seconds. A built-in stopwatch on the researcher's computer directed the researcher when to scan and report the students' behaviors. To perform MTS, the observer coded students' behavior as on or off task every 30 seconds. Coding included three on-task behaviors (listening to teacher, doing individual work, doing group work)

and three off-task behaviors (out of seat, talking to peers, gazing off/distracted). Table 1 is an example of the on- and off-task behavior that was observed and recorded for each randomly selected student.

Table 1

Example of MTS for Student On- and Off-Task Behaviors in 30-Second Intervals

<i>Time</i>	<i>Subject</i>	<i>On task</i>	<i>On task</i>	<i>On task</i>	<i>Off task</i>	<i>Off task</i>	<i>Off task</i>
		Listening to teacher	Individual work	Group work	Out of seat	Talk to peers	Gazing off
8:06:00	Math			X			
8:06:30	Math			X			
8:07:00	Math		X				
8:07:30	Math				X		

At the end of the school day, the researcher collected the accelerometers from the classroom teachers. All data from the accelerometers and MTS were recorded using anonymous confidential identification numbers.

Data Analysis

Data were entered and results were generated using SPSS (Version 20.0). Daily in-class PA steps and the time spent in various PA intensity levels (sedentary, light, and moderate) served as independent variables in this study. The dependent variable was the students' percentage of on-task behavior in the classroom. Steps taken, percentages of PA intensity levels, and percentages of on-task behavior accrued during classroom activities were summed and averaged. Prior to analyzing any statistics, any steps taken and PA levels recorded on the accelerometer during lunch, recess, and transitional breaks were

removed from the data set in order to obtain a more consistent analysis of the students' PA and on-task behaviors in the classroom settings. These procedures for PA data collection have previously been used with elementary students and are supported by other studies (Craig, Tudor-Locke, Cragg, & Cameron, 2010; Gerda et al., 2013). Total steps, PA intensity levels, and on-task behaviors were averaged and treated separately for each of the two days for all 72 participants. This resulted in a total of 144 observational points for 72 subjects.

Fisher's coefficient of skewness was conducted on all independent and dependent variables to assess the normality of the variables' distributions. A skewness greater than the absolute value of 1.96 suggests significant skewness, and such variables are recommended for further statistical examination (Cramer & Howitt, 2004). The present study had three variables greater than the absolute value of 1.96: overall PA steps taken (2.17), pre-recess steps (3.15), and post-recess on-task behavior (2.60). Although the other variables were less than the absolute value of 1.96, further statistical analyses such as multiple linear regressions and a paired *t* test were performed on all variables because the skewness of all variables was within acceptable values.

Three stepwise multiple linear regression analyses were used to assess the relationship between students' PA steps and intensity levels versus students' relative on-task behavior at three time points (throughout the classroom instructional day [non-recess], classroom instructional time before recess only, and classroom instructional time after recess only). The sample's classroom in-school PA levels were quantified as the average number of steps taken and the percentage of time spent in sedentary and light PA levels. Paired sample *t* tests were used to compare pre-recess and post-recess step counts

and relative sedentary and light PA levels during classroom instructional time to the percentages of on-task behavior in the classroom setting. The level of significance was set at $p < .05$ for all statistical analyses.

Chapter Four: Results

Overall descriptive statistics, along with standard deviations and the minimum to maximum range in classroom PA steps, percentage of time spent in sedentary and light classroom PA levels, and percentage of on-task behaviors in the classroom for students in first and second grade, are displayed in Table 2. On average, the students were involved in the classroom 4.6 hours per day. During the classroom school day, students averaged 1,406.6 steps, were considered sedentary 94.9% of the time in class, and were in light classroom PA intensity levels 4.3% of the time. Furthermore, on average, the students were on task 94.2% (SD = 4.4%) of the time that they spent in the classroom setting.

Table 2

Mean Step Counts, Time Spent in PA Intensity Classifications, and Percentage of On-Task Behavior During the (Non-recess) School Day

Descriptives	Overall steps	Overall % sedentary PA	Overall % light PA	Overall % on task
Mean	1,406.6	94.9	4.3	94.2
SD	804.9	3.6	3.2	4.4

Note. $N = 72$.

Overall Physical Activity and On-Task Behavior

Multiple linear regression analyses were conducted to assess the relationship between students' overall classroom PA and overall percentage of on-task behavior in the classroom setting. The predictors were the students' overall steps taken throughout the instructional setting in the classroom and the percentage of time spent in various PA intensity levels during the same instructional classroom time. There was a significant inverse correlation ($R = -.36$, $R^2 = .13$, $SEE = .041$) between overall percentage of on-task behavior in the classroom and overall classroom PA steps (Table 3). This suggests that the more steps that students took in the classroom, the less on task the students were.

The students' overall classroom PA steps were significantly related to the students' on-task behavior in the classroom, $F(1, 142) = 21.39, p = .001 R = -.36, R^2 = .13$.

The linear regression analysis conducted indicates there was no correlation between the students' classroom on-task behavior and the sedentary ($p = .094$) and light ($p = .271$) PA intensity levels taken in the classroom. Table 3 presents the indices to indicate the relative strength of the individual predictors. Step counts accounted for 13% of the variance in students' overall classroom on-task behavior, suggesting that 87% of the variance of the students' classroom on-task behavior and classroom PA steps are accounted for by other variables not addressed in this study.

Table 3

Correlation Coefficients of the Predictors With Overall Percentage of Classroom On-Task Behavior

Predictors	Correlation between each predictor and on-task behavior (R value)
Classroom PA (steps)	-.36*
Classroom sedentary PA	.14
Classroom light PA	-.09

Note. $N = 72$ students. $*p < .05$. PA: Physical Activity.

Pre-recess Physical Activity and On-Task Behavior

A second multiple linear regression analysis was conducted to assess the relationship between students' pre-recess classroom PA and pre-recess percentage of on-task behavior in the classroom. The predictors were students' pre-recess classroom step counts and pre-recess percentage of time in various classroom PA intensity levels. There was a significant inverse correlation ($R = -.18, R^2 = .03, SEE = .063$) between pre-recess percentage of on-task behavior in the classroom and pre-recess classroom PA steps

(Table 4). This suggests that the more steps that students took in the classroom, the less on task the students were. The students' pre-recess classroom PA steps were significantly related to the students' on-task behavior in the classroom, $F(1, 142) = 4.96, p = .03, R = -.18, R^2 = .03$.

There was no relationship between students' pre-recess percentage of on-task behavior in the classroom and pre-recess percentage of sedentary ($p = .270$) and light ($p = .340$) classroom PA intensity levels. Table 4 presents the indices to indicate the relative strength of the individual predictors. Pre-recess classroom step counts accounted for only 3% of the variance in students' pre-recess on-task behavior in the classroom. This suggests that 97% of the variance of the students' pre-recess classroom on-task behavior and pre-recess classroom PA steps are accounted for by other variables not addressed in this study.

Table 4

Correlation Coefficients of the Predictors With Pre-recess Percentage of Classroom On-Task Behavior

Predictors	Correlation between each predictor and on-task behavior (R value)
Pre-recess PA (steps)	-.18*
Pre-recess sedentary (%)	.09
Pre-recess light (%)	-.80

Note. $N = 72$. * $p < .05$. PA: Physical Activity.

Post-recess Physical Activity and On-Task Behavior

A third multiple linear regression analysis was conducted to assess the relationship between students' post-recess classroom PA and post-recess percentage of on-task behavior in the classroom. The predictors were the students' post-recess classroom steps taken throughout the day and post-recess percentage of time in various

classroom PA intensity levels. There was a significant inverse correlation ($R = -.20$, $R^2 = .04$, $SEE = .051$) between post-recess percentage of on-task behavior in the classroom and post-recess classroom PA steps (Table 5). This suggests that the more steps that students took in the classroom after recess, the less on task the students were. The students' post-recess classroom PA steps were significantly related to the students' on-task behavior in the classroom, $F(1, 142) = 6.10$, $p = .02$, $R = .20$, $R^2 = .04$.

No relationship between students' post-recess percentage of on-task behavior in the classroom and post-recess percentage of sedentary ($p = .270$) and light ($p = .340$) classroom PA intensity levels were found. Table 5 presents the relative strength of the individual predictors to the post-recess on-task behavior. Post-recess classroom step counts accounted for only 4% of the variance in students' post-recess on-task behavior in the classroom. This suggests that 96% of the variance of the students' post-recess classroom on-task behavior and post-recess classroom PA steps are accounted for by other variables not addressed in this study.

Table 5

Correlation Coefficients of the Predictors With Post-recess Percentage of Classroom On-Task Behavior

Predictors	Correlation between each predictor and on-task behavior (R value)
Post-recess PA (steps)	-.20*
Post-recess sedentary (%)	.07
Post-recess light (%)	.10

Note. $N = 72$. * $p < .05$. PA: Physical Activity.

Pre-recess Outcomes vs. Post-recess Outcomes

The students' percentage of on-task behavior in the classroom was 92.9% before recess and 95.9% after recess ($t(143) = -4.32, p < .001$). Tables 6 and 7 identify the percentages of the students' classroom on-task behaviors. After participating in recess, students' on-task behaviors significantly improved by 3.0%. This suggests that students will likely be labeled as staying on task in the classroom longer after participating in recess.

Tables 6 and 7 represent no significant difference between classroom step counts before versus after recess ($t(143) = 1.92, p = 0.06$), despite students spending 44% less time in the classroom after recess (before recess: 176.3 minutes vs. after recess: 98.3 minutes). The students' percentage of sedentary classroom PA intensity levels before recess and after recess ($t(143) = 3.34, p = .001$) and light PA classroom intensity levels ($t(143) = -3.05, p = .003$) are also displayed in Tables 6 and 7. These results indicate that students' PA intensity levels in the classroom decreased in sedentary behaviors and increased in light intensity levels after participating in recess.

Table 6

Mean Pre-recess Classroom Step Counts, Time Spent in Classroom PA Intensity Classifications, and Percentage of Classroom On-Task Behavior During the (Non-recess) Classroom Instructional Day

Descriptives	Pre-recess steps	Pre-recess % sedentary PA	Pre-recess % light PA	Pre-recess % on task
Mean	747	95.5	3.9	92.9
SD	568	3.4	3.3	6.4

Note. $N = 72$.

Table 7

Mean Post-recess Classroom Step Counts, Time Spent in Classroom PA Intensity Classifications, and Percentage of Classroom On-Task Behavior During the (Non-recess) Classroom Instructional Day

Descriptives	Post-recess steps	Post-recess % sedentary PA	Post-recess % light PA	Post-recess % on task
Mean	655	94.0	5.0	95.9
<i>SD</i>	404	5.5	4.6	5.2

Note. $N = 72$.

Chapter Five: Discussion

The purpose of this study was to examine the relationship between student PA and the percentage of time that students were on task in the classroom. In addition, this study also examined whether students were on task for a greater percentage of time before recess or after recess. On average, students spent 4.6 hours in the classroom, with the remaining 2.1 hours of the school day spent in transitional breaks, lunch, and recess. The findings regarding on-task behavior and PA are discussed below.

On-Task Behavior

The primary findings from this study indicate that the volume of PA was inversely associated with on-task behavior. Although these findings seem to refute the literature, the results suggest that perhaps there is a ceiling effect of students' PA levels relative to their on-task behavior. The fact that the students in the present study had an extraordinary high on-task percentage in the classroom, this study suggests that once students reach a high level of on-task behavior, on-task behaviors have a greater chance to decrease. Other on-task behavior studies such as Mahar et al. (2006) and Jarrett (1998), observed students who exhibited lower overall on-task behaviors than the current study. Both the Mahar (2006) and the Jarrett (1998) studies suggest students' on-task behaviors increased after participating in PA. Furthermore, the high rate of on-task behavior (94%) in the current study may leave little reasonable margin for improvement.

While observing the participants in the present study, the researcher noted that their overall percentage of on-task behaviors was recorded at 94% as compared to the students from the Mahar et al. (2006) study, in which 71% of students were recorded as on task. The results from the current study suggest that the students were generally well

behaved. The present study revealed a 3% increase in on-task behavior after participating in recess, compared to Mahar et al. (2006), who found an 8% increase in on-task behavior and Jarrett et al. (1998) who found a 5% increase in on-task behavior. The present study likely had a lower increase in on-task behavior because the students were already better behaved overall.

The present study's finding of a weak correlation between overall step counts and overall on-task behaviors suggests that other variables not accounted for in this study—such as seasonality, teachers, home environment, peer behavior, electives, etc.—could play a role in students' on-task behaviors. The current study was conducted close to the winter break, so students' behaviors could reasonably have varied based on the time of year or the approaching holiday season. Teachers could also have influenced students' on-task behaviors, especially through classroom management. Classroom management not only provides opportunities for students to stay on task, but also aids the teacher in organization and effective teaching. Gettinger and Stoiber (1999) identified four components as important in effective teaching: (a) allocated time, (b) engaged time, (c) instructional time, and (d) academic productivity. Depending on the instructional strategy used most often, teaching style may influence the percentage of time that students are observed to be on task.

Timing of electives may also have affected this study's results. The majority of students in the current study participated in electives in the afternoon, whereas primary core classes were taught in the mornings. The timing of certain classes could affect the differences in students' on-task behaviors. Pellegrini and Davis (1993) studied students' on-task behaviors after a set of morning recess followed by a controlled set classroom

(math or science). Pellegrini and Davis' results indicated that students' on-task behaviors decreased the longer students sat sedentarily in the classroom. The results from Pellegrini and Davis report similar findings of PA to the present study, but differences to the students' behavior. When analyzing students' behaviors after recess, Pellegrini and Davis found no significant differences between the various PA intensity levels and students' concentration behaviors. The present study suggest that after participating in PA, there was a significant increase in students' on-task behaviors, suggesting that PA levels may positively influence on-task behaviors.

Mahar et al. (2006) examined activity breaks (e.g., energizers) in relation to elementary students' on-task behaviors. Mahar et al. studied on-task behavior by conducting an intervention using these energizers. Comparing the pre-intervention on-task behavior to post-intervention results showed that students' participation resulted in significantly increased on-task behavior. Findings from the current study parallel the intervention period from the Mahar et al. results, which show a significant difference (3%) between pre- and post-recess on-task behaviors for the current study. This may be due to participation in specials in the afternoon or the limited classroom time following recess.

Jarrett et al. (1998) analyzed the differences in children's on-task behavior based on the timing of having recess or not having recess. In a pre-recess observation period, Jarrett et al. found similar behaviors between days that included and days that excluded recess. However, students' on-task behaviors during a post-recess observation period significantly improved by 5% on days when students did participate in recess compared to days when recess was not an option (Jarrett et al., 1998).

Results from the current study indicate similar findings to that of Pellegrini and Davis (1993) and Jarrett et al. (1998) of little to no difference between students' on-task behaviors before and after recess. The present results, along with those from Pellegrini and Davis (1993), Jarrett et al. (1998), and Mahar et al. (2006), suggest that the anticipation of PA has minimal effect on on-task behavior. However, with students' already high percentage of on-task behavior in the present study (94%), there may not be enough data to determine whether recess should or should not be offered to increase on-task behavior. This study does support the conclusions of Pellegrini and Davis, Jarrett et al., and Mahar et al. that participating in recess does not negatively impact students' on-task behaviors in the classroom. Given these findings, schools should continue to offer recess because of the individualized cognitive, physical, and social benefits offered.

Physical Activity

Overall, participants were fairly inactive during classroom time. Students in the present study wore an Actigraph GT1M accelerometer for a total of 2 school days. Although Tudor-Locke et al. (2011) suggest wearing an accelerometer for 4 days during waking hours, there has not been a definitive answer for how many days students should wear an accelerometer during school to provide acceptable levels of reliability. The scales from 2 items had a Cronbach's alpha of 0.55 level of internal consistency, suggesting that perhaps students should wear the accelerometer for additional days to enhance the reliability of the measure.

In a 4.6-hour stretch of classroom time (excluding 2.1 hours of transitions, lunch, and recess), students took an average of 1,406.6 steps. In the classroom setting, students were also engaged in sedentary activity 94.8% of the time and were considered in light

activity 4.3% of the time. The daily national average of steps taken is 11,000 for girls and 13,000 for boys (President's Council on Physical Fitness and Sports, 2003). Although Craig et al. (2001) stated that PA in the school can account for 20–40% of children's total activity, Brusseau et al. (2011) suggested that 5% of students' daily PA (500–650 steps for girls and 600–800 steps for boys) occurs in the classroom. When analyzing data from the present study, the researcher found the daily average of steps taken (1,406.6) to be above average (500–800 steps). One potential reason for this is greater interactive learning opportunities with students' peers and teacher built into the curriculum. Physical activity steps in the classroom were higher than initially expected. During the study, students' numbers of steps corresponded well to the expectations of the learning activities. The findings for PA intensity levels were expected; students are known to be more sedentary during instruction time.

Participants recorded light and moderate PA intensity levels 4.5% of the time before recess. After recess participants recorded light and moderate PA intensity levels 6% of the time. Participants recorded 747 steps before recess and 655 steps after recess. Although students took fewer steps after recess ($p = .057$), students' light activity levels increased by 1% and the students' sedentary activity levels decreased by 1%. Results from the present study suggest that although students do not take more steps in the classroom setting after recess, students do participate in more frequent light PA intensity behaviors. One reason for this finding could be that students are still shifting their mindsets from unstructured activities during recess to more structured activities or lessons in the classroom after recess.

Another possible explanation for why the students engaged in more light PA intensity levels after recess could be that electives (i.e. music class) are taking place in the afternoon which tend to provide more active learning opportunities. School A participated in two electives per day in the afternoon. Both were offered on a condensed 25-minute schedule. Each elective met at least twice per week. School B participated in one elective per day for approximately 50 minutes in the afternoon. Electives for School B were on a six-day rotation, resulting in one week where the students might not participate in a particular elective. During their time participating in electives, students from both schools appeared to be more actively involved in learning. For example, the students rotated around in music class as they learned to play various instruments. In art class, students moved from table to table, gathering new tools such as crayons, paper, and markers. The researcher observed anecdotally that students did not have this autonomy to move around during regular classroom instruction.

When examining the differences in PA by school, the researcher noted that students from School A appeared to be more active than students from School B. School A incorporated PA breaks during the mornings, which fell within the pre-recess data collection time period. All the teachers from School A expressed their belief that students needed a “brain break” from academic rigor, so each teacher used the free Internet educational resource [gonoodle.com](http://www.gonoodle.com) as part of their daily brain breaks. However, step counts and PA intensity levels accumulated during the PA brain breaks were not included in the present study because PA brain breaks were considered transitional periods. Without adding in the steps and PA intensity levels taken during PA brain breaks, School A averaged 992 steps before recess. School B averaged 502 steps before recess, thus

indicating that School A was more physically active in the classroom setting before recess, even when excluding the PA brain breaks.

The PA intensity levels of the students from School A and School B also differed before recess. Students from School A were considered at 1% less sedentary PA intensity levels and 2% higher light PA intensity levels when compared to School B. Even after recess, School A participated in more PA. School A students averaged 822 steps after recess, whereas students from School B averaged 488 steps after recess. The students' PA intensity levels also differed after recess. Students from School A were labeled as participating in 6% light PA intensity levels and 92% sedentary PA intensity levels, while School B students were considered as participating in 4% light PA intensity levels and 96% sedentary PA intensity levels.

These results suggest that the more opportunities students have to be physically active, the more active students may choose to be. Even without adding in the PA differences of students participating in PA brain breaks at School A and those not participating in PA brain breaks at School B, the students at School A were more actively involved in learning. This indicates that students can participate in PA during classroom learning.

What makes the current study unique is that the present study measured students' PA in the classroom from the beginning of the school day (before recess) throughout the remainder of the school day (after recess). The data from the current study on students participating in movement integration during learning, along with information from Mahar et al. (2006) stating that students can gain extra steps in school by adding in PA breaks, suggest that promoting movement integration in the classroom and providing PA

breaks for children is beneficial. Mahar et al. (2006) examined the differences in students' PA and on-task behaviors after implementing a scheduled PA break. The difference between Mahar et al. (2006) and the present study is that the current study adds to research that students can also achieve PA in the classroom by participating not just in planned PA breaks, but in active lessons as well.

Conclusions

Because schools face the NCLB mandate to improve test scores, administrators and teachers are under pressure to provide more academic instruction time (Lee, 2006); thus, PA opportunities often decline. Due to the fact that children are not meeting the recommended 60 minutes of daily PA, Telford et al. (2012) suggested that the education process itself presents opportunities for PA integration. The present study showed that, when PA is implemented in classroom settings where strong on-task behavior exists, other variables must also be taken into consideration. Although these variables were not the subject of this study, the weak negative correlations between PA steps, PA intensity, and on-task behavior demonstrate that other variables such as teachers and teaching styles, home environment expectations, and peer behavior could play a larger role in maintaining student on-task behavior than is currently known and should be considered for future studies.

Limitations

Although they were instructed not to, the teachers and students may have altered their behavior because they were being observed, resulting in reactivity. Observing the classes for longer than two days each could address this limitation. Additionally, the time of the school year during which the study was conducted may have affected the time

spent in various lesson contexts. For example, math testing was scheduled to take place in the near future at School A, and make-up math testing was occurring during observations of School B. This may have resulted in more time spent on math content in the classroom. Another time-of-year limitation that may have influenced the on-task behavior and PA of students at School B was the impending winter break, which may have resulted in these students being considered less on task than those from School A. However, with the teachers maintaining a structured daily schedule, the students at both schools were still considered 94% on task throughout the day.

Another limitation of the current study could be the instructional habits of the teachers. The teachers were instructed to teach their classes as they normally would, but teachers at the two schools varied their teaching approaches. At School A, multiple teachers taught core classes as well as special classes. However, at School B the identified primary teacher taught every core class, and a different teacher only taught electives. Although there were few differences in on-task behavior and PA between the two schools, the data supplied here represent the students at each school. Further research with more diverse schools would provide more balanced data about the varying practices at different schools.

A third limitation of the study was the overall behavior of the participants. The students were considered on task 94% overall. Thus, there were fewer possibilities to increase on-task behavior and minimal variability of showing significant positive outcomes of overall percentages of on-task behavior. Perhaps if the study were conducted at schools where the percentage of on-task behavior is considered much lower, then the

study would provide more variability and significant results would provide more explicit data on whether PA breaks are a potentially worthwhile intervention.

A final limitation of the present study was that it did not use a control school in order to determine differences in percentages of on-task behavior with PA steps and PA intensity levels. Utilizing a control school would help to determine whether percentages of on-task behavior differ before and after recess and analyze the impact that recess has on students' percentage of overall on-task behavior in the classroom.

Future Research

The Centers for Disease Control and Prevention (2010) reported an increase in on-task behavior when PA was utilized as a teaching strategy in the classroom. For future studies, researchers could investigate the incorporation of established, structured brain breaks or movement integration throughout the school day. This could help analyze the specific PA in the classroom as well as the students' time spent on task following movement breaks. Further research could also examine other academic indicators during the school day, rather than primarily assessing on-task behavior. Such indicators could include academic progress on tests, motivation in school, and other academic or behavioral measures.

Another future study could conduct research similar to the present study in schools where students are considered less well behaved in the classroom. With students in the current study considered as 94% on task overall, there was hardly room for improvement in their on-task behavior. However, if a similar study were conducted at lower performing schools, perhaps results in on-task behavior and PA would differ.

A related future study might compare controlled classrooms to non-controlled classrooms in order to note any differences in on-task behavior and PA levels. Using similar protocols to the Jarrett et al. (1998) study, this future study could include recess as the intervention. Measuring any differences in on-task behaviors between the classrooms throughout the day would still be the dependent variable. A controlled recess regimen would distinguish this future study from the Jarrett et al. (1998) study. For example, one non-controlled classroom would provide unstructured, free-time-play recess opportunities. A controlled classroom would not provide any recess throughout the day, while a second controlled classroom would provide a teacher-led, structured recess for a set duration of time. Such research would provide insights into the influence of frequent PA breaks throughout the day on students' on-task behaviors in the classroom.

Studying the effect of equipment interventions on student on-task behaviors is an additional area for future research. Studies incorporating the use of different equipment such as stability balls or standing desks to observe students' on-task behaviors and PA are warranted. In a study from Fedewa and Erwin (2011), results indicated that elementary students labeled with ADHD appeared to be more on-task in the classroom when sitting on stability balls as compared to sitting on chairs. Researching various pieces of physical equipment in the classroom could provide useful insights on their impact on student outcomes.

Finally, various educational strategies (e.g., distinct teaching styles, units of instruction, content areas) should be subjected to further research because differences in these areas may affect student learning and academic achievement. Teacher behaviors—such as the establishment of classroom rules, modeling, positive discipline, praise, and a

behavior management system—can greatly affect student behavior and academic success (Boice-Mallach, 2010, October). Teacher perceptions of the benefits of integrating PA during the school day (Erwin, Fedewa, Beighle, & Ahn, 2012) may influence their acceptance of or resistance to this practice. Mahar et al. (2006) demonstrates that classroom teachers can incorporate PA breaks in the classroom, which assist in increasing students' PA levels. It is known that teachers can feasibly integrate PA and PA breaks into their lessons; motivating teachers to do this on a consistent basis is the challenge.

Appendix A

Parent Consent to Participate in a Research Study University of Kentucky

“The relationship between physical activity and on-task behavior in early primary school students”

WHY ARE YOU BEING INVITED TO TAKE PART IN THIS RESEARCH?

As the legal guardian of a student enrolled at the participating school, you are being asked to allow your child to participate in a research study by the University of Kentucky. Only first and second grade classrooms will participate. If you agree to allow your child to take part in this study, he/she will be one of about 200 children to do so.

WHO IS DOING THE STUDY?

The people in charge of this study are Michelle Thornton, a PhD student from the University of Kentucky in the Department of Kinesiology and Health Promotion, and Dr. Heather Erwin, also from the Department of Kinesiology and Health Promotion. You may contact Michelle Thornton at 859.359.6741 or at michellethornton@uky.edu, or Dr. Heather Erwin at 859.257.5311 or herwi2@email.uky.edu if you have any questions or concerns.

WHAT IS THE PURPOSE OF THIS STUDY?

The purpose of this study is to understand approximately how long students continue to stay on-task during classroom lessons before and after any physical activity (recess, physical education, physical activity breaks, etc.), and whether the style of teaching has any influence on the students' on-task behaviors.

ARE THERE REASONS WHY YOU SHOULD NOT TAKE PART IN THIS STUDY?

There are no exclusionary criteria for this study. First and second grade classrooms from Southside Elementary and Wilmore Elementary are being asked to participate in the study.

WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST?

The research procedures will be conducted within your child's regular education classroom. The length of the study will last for two days in your child's classroom during the months of October through December.

WHAT WILL YOU BE ASKED TO DO?

As a parent of a participating student, your child will be observed throughout the school day to determine the students' on-task behaviors, along with the teaching styles of the teacher. Students will be randomly selected to be observed throughout the school day. To measure physical activity, your child will also wear an accelerometer. The accelerometer is a small device worn on the waist that records how physically active your child is, by

tracking the movement created by your child, throughout the day. The accelerometer will not take away from your child's learning, as the accelerometer will be put on by your child at the beginning of the school day and will not take it off until the end of the school day.

For two days a week, researchers from the University of Kentucky will come to observe the students using a momentary time sampling method. During these observations, your child may be randomly selected to be observed by the researcher during class. The researcher will be observing behaviors such as doing work, listening to the teacher, out of seat, or talking with peers.

* By signing this form, you agree for your child to be observed throughout the school day to examine the relationship between physical activity and students' on-task behavior in school. The data collected will be confidential and not linked to your child's name, but instead an identifying number.

*By signing this form, you consent that your child will wear an accelerometer on the waistband to measure your child's daily physical activity.

*By signing this form, you consent that researchers from the University of Kentucky will observe and collect momentary time sampling on your child, in regards to their on-task behavior. This process will not interfere with any classroom teaching.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS?

The activities your child will be doing in his/her classroom, during this study, will have no more risks or possibility of harm than your child typically experiences in everyday classroom activities.

WILL YOU BENEFIT FROM TAKING PART IN THIS STUDY?

There is no guarantee that either you or your child will get any benefit from taking part in this study. Your willingness to allow your child to take part, however, may help society as a whole better understand the effects of physical activity and on student on-task behavior in the classroom.

DO YOU HAVE TO TAKE PART IN THE STUDY?

If you decide that you want your child to take part in the study, it should be because you really want your child to volunteer. Your child will not lose any benefits or rights he/she would normally have if your child chooses not to volunteer. Your child can stop at any time during the study and still keep the benefits and rights your child had before volunteering. If you decide not to want your child to take part in this study, your choice will have no effect on your child's academic status.

IF YOU DON'T WANT TO TAKE PART IN THE STUDY, ARE THERE OTHER CHOICES?

If you do not want your child to take part in the study, your child does not have to take part in the study.

WHAT WILL IT COST YOU TO PARTICIPATE?

There are no costs associated with taking part in the study.

WILL YOU RECEIVE ANY REWARDS FOR TAKING PART IN THIS STUDY?

You and your child will not receive any rewards or payment for taking part in the study.

WHO WILL SEE THE INFORMATION THAT YOU GIVE?

We will make every effort to keep private all research records that identify your child to the extent allowed by law. However, there are some circumstances in which we may have to show your child's information to other people. For example, the law may require us to show your child's information to a court. Also, we may be required to show information that identifies your child to people who need to know in order to be sure that we have done the research correctly; these would be people from such organizations as the University of Kentucky.

The information about your child will be combined with information from other children taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. Thus, your child will not be personally identified in these written materials. We may publish the results of this study; however, we will keep your child's name as well as each teacher's name and other identifying information private.

We will make every effort to prevent anyone who is not on the research team from knowing the data collected about your child. All data gathered from the observations will be attached to a code, and will only be linked to your child's name in a secure electronic database accessible by only the Principal Investigator and Co-Principal Investigator. When analyzing the data, only the data information will be showed that is linked to codes, not your child's name or other personal identifying information. This data will be securely stored electronically for a period of at least six years as is required by the Institutional Review Board.

CAN YOUR TAKING PART IN THE STUDY END EARLY?

If you decide to allow your child to take part in the study you still have the right to decide at any time that you no longer want your child to continue. Your child will not be treated differently if you or your child decides to stop taking part in the study.

The individuals conducting the study may need to withdraw your child from the study. This may occur if your child is not able to follow the directions they provide him or her, if they find that your child being in the study is more a risk than benefit to him or her, or if the investigator decides to stop the study early for a variety of scientific reasons.

WHAT ELSE DO YOU NEED TO KNOW?

There is a possibility that the data collected from your child may be shared with other investigators in the future. If that is the case the data will not contain information that can identify your child unless you give your consent or the UK Institutional Review Board (IRB) approves the research. The IRB is a committee that reviews ethical issues, according to federal, state and local regulations on research with human subjects, to make sure the study complies with these before approval of a research study is issued.

WHAT IF YOU HAVE QUESTIONS, SUGGESTIONS, CONCERNS, OR COMPLAINTS?

Before you decide whether to accept this invitation in allowing your child to take part in the study, please ask any questions that might come to mind now. Later, if you have questions, suggestions, concerns, or complaints about the study, you can contact the investigator, Michelle Thornton, at 859-351-6747. If you have any questions about your rights as a parent of a child involved in this research, contact the staff in the Office of Research Integrity at the University of Kentucky at 859-257-9428 or toll free at 1-866-400-9428. Please sign and return one of the two copies, while the other copy is for you to keep.

We greatly appreciate your and your child’s willingness to participate in this study.

Signature of parent/guardian agree to allow child to take part in the study *Date:* _____

Printed name of parent/guardian agree to allow child to take part in the study

Printed name of child who will take part in the study

Appendix B

Teacher Consent to Participate in a Research Study University of Kentucky

“The relationship between physical activity and on-task behavior in early primary school students”

WHY ARE YOU BEING INVITED TO TAKE PART IN THIS RESEARCH?

As the teacher at a participating school, you are being asked to participate in a research study by the University of Kentucky. A total of six, first grade and six, second grade classrooms from two different schools will participate. If you agree to take part in this study, you will be one of twelve teachers to do so.

WHO IS DOING THE STUDY?

The people in charge of this study are Michelle Thornton, a PhD student from the University of Kentucky in the Department of Kinesiology and Health Promotion, and Dr. Heather Erwin, also from the Department of Kinesiology and Health Promotion. You may contact Michelle Thornton at 859.359.6741 or at michellethornton@uky.edu, or Dr. Heather Erwin at 859.257.5311 or herwi2@email.uky.edu if you have any questions or concerns.

WHAT IS THE PURPOSE OF THIS STUDY?

The purpose of this study is to understand approximately how long students continue to stay on-task during classroom lessons before and after any physical activity (recess, physical education, physical activity breaks, etc.), and whether the style of teaching has any influence on the students' on-task behaviors.

ARE THERE REASONS WHY YOU SHOULD NOT TAKE PART IN THIS STUDY?

There are no exclusionary criteria for this study. First and second grade classrooms from Southside Elementary and Wilmore Elementary are being asked to participate in the study.

WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST?

The research procedures will be conducted within your regular education classroom. The length of the study will last for two days in your classroom during the months of October through December.

WHAT WILL YOU BE ASKED TO DO?

As a teacher of a participating classroom, your classroom will be observed throughout the school day to determine the students' on-task behaviors, along with the teaching styles of the teacher. Students will be randomly selected to be observed throughout the school day.

All of your participating students will wear an accelerometer, which is a small device that measures physical activity.

For two days a week, researchers from the University of Kentucky will come in to observe the students using a momentary time sampling method. During the observation, the researcher will observe six random students in 30-second intervals, documenting whether the student is on-task (doing work, listening to the teacher) or off-task (out of seat/stability ball, talking to peers when not instructed to do so, or in seat, but distracted).

* By signing this form, you agree for your classroom to be observed throughout the school day to determine the relationship between physical activity and students' on-task behavior in school. The data collected will be confidential and not linked to your students' name, but instead an identifying number will be created.

*By signing this form, you agree to help ensure your students place their designated accelerometer on their waist at the beginning of the school day and remove the accelerometer and place on the charger at the end of the school day.

*By signing this form, you consent that researchers from the University of Kentucky will come to school, twice a week to observe and collect momentary time sampling on your classroom and your teaching style. This process will not interfere with any classroom teaching. Observations completed by a graduate student, will be collected in 30-second bouts.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS?

To the best of our knowledge, the activities you and your students will be doing in your classroom will have no more harm than your student typically experiences in everyday classroom activities.

WILL YOU BENEFIT FROM TAKING PART IN THIS STUDY?

There is no guarantee that either you or your students will get any benefit from taking part in this study. Your willingness to take part, however, may help society as a whole better understand the effects of physical activity and students' on-task behavior in the classroom.

DO YOU HAVE TO TAKE PART IN THE STUDY?

If you decide that you want to take part in the study, it should be because you really want to volunteer. You will not lose any benefits or rights you would normally have if you choose not to volunteer. You can stop at any time during the study and still keep the benefits and rights you had before volunteering. If you decide not to take part in this study, your choice will have no effect on your students' academic status or your own job status.

IF YOU DON'T WANT TO TAKE PART IN THE STUDY, ARE THERE OTHER CHOICES?

If you do not want to take part in the study, your classroom does not have to take part in the study.

WHAT WILL IT COST YOU TO PARTICIPATE?

There are no costs associated with taking part in the study.

WILL YOU RECEIVE ANY REWARDS FOR TAKING PART IN THIS STUDY?

You will not receive any rewards or payment for taking part in the study.

WHO WILL SEE THE INFORMATION THAT YOU GIVE?

We will make every effort to keep private all research records that identify you to the extent allowed by law. However, there are some circumstances in which we may have to show your information to other people. For example, the law may require us to show your information to a court. Also, we may be required to show information that identifies you to people who need to know in order to be sure that we have done the research correctly; these would be people from such organizations as the University of Kentucky.

The information about you will be combined with information from other participants taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. Thus, you will not be personally identified in these written materials. We may publish the results of this study; however, we will keep your student's name as well as each teacher's name and other identifying information private.

We will make every effort to prevent anyone who is not on the research team from knowing the data collected about you. All data gathered from the observations will be attached to a code, and will only be linked to each name in a secure electronic database accessible by only the Principal Investigator and Co-Principal Investigator. When analyzing the data, only the data information will be showed that is linked to codes, not your name or other personal identifying information. This data will be securely stored electronically for a period of at least six years as is required by the Institutional Review Board.

CAN YOUR TAKING PART IN THE STUDY END EARLY?

If you decide to take part in the study you still have the right to decide at any time that you no longer want to continue. You will not be treated differently if you decide to stop taking part in the study.

The individuals conducting the study may need to withdraw you from the study. This may occur if you are not able to follow the directions they give you, if they find that your being in the study is more risk than benefit to you, or if the investigator decides to stop the study early for a variety of scientific reasons.

WHAT ELSE DO YOU NEED TO KNOW?

There is a possibility that the data collected from you and your classroom may be shared with other investigators in the future. If that is the case the data will not contain information that can identify you unless you give your consent or the UK Institutional Review Board (IRB) approves the research. The IRB is a committee that reviews ethical issues, according to federal, state and local regulations on research with human subjects, to make sure the study complies with these before approval of a research study is issued.

WHAT IF YOU HAVE QUESTIONS, SUGGESTIONS, CONCERNS, OR COMPLAINTS?

Before you decide whether to accept this invitation in taking part in the study, please ask any questions that might come to mind now. Later, if you have questions, suggestions, concerns, or complaints about the study, you can contact the investigator, Michelle Thornton, at 859-359-6741. If you have any questions about your rights as a participant involved in this research, contact the staff in the Office of Research Integrity at the University of Kentucky at 859-257-9428 or toll free at 1-866-400-9428. We will give you a signed copy of this consent form to take with you.

We greatly appreciate your willingness to participate in this study.

Signature of person agreeing to take part in the study

Date

Printed name of person agreeing to take part in the study

Name of (authorized) person obtaining informed consent

Date

Appendix C

Assent Form

“The relationship between physical activity and on-task behavior in early primary school students”

You are invited to be in a study being done by Michelle Thornton from the University of Kentucky. You are invited because you are in the first or second grade and attend the participating school.

This study is being done to help understand if physical activity can help students focus in class longer. If you decide to participate, this would mean a few things: 1.) one adult may watch you during class to view your behavior and 2) you will wear an accelerometer, which is a small tool that will measure your physical activity.

By saying you want to be in the study, you are agreeing to do so because you would like to, not because someone else is telling you. Your family will know that you are in the study. If something makes you feel bad while you are in the study, please tell Michelle Thornton, or tell your teacher. If you decide at any time you do not want to finish the study, you may stop whenever you want.

You can ask Michelle Thornton questions any time about anything in this study. Saying “yes” to be in this study means that you want to be in the study. If you do not want to be in the study, do not say “yes”. Being in the study is up to you, and no one will be mad if you do not want to be in it or even if you change your mind later.

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Publications:

Thornton, M., Erwin, H., Moore, E., & Johnson, C. (2015). Effects of stability balls on student activity and teacher perceptions. SHAPE presentation.

Thornton, M., Babkes Stellino, M., Moore, E., Johnson, C., and Erwin, H. (2015) Gender inequalities in elementary recess physical activity. SHAPE poster presentation.

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- Morgan, C.F., Thornton, M., & Murata, N. (2015). In-school physical activity in a sample of low income children. SHAPE poster presentation.
- Thornton, M., Moore, E., Johnson, C., Stellino, M., & Erwin, H. (2014). Relationship between recess physical activity levels and the built environment. AAHPERD poster presentation.
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- Beighle, A., Erwin, H., Moore, E., Johnson, C., & Thornton, M. (2014). Teaching fitness activities K-12. Southern District AHPERD presentation.
- Moore, E., Thornton, M., & Johnson, C. (2014). P.R.A.I.S.E. – Strategies to promote motivation in youth sports. Southern District AHPERD presentation.
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- Moore, E., Johnson, C., Thornton, M. (2013). Planning effective outdoor lessons for physical education. *Journal of Physical Education, Recreation, and Dance*. May/June 84:5, 11-13.
- Erwin, H., Beighle, A., Johnson, C., Moore, E., & Thornton, M. (2013). Impact of professional development on student activity during physical education. AAHPERD poster presentation.
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