# The Effect of an Evidence-Based Physical Education Curriculum and/or an After School Activity Program on Cardiovascular Endurance and Fundamental Motor Skill Proficiency in Grade Five

By

Carolyn M. Gross

A DISSERTATION

Submitted to

Plymouth State University

In partial fulfillment of

the requirements for the degree of

Doctor of Education

Defended July 7, 2016

AN ABSTRACT OF THE DISSERTATION OF Carolyn M. Gross for the degree of Doctor of Education in Learning, Leadership and Community presented on July 7, 2016.

Title: The Impact of an Evidence-Based Physical Education Curriculum and/or an After School Activity Program on Cardiovascular Endurance and Fundamental Motor Skill Proficiency in Grade Five

Abstract approved:

_____

Kathleen Norris, MFA, Ed.D., CASE

Dissertation Committee Chair

The purpose of this study was to determine the effect of an evidence-based physical education curriculum and/or an after school activity program on cardiovascular endurance performance and fundamental motor skill proficiency for grade five students. The sample included 95 participants (46 boys/49 girls) over a 12-week study, separated into a control group and three intervention groups. Levels of fitness were determined pre- and post study using the Fitnessgram protocol. Fundamental motor skill proficiency was determined with the Test of Gross Motor Development-2 standards. The data were analyzed with an independent t-test and the 2 x 2 two-factor ANOVA for repeated measures. According to the findings, children that participated in the after school program were better prepared than the control and evidence-based physical education group to meet the Fitnessgram Healthy Fitness Zone standards for the one-mile cardiovascular endurance assessment. Also, the children that were taught utilizing the evidence-

based physical education curriculum had a higher percentage of participants meeting Level 4 proficiency on 4 of the 6 fundamental motor skills than the children in the control group and after school activity group. An increase in time for physical activity before or after school and a change of curriculum, that has a focus on moderate-to-vigorous physical activity and fundamental motor skills, could be the combination physical education teachers are seeking to meet national and state standards within their programs.

*Keywords:* evidence-based physical education curriculum, cardiovascular endurance, fundamental motor skills

Dissertation of Carolyn M. Gross

Presented on July 7, 2016

APPROVED:

---

Kathleen Norris, MFA, Ed.D., CASE, Dissertation Committee Chair

---

Linda L. Carrier, Ed.D., Dissertation Committee

---

Paul S. Visich, Ph.D., MPH, Dissertation Committee

---

Gail Mears, Psy.D., Dean of the College of Education, Health and Human Services

I understand that my dissertation will become part of the permanent collection of Plymouth State University, Lamson Learning Commons. My signature below authorizes release of my dissertation to any reader upon request.

# ACKNOWLEDGEMENTS

I would like to express my gratitude to the grade five students that participated in this study. Each student was patient on assessment days and mindful of their best performance on cardiovascular and fundamental motor skill performances. Working so closely with this group has left a lasting impression of them that I will always have in my memories of teaching.

I must also acknowledge the After School Activity staff from BCES and UNE. They were patient with the students, and me, over the course of the study. I could not have asked for a better group of coaches to help with this project.

I would be remiss if I did not recognize my doctoral cohort, the Summer Campers. This group of people has always been a source of support and have held each other up through thick and thin. This group of people are truly wonderful and will be amazing in their future endeavors.

I want to thank my committee chair, Dr. Kathleen Norris, who has been my guide through this six year journey. Many important lessons have been conveyed and learned. Dr. Linda Carrier and Dr. Paul Visich have also given me new perspectives and life lessons. The doctoral program at Plymouth State University is a cut above the rest and was a great match for this journey.

I dedicate this work to my parents: Ralph and Lois Gross. They have always believed in me and have given unconditional support for every endeavor I have wanted to pursue in my life. Education has always been valued in my family, starting with my grandfather, Lester Gray. This doctoral journey was no exception and one that strengthened my resolve to always have goals and do what it takes to accomplish them.

## Table of Contents

# The Impact of an Evidence-Based Physical Education Curriculum and After School Physical Activity Program on Cardiovascular Endurance and Fundamental Motor Skill Proficiency in Grade Five

By

Carolyn Marie Gross

A DISSERTATION

Submitted to

Plymouth State University College of Graduate Studies

In partial fulfillment of
the requirements for candidacy for the degree of
Doctor of Education

July 7, 2016

# Chapter 1: Introduction to the Study

Physical activity is essential to overall health for all populations (American Heart Association [AHA], 2013a; MacNamera, Collins, Bailey, Toms, Ford, & Pearce, 2011; National Association of Sport and Physical Education [NASPE], 2013; Society of Health and Physical Educators [SHAPE], 2014). Physical activity interventions have been implemented in schools to address childhood obesity and cardiovascular fitness, in order to identify the variables that encourage children to be physically active on a daily basis. Unfortunately, the rate of obesity among children and adolescents has tripled over the past 30 years, with 17% of children reported as obese in 2010 (United States White House Task Force on Obesity, 2010). The tracking of data for obesity and the amount of physical activity led researchers to determine that these two factors complement one another and can be controlled during the childhood years (American Academy of Pediatrics, 2011; Texas Heart Institute, 2015).

Additionally, researchers had hypothesized that regular physical activity at a moderate-to-vigorous level could lead to the health-related benefit of improved cardiovascular fitness and an increased focus on moderate-to-vigorous physical activity during physical education classes. It was thought that increased physical activity as part of physical education class would naturally evolve into physical activity outside of the school day (AHA, 2013a; Centers for Disease Control and Disease Prevention [CDC], 2010; Daniels, Pratt, & Hayman, 2011; United States White House Task Force on Obesity, 2010). The overarching goal was to develop a habit of exercise that might translate to children achieving a recommended 60 minutes of daily exercise (Active Living Research, 2006; American Academy of Pediatrics, 2011; AHA, 2013a; CDC, 2010; NASPE, 2004; United States Department of Health and Human Services [USDHHS], 2008).

Nationally representative data indicates that 50% of youth are not meeting the recommended 60 minutes of exercise on a daily basis (Daniels et al., 2011).

Researchers suggest that a habit of exercise developed during childhood can have a positive impact as children progress into adulthood (AHA, 2013a; CDC, 2013; SHAPE, 2014; USDHHS, 2008). Acceptable levels of cardiovascular fitness are associated with a lesser risk of developing obesity, diabetes, high blood pressure, and other health problems (American Academy of Pediatrics, 2011; AHA, 2013a; The Cooper Institute, 2010). The risk factors listed above can be identified in children and traced from childhood into adult life (American Academy of Pediatrics, 2011). Therefore, the evidence is strong to support the benefits of increased MVPA for the overall health of children (American Academy of Pediatrics, 2011; AHA, 2013a; CDC, 2010; United States White House Task Force on Obesity, 2010).

In the effort to increase and improve the opportunity for physical activity, the role of the school is an important one. The environment of a school is a key component to encouraging and providing opportunities for children to be active (Institute of Medicine of the National Academies, 2013). Youth and children are in a school setting for many hours a day, thus making it logical that physical activity should be a priority for all schools during the school day (Institute of Medicine of the National Academies, 2013; McKenzie & Lounsbery, 2009). However, a number of schools do not have the ability and/or flexibility to change the amount of time afforded to the discipline of physical education.

While the function of schools in physical education is known, schools are constrained in terms of the amount of time they can devote to physical education. A physical education program that effectively matches the school environment can create conditions to assist students

in learning the importance of leading physically active lives, thus encouraging them to be more active on a regular basis (McKenzie & Lounsbery, 2009). The incorporation of preventive efforts, along with providing physical activity and physical education at the elementary level, can lead to a generation of children that are able to maintain low-risk cardiovascular health status into adulthood (Daniels et al., 2011). Also, students who understand that they can confidently perform fundamental motor skills (FMS) are more likely to include physical activity as part of a daily routine as children and into their adult lives (Abbott & Collins, 2004; Ericsson, 2011; Palmer & Bycura, 2014).

Elementary physical education has a strong tradition of being the foundation and vehicle for children to learn about physical activity and become physically active participants. Sound evidence exists stating that quality physical education programs, with appropriate instruction and assessment protocols, are effective for increasing students' physical activity (Institute of Medicine of the National Academies, 2013, NASPE, 2013; SHAPE, 2014). Physical education is an important instruction time as part of the elementary school experience that affords our youth the opportunity to practice fundamental motor skills, with specific feedback from a certified physical education specialist.

Physical education and physical activity are often conflated and the two are not one in the same. Physical activity is the movement of the body produced by skeletal muscles resulting in energy expenditure (AHA, 2013a). On the other hand, physical education is a content area in schools where children are able to learn fundamental motor skills, health-related fitness components (cardiovascular, muscle strength, muscle endurance, flexibility, and body composition), team sports, and life skill activities to enjoy for their life span (NASPE, 2004).

The level of ability and the degree to which a person is able to participate in physical activity are both dependent upon a solid physical education experience (SHAPE, 2014; Sports, Play, and Active Recreation for Kids [SPARK], 2014).

Though the importance of a complete physical education experience is clear, cardiovascular health risks remain an issue for children. Elementary schools have a fixed amount of time for physical education each week. Researchers in the field of physical education have clearly revealed that the rate of obesity is rising and a lack of physical activity at a moderate level, for the purpose of maintaining cardiovascular health, must be the culprit (Active Living Research, 2007; American Academy of Pediatrics, 2011; AHA, 2013a; CDC, 2010; Robert Wood Foundation, 2013). Subsequently, the researchers made the recommendation that the opportunities for vigorous exercise must be increased (Active Living Research, 2007; American Academy of Pediatrics, 2011; AHA, 2013a; Robert Wood Foundation, 2013). A growing amount of evidence suggests that other factors, including fundamental motor skill competency, are essential to promote and maintain participation in physical activity for children and youth (SHAPE, 2014).

Every school across the United States was strongly encouraged to dedicate a minimum of 50% of physical education time to moderate-to-vigorous physical activity (MVPA), for the purpose of improving cardiovascular health (Active Living Research, 2006; AHA, 2013a; CDC, 2010; NASPE, 2004; SHAPE, 2014; USDHHS, 2008). A rise in MVPA compromised the amount of instructional time in physical education classes previously devoted to the mastery of fundamental motor skills. The variable of FMS had to be reduced in order to effectively meet the 50% (+) guideline for moderate-to-vigorous physical activity (Cote, Baker, & Abernethy,

2007; MacNamera et al., 2011; Palmer & Bycura, 2014; Penney & Jess, 2004). However, the additional physical education time devoted to MVPA did not prove to be the solution, as childhood obesity continued to rise. It was clear that continued research was necessary to fill the gap in knowledge about physical activity/physical education in the school environment and the effects that the lack of physical activity was having on the health of our youth (Institute of Medicine of the National Academies, 2013).

Many physical education professionals, including Blankenship (2013) and Lund (2013), have begun to question if decreasing the amount of time devoted to FMS could be connected to the perceptions of competency and the self-confidence of children in their choice to be physically active on a regular basis. Children's ability to perform fundamental motor skills with confidence, and to demonstrate proficiency for those skills, must be reinforced and taught by a qualified individual trained in the field of physical education. A certified physical education teacher can institute and assist with the maintenance of positive health behaviors early in life for the achievement of cardiovascular health and fundamental motor skills (Daniels et al., 2011).

## Setting

The setting for this study was an elementary school located in a suburb of a large metropolitan area in York County, Maine. The school is part of a regional school unit that has a mixture of rural and suburban schools. The mission of the elementary school is stated in the school handbook (Regional School Unit Elementary Administrative Team, 2014): "The school community works collaboratively to provide diverse learning experiences for all students to reach their full potential."

This school had approximately 600 students, grades kindergarten through grade five.

Student composition, in terms of ethnicity, was predominantly Caucasian (98%). The percentage of students that were eligible for free and reduced lunch was 39% (personal communication, Food Services Director, 2015).

All grade levels are exposed to a variety of locomotor and fundamental motor skills each year as part of the district sports-based physical education curriculum, that was established in 2001 and updated in 2009. The skills include: hop, leap, jump (horizontal/vertical), run, gallop, slide, skip, strike (short-handled/long-handled implements), throw (overhand/underhand), catch, kick, roll, volley, and dribble (hand/foot/implement). Students are given the opportunity to practice a variety of the skills as part of regular participation in physical education class, however the students are not assessed on all of the skills as part of the reporting system. Students that require adapted physical education have a scheduled class each week, to practice a variety of fundamental motor skills according to their Individualized Education Plan (IEP). The physical education program at the school was taught by one, full-time physical education teacher.

Physical education was part of the required curriculum for all grades. The physical education teacher was responsible for teaching every grade level, in addition to all adapted physical education classes. The school had a number of self-contained classrooms with the following goals: to address low cognitive ability, the acquisition of life skills, and/or the management of behavior concerns. Students enrolled in the self-contained classrooms were mainstreamed into grade-appropriate physical education classes and attended physical education with the support of an educational technician or attended the adapted physical education class.

The district's physical education program did not have a formalized philosophy, however the curriculum was aligned with the Maine Parameters of Learning (Maine Department of

Education [MDOE], 2014), and selected portions of the Society of Health and Physical Educator's National Standards (SHAPE, 2014). The facilities at the school included a gymnasium, a fitness room, and two outside fields with playground equipment.

The district had been open and welcome to research opportunities in the content area of physical education and health education. Educational programs with a focus on the improvement of cardiovascular health, nutrition, and the reduction of obesity had been of particular interest. The University of New England, located in Biddeford, Maine, reached out to the district administration in the spring of 2013 in regard to the implementation of a research project and program with a focus on cardiovascular health. The Cardiovascular Health Intervention Program (CHIP) was integrated during the fall of 2013 and overlapped with this study.

## Statement of Problem

The Society of Health and Physical Educators (2014) recommends 150 minutes of physical education per week for grades kindergarten through grade 5. In addition, the Society of Health and Physical Educators (2014) promotes a goal of increasing the amount of physical activity as part of physical education classes in schools across the United States. The organization also defines what students are expected to know and do as a result of participation in a quality physical education program. The goal of physical education is outlined by SHAPE (2014) as the process to develop physically literate individuals in the areas of knowledge, skill, and confidence for a lifelong enjoyment of healthy physical activity.

According to the Maine Department of Education (2010), a majority of elementary schools in Maine (89.8%) had physical education for 36 minutes per week in 2009, an amount that falls considerably short in comparison to the NASPE/SHAPE recommended 150 minutes

(NASPE, 2013; SHAPE, 2014). The length of an elementary physical education class in the district for this study was approximate to the Maine average for elementary school students: 40 minutes of physical education, one time per week. The students were also afforded one daily 20-minute recess, contributing to the recommended 60 minutes of daily physical activity (American Academy of Pediatrics, 2011; AHA, 2013a; CDC, 2010; NASPE, 2004; USDHHS, 2013). However, the 20-minute recess was categorized as physical activity and could not be included toward meeting the 150 minutes of physical education recommended per week.

The amount of time allocated to elementary physical education in the school district was not adequate to meet the National Standards and Grade-Level Outcomes (SHAPE, 2014) in physical education, to reach a proficiency level for fundamental motor skills, and to achieve the Fitnessgram Healthy Fitness Zone expectations, all of which were partially included in the district curriculum assessment standards. Time devoted to physical education was not expected to change in the public schools of the district. Students were successful in meeting the expectations and standards for some of the assessments administered from kindergarten through grade five. However, given the limited time afforded to physical education, other students were not able to become proficient with skills and maintain the minimal performance levels to be active on a regular basis. MacNamera et al. (2011) found that children who lack the fundamental motor skills to participate in physical activity are less likely to engage in physical activity outside of school and into adulthood. An absence of physical ability and a decreased confidence to perform FMS could make it likely that children would not want to continue to exercise or participate in physical activity beyond their elementary school experience. Understanding that an increase in academic physical education time was unlikely to occur, an alternative solution

was needed to increase overall fitness and the improvement of fundamental motor skills.

Without being able to increase the time devoted to physical education, a change in the physical education curriculum was considered. McKenzie and Lounsbery (2009) have stated that moderate-to-vigorous physical activity could be increased as much as 18% by incorporating a curriculum change, with the frequency and duration of physical education classes remaining constant. The district, in their desire to remain on track with improving cardiovascular endurance and fundamental motor skills, considered the proposal for a change to an evidence-based physical education curriculum.

**Fitness Assessment, Standards, and Performance**

Moderate-to-vigorous physical activity levels are a priority for physical education teachers (AHA, 2013b; CDC, 2010; SHAPE, 2014). It is essential to provide students with the information necessary to make healthy choices, set goals and improve physical activity, be active away from school, and have the tools to practice motor skills with proficiency. All are vital to maintaining overall health. In fact, SHAPE (2014) highly recommends that fitness assessments be administered to all elementary students (grades K-5).

The Cooper Institute (2010), an organization dedicated to public health, has established criterion-referenced standards in association with good health for children and youth. The Fitnessgram criterion-referenced standards are utilized to determine Healthy Fitness Zone (HFZ) criteria for each of the health-related fitness components (muscle endurance, muscle strength, flexibility, cardiovascular endurance, and body composition). Described as a tool with the purpose of educating, reporting, and promoting fitness, the Fitnessgram is used to assess physical fitness and physical activity levels for children (The Cooper Institute, 2010). A variety of health-

related fitness tests are used as part of the Fitnessgram, for the purpose of determining overall fitness levels for students (The Cooper Institute, 2010). The program also recommends strategies for improvement (The Cooper Institute, 2010). The criteria levels, according to gender and age, have been researched, validated, and refined over years of study (The Cooper Institute, 2010). The Healthy Fitness Zones represent minimum levels of fitness for children and youth, to protect against diseases that could result from living a sedentary lifestyle (The Cooper Institute, 2010). A range is given to indicate an average HFZ, understanding that a score higher than the range would be rated as above average and a measurement under the minimum of this range is described as the Needs Improvement level. This tool has been recommended as one that works well with an evidence-based physical education curriculum, to assist participants with the improvement of physical fitness and understanding the value of a physically active lifestyle (Human Kinetics, 2014).

The National Standards & Grade Level Outcomes document (SHAPE, 2014) recommends multiple fitness assessments for grade 5. Fitness assessments are also a required part of the Maine Parameters of Learning (MDOE, 2011). Fitness assessment data was collected two times per year (fall/spring) at the elementary school as part of the grade 5 physical education curriculum. A high percentage of the grade 5 students at this elementary school were able to perform at or above the HFZ on muscular endurance activities (curl-ups/push-ups) between 2012 and 2014 (Appendix A). However, fifth grade cardiovascular endurance performance for the one-mile run remained of great concern during the same academic timeframe (Appendix A). The Society of Health and Physical Educators (2014) indicates that grade 5 students are expected to demonstrate the knowledge and skills to achieve and maintain a health-enhancing level of

physical activity and fitness (p. 34). The inability to achieve the HFZ on a cardiovascular fitness assessment prevents a student from meeting the fitness assessment standard at the national level and state level.

The one-mile run was the fitness assessment with the highest percentage of students performing at a Needs Improvement level (Appendix A). Therefore, a significant number of students (30%) were unable to meet the national standard addressing fitness, due to their cardiovascular fitness score. A change was necessary to increase the level of physical activity, to increase the percentage of students meeting the cardiovascular endurance HFZ as outlined in the Fitnessgram protocol (The Cooper Institute, 2010). The district recognized that a higher percentage of grade 5 students should be meeting this standard and made a conscious choice to implement an evidence-based physical education curriculum to address any HFZ deficits that may exist.

**A Change of Curriculum**

The Sports, Play and Active Recreation for Kids (SPARK) evidence-based physical education curriculum was approved by district administration to conduct the study. The administration approved the choice of the SPARK curriculum due to the following key components: 1) a highly active curriculum with unit and lesson objectives connected to the SHAPE Standards and the Common Core guidelines, and 2) lessons that build upon previously learned skills and activities that are age-appropriate (SHAPE, 2014; SPARK, 2014). In addition, the Sports, Play and Active Recreation for Kids research team reported an increase in physical activity with regular use of their lessons (SPARK, 2014).

**Curriculum Information.** Sports, Play and Active Recreation for Kids is a public health

organization dedicated to creating, implementing, and evaluating research-based programs that promote lifelong wellness (SPARK, 2014). The objectives of the SPARK evidence-based curriculum are parallel with three key standards of the district curriculum: 1) the development and maintenance of acceptable levels of health fitness, 2) the development of basic movement and object control skills, and 3) to experience success and be comfortable with activity in the present and the future (SPARK, 2014). The website for SPARK (2014) describes the grade 3-6 physical education curriculum as one that actively engages students, increases MVPA, and improves fundamental motor skills. The Sports, Play, and Active Recreation for Kids curriculum is also recognized as more cooperative than competitive, having a purposeful connection to the SHAPE National Standards and the Maine Parameters for Learning, in addition to strong links with the Common Core Standards (SPARK, 2014). The Colorado Connections for Healthy Schools (2005) endorsed the SPARK physical education curriculum as an effective educational tool, due to the repetition of movement concepts that are detailed in individual lessons and overall units that increase student learning and mastery of skills.

The Sports, Play and Active Recreation for Kids evidence-based curriculum and the school district sports-based curriculum share similarities and have distinct contrasts. The school district's curriculum was established in 2001 and updated in 2009, in an attempt to reflect a standards-based reporting system. The school and SPARK curricular programs consist of units that include object control skills, locomotor skills, and connections to sport. Also, the two curricular programs are aligned with the Maine Parameters for Learning (MDOE, 2011). However, while each curriculum includes objectives for developing and maintaining acceptable levels of physical fitness, the current district program is falling short of attaining acceptable

levels of physical fitness in the area of cardiovascular fitness.

The Sports, Play and Active Recreation for Kids curriculum blends fundamental motor skills and MVPA into every lesson. In turn, these two key components of physical education and physical activity are fused in a manner that students are able to maintain a healthy level of cardiovascular fitness and develop the necessary movement and object control skills for the present and the future (SPARK, 2014). In addition, follow-up support programs connected to the promotion of lifelong wellness are an integral part of the SPARK system (after school program guides, parent resources, nutrition programs, etc.) (SPARK, 2014).

Therefore, the Sports, Play and Active Recreation for Kids evidence-based physical education curriculum was a logical choice to use for the study. Every lesson from the SPARK curriculum is structured with clear objectives, a strong connection to the SHAPE National Standards and the Maine Parameters for Learning, and includes challenges for students who have reached a mastery level of proficiency. Participants could maintain the fitness levels and FMS they have developed by utilizing the SPARK curriculum (Colorado Connections for Healthy Schools, 2005; SPARK, 2014). Additionally, students who demonstrate deficiencies in physical fitness can begin to improve their performance. The students could also make progress toward, and have the potential to meet, an appropriate level of proficiency with fundamental motor skills. The curriculum outlined by SPARK, designed to increase MVPA and actively engage students in fundamental motor skills, could ultimately improve the overall health of children (SPARK, 2014).

**Implementation of the Cardiovascular Health Intervention Program**

The elementary administration team in the school district had clearly recognized that

changes were necessary for the health of our elementary students. Along with a transition to an evidence-based physical education curriculum, a focus on cardiovascular fitness also came to the forefront.

The Cardiovascular Health Intervention Program (CHIP), made available through the Clark Charitable Foundation as part of a research intervention with the University of New England, was initiated with grade 4 students at the elementary school in the fall of 2013. The Cardiovascular Health Intervention Program had three major purposes: 1) to assess children's cardiovascular disease factors (triglycerides, body mass index, cardiovascular endurance, etc.) at the start of grade 4 and create a profile for each child, 2) to provide an educational program with a focus on cardiovascular health, healthy food choices, and physical activity as part of grades 4 and 5, and 3) to re-assess the children's cardiovascular health profiles at the end of grade 5, to evaluate changes over the length of the research project/program (personal communication, P. Visich, 2013).

The Cardiovascular Health Intervention Program began one year before the data for this study was collected. The participants from this study were in grade 4 when the CHIP study began. Parents had the choice to enroll their child in the CHIP program at the start of grade 4, with 95% opting into the study. Data on cardiovascular risk factors were collected in the fall of 2013 and cardiovascular health education mini-lessons were taught in the classroom during the winter and spring of 2014. The cardiovascular health education lessons, with a focus on making healthy choices, were an opportunity for all grade 4 students that they would not have otherwise received in the classroom setting.

Despite the first year efforts to educate grade 4 students on the topics of cardiovascular

health and physical activity, the cardiovascular endurance fitness assessment scores continued to be of concern at the end of the 2013/2014 school year (Appendix A). A high percentage (64%) of students remained below the HFZ in terms of cardiovascular endurance after the first year of the CHIP intervention. The second year of the Cardiovascular Health Intervention Program research study overlapped the period when the data for this study was collected.

**After School Program.** The cardiovascular health lessons that were part of the CHIP program extended into the fall of 2014 and the winter of 2015. The participants transitioned from grade 4 to grade 5. In response to the cardiovascular data information from year one and in relationship to physical activity, the researcher team for the CHIP study initiated an after school activity option for grade 5 students. The after school program was conducted two days per week during the fall of 2014. The Sports, Play and Active Recreation for Kids After School program was implemented as the guide for the after school activity. The purpose of this after school program was to utilize and refine fundamental motor skills practiced as part of physical education class, in addition to increasing the amount of moderate-to-vigorous physical activity and the improvement of cardiovascular fitness. Activities for the after school program included cardiovascular endurance and pacing activities, along with movement games that incorporated various fundamental motor skills. Self-improvement was woven into all after school activities for increased engagement (Ennis, 2011). Five instructors were responsible for the after school activity, with two instructors for the Tuesday sessions and three instructors for the Thursday sessions.

All grade 5 students were invited to be part of the after school activity. The after school program was offered at no cost to the participants and bus transportation from school to home

was included. The after school activity started the first week of October in 2014 and concluded the third week in December 2014, a total of 10 weeks. Active participation in the program added 3 hours of physical activity for participants each week, with a focus on fundamental motor skills and cardiovascular endurance. On average, thirty-seven grade 5 students regularly attended the after school program sessions. In an effort to ensure that the SPARK after school resources were utilized to full capacity, two of the five instructors for the after school program had been trained to use the SPARK resources.

The extension of the SPARK curriculum was an opportunity for the participants to grow cognitively and physically (SPARK, 2014). The two SPARK resources, the curriculum guide and after school program, were meshed together to increase participation in the area of physical activity, to enhance the participants' mastery of physical education content, to improve cardiovascular fitness, and to create a climate of prolonged engagement in physical activity (Bevans, Fitzpatrick, Sanchez, & Forest, 2010).

## Purpose of Study

The purpose of this study was to evaluate the effectiveness of the Sports, Play and Active Recreation for Kids (SPARK) evidence-based, physical education curriculum and an after school activity program, for the improvement of: 1) cardiovascular endurance fitness assessment scores in grade 5, and 2) meeting proficiency standards on fundamental motor skill performance for grade 5 students. Cardiovascular and muscle endurance performance, and FMS scores of grade 5 students were analyzed.

The scores of the grade 5 students from this district were appropriate to analyze for a number of reasons. The National Standards for the Society of Health and Physical Educators and

the Maine Parameters of Learning state that multiple opportunities for assessment in elementary school are necessary (SHAPE, 2014; MDOE, 2014). Additionally, the grade 5 students participated in fitness assessments, along with selected FMS assessments, as part of grade 3 and grade 4. Therefore, the participants were accustomed to this type of assessment.

Specifically, three intervention groups and one control group were observed and the fitness assessment data and the FMS data were recorded. The control group followed the sports-based district curriculum as part of the 12-week time period. The intervention groups for the 12-week study were as follows: 1) a group that attended the after school activity and utilized the district curriculum (ASA), 2) a group that utilized an evidence-based physical education curriculum only (EBPE), and 3) a group that utilized an evidence-based physical education curriculum and attended the after school activity (EBASA).

**Research Questions**

1. Does an evidence-based physical education curriculum and/or an after school activity program improve cardiovascular fitness scores for grade 5 students to a statistical level of significance? (p-value of $\leq 0.05$)

2. Does an evidence-based physical education curriculum and/or an after school activity program improve fundamental motor skill performance for grade 5 students to a statistical level of significance? (p-value of $\leq 0.05$)

**Definitions of Key Terms**

cardiovascular (cardiorespiratory) endurance-the ability of the heart, blood vessels, blood and respiratory system to supply oxygen and fuel to the muscles continually over a period of time (Maine Department of Education [MDOE], 2010).

flexibility-the ability to move joints and use muscles to move the muscles through their full range of motion (MDOE, 2010).

fundamental motor skills-an essential element to physical education, including locomotor skills (jumping, running, galloping, sliding, etc), non-locomotor movements (bending, twisting, static balance, etc.), and object control skills (throwing, catching, striking, etc.) (SHAPE, 2014).

healthy fitness zone (HFZ)-criterion-referenced standards, established by the Cooper Institute, representing minimum levels of fitness that protect against the diseases resulting from sedentary living (The Cooper Institute, 2010).

moderate-to-vigorous physical activity (MVPA)-refers to the intensity at which physical activity is being performed. Requires a large effort and causes rapid breathing and a substantial increase in heart rate (World Health Organization, 2014).

muscle endurance/strength-the ability to use muscles to produce force continually over a period of time/the ability of the muscles to exert force against a resistance one time (MDOE, 2010).

National Association for Sport and Physical Education (NASPE)-part of the Society of Health and Physical Educators. Their mission is to enhance knowledge, improve professional practice, and increase support for high quality physical education, sport, and physical activity programs (NASPE, 2013).

obesity-excessive body fat, as measured by body mass index (AHA, 2013b).

physical activity-movement of the body produced by skeletal muscles resulting in energy expenditure (AHA, 2013b).

physical education-school classes in which children exercise and learn to play sports, or the area of study relating to such classes (NASPE, 2004).

physical fitness-a person's ability to perform physical activity that consists of five components: cardiovascular endurance, muscular endurance, muscular strength, flexibility and body composition (MDOE, 2010).

Society of Health and Physical Educators (SHAPE)-formerly the American Alliance for Health, Physical Education, Recreation and Dance. Produces a curriculum framework that serves teachers and informs outside constituencies about physical education (SHAPE, 2014).

Sports, Play, and Active Recreation for Kids (SPARK)-a research-based, public health organization dedicated to creating, implementing, and evaluating programs that promote lifelong wellness (SPARK, 2014).

## Conclusion

Physical education teachers are responsible for physical education and physical activity experiences in elementary schools. Their ultimate goal is to intensify students' interest in physical activity. The school district for this study, and the physical education teacher who was responsible for physical education instruction, had tried a number of methodologies and activities for children. In spite of these efforts, over 40% of students had performed below the established national and state standards in terms of cardiovascular endurance fitness evaluation. Fundamental motor skill proficiency was also inconsistent across grade levels.

A study addressing the effectiveness of an evidence-based physical education curriculum, to improve cardiovascular fitness performance and the ability to perform fundamental motor skills to proficiency, could shed light on elementary physical education programs faced with similar constrictions related to the factor of time. It was clear that the schools in this district and in the state of Maine were not able to alter the amount of time designated for elementary physical education. Physical education teachers were searching for an alternative method to assist with meeting the standards established by the Society of Health and Physical Educators (2014). The Sports, Play, and Active Recreation for Kids program is designed to promote a belief in self for children, the confidence to perform fundamental motor skills to the best of their ability, and to increase the amount of physical activity (SPARK, 2014). The results of this study are important to physical education professionals in regard to the effectiveness of utilizing an evidence-based physical education curriculum, like the program offered by Sports, Play and Active Recreation

for Kids. A change in curricular programming could support the development of children's fundamental motor skills and cardiovascular fitness.

## Chapter 2-A Review of Related Literature

Researchers in the field of physical fitness and physical activity, along with physical education specialists, are divided regarding the importance that physical activity and motor skill competency play in developing the habit of exercise among youth. In response to the increasing obesity epidemic that has occurred over the past 30 years, medical professionals and health organizations hypothesized that 50% or more of each physical education session should be dedicated to moderate-to-vigorous physical activity (MVPA) in order to develop a habit for physical exercise (AHA, 2013a; CDC, 2010; USDHHS, 2008). In response to this determination, physical education teachers adhered to the researchers' suggestions and adapted their lessons to accommodate increased physical activity at a moderate-to-vigorous level. The additional time devoted to MVPA did not translate to an increased amount of physical activity for children on a daily basis. Obesity rates remained at a level of 31.7% for children and adolescents (United States White House Task Force on Obesity, 2010). Blankenship (2013) and Lund (2013), believing motor competency is an important factor to the maintenance of physical activity, uphold their stance that a greater emphasis should be placed on fundamental motor skills and a method to monitor this physical growth must be developed in order for our young people to maintain a regular exercise routine and build confidence in their own physical ability.

Information regarding the SHAPE National Standards and Grade-Level Outcomes, the National Association of Sport and Physical Education's (NASPE) vision of physical education, the trend of increasing MVPA, evidence-based physical education, and the connection that motor competency has with increased physical activity, will all be reviewed and examined in this chapter. A large number of physical activity intervention studies have been completed with

elementary school-aged children in an attempt to discover the factors that must be present to assist our children in establishing a regular habit of exercise. Despite the fact that the rate of childhood obesity appears to have leveled in recent years, obesity rates are not declining in response to the emphasis on increased physical activity alone (United States White House Task Force on Obesity, 2010). Additional research must be completed to determine the missing variable(s).

## Vision of Physical Education

### National Standards & Grade-Level Outcomes for K-12 Physical Education

The Society of Health and Physical Educators (SHAPE) (2014) have articulated the following vision:

> To develop physically literate individuals who have the knowledge, skills, and confidence to enjoy a lifetime of healthful physical activity (p. 11).

This definition was adapted from the description of a physically educated person as described by the National Association for Sport and Physical Education (2004).

The Society of Health and Physical Educators (2014) National Standards and Grade-Level Outcomes serve as the framework and guiding force for state and local curriculum development. A quality physical education program should include five physical and educational benefits: 1) learning the skills necessary to participate in a variety of physical activities, 2) understanding the implications and benefits to being involved in many types of physical activity, 3) participating regularly in physical activity, 4) being physically fit, and 5) knowing the value of physical activity and how it contributes to a healthy lifestyle (SHAPE, 2014). The following components are also recommended for a quality physical education program: the opportunity to

learn, the use of appropriate instructional practices, and student and program assessment (NASPE, 2004).

MacNamera et al. (2011) surveyed 52 countries and discovered that the promotion of lifelong physical activity has become the universal aim of physical education. In most developed countries, children ages 5-16 experience physical education in a school setting (Hardman & Marshall, 2008; Puhse & Gerber, 2005). A number of sources recommend that all elementary students participate in physical education for a total of 150 minutes per week, in programs taught by a qualified physical education specialist, and with the use of adequate equipment and facilities, thus maximizing the opportunity to learn (Active Living Research, 2011; Active Living Research 2007; AHA, 2013a; AHA, 2013b; CDC, 2012; NASPE, 2004). However, public schools are facing economic challenges and a continued pressure to improve standardized test scores in the areas of literacy and math. The increased necessity to perform well on standardized tests is one factor that impacts the inability to meet the recommended minutes of physical education each week. While the demand to improve the test scores in other content areas will remain constant and be a priority for schools, the organization and structure to teach physical education and reinforce physical activity must shift to maximize the time that is available during the school day.

Appropriate standards and objectives, along with meaningful content and effective instruction, are core factors in physical education. The base of a physical education curriculum is established from national and state standards. The standards have a focus on motor skills, fitness education, concepts to implement knowledge, an understanding of the value of physical activity, and responsible personal and social behaviors (SHAPE, 2014). Students require

mastery opportunities and physical education content matching their current grade level, age, and cognitive development in order to achieve success. Regular assessment must also be included to track students on motor skill development and growth in personal fitness (NASPE, 2010). Students that participate in physical education at a level to achieve success, and also receive positive/constructive feedback from a physical education specialist using a formative assessment system, are able to identify goals for themselves. The National Association for Sport and Physical Education (2010) also recommends that stakeholders (administrators, teachers and parents) be afforded the opportunity to evaluate the physical education program.

**Opportunity to learn motor skills.** Fundamental motor skills, also known as motor competency, are an essential element in physical education standards. Fundamental motor skills include locomotor movements (jump, run, gallop, slide, etc.), non-locomotor movements (twist, static balance, bend, etc.), and object control skills (throw, kick, catch, strike, etc.) (Graham, Holt/Hale, & Parker, 2009).

Referring back to a NASPE resource (2009), the goal of elementary physical education emphasizes

> …the development of fundamental locomotor, non-locomotor, and manipulative skills through the main content areas of educational games, dance, and gymnastics. The movement framework (i.e., body, space, effort, and relationship) is also part of the core content and is the basis for developing, expanding, and refining children's range of motor skills and awareness. Quality instruction by physical education professionals is critical if children are to develop fundamental motor patterns (e.g. jump, throw, catch, and kick). The motor skills foundation established during the elementary grades may

> enhance children's social, cognitive and physical development and increase the likelihood of continued interest and participation in physical activity (p.3).

Therefore, children who lack the skills to engage successfully, and who experience failure in terms of motor competency, are unlikely to become involved in physical activity (Cote, Baker, & Abernethy, 2007). In a study on the topic of increasing physical activity outside the school setting, Palmer & Bycura (2014) did not address the factor of motor skills as part of their study. This decision was based on an assumption that most physical education teachers already direct a significant amount of effort to motor skills (Palmer & Bycura, 2014). Thinking all physical education teachers are adequately covering any portion of the SHAPE standards is a dangerous assumption to make, as there is a lack of uniformity in regard to the time devoted to physical education on a weekly basis across the United States (Beighle, Morgan, LeMasurier, & Pangrazi, 2006; United States White House Task Force on Obesity, 2010). Additionally, the trend to increase MVPA to 50% of physical education classes shifted the priorities for physical education teachers.

Penney and Jess (2004) move one step further and state that movement competency, as a basis of knowledge and essential understanding for lifelong participation in physical activity, is not valued as an essential element for physical education. MacNamera et al. (2011) also argue that many curricular models for physical education instruction do no equip individuals with the skills necessary to maintain their involvement in sport and do not include the information needed to assist them in the ability to move back and forth between various types of activities.

Physical activity requires a range of fundamental motor skill pre-requisites for participation and children can pass through a proficiency barrier of simplistic activities at the

elementary level, allowing them to move on to more complex activities during the middle and high school years, and ultimately into adulthood (MacNamera et al., 2011). Elementary physical education is the building block for all physical activity that follows (MacNamera et al., 2011). Researchers are beginning to suggests that children who can demonstrate a mastery of fundamental motor skills, and perceive themselves as proficient in those skills, are more likely to stay physically active (Barnett, Morgan, van Beurden, & Beard, 2008; Biddle & Wang, 2003; Castelli & Valley, 2007; Raudsepp & Liblik, 2002, Senne, 2013).

**Time for Fitness Development and Education.** A physically literate individual is able to demonstrate knowledge and skills in order to attain and continue a health-enhancing level of physical activity (SHAPE, 2014). Fitness education is defined by NASPE (2013) as:

> The instructional and learning process of acquiring values, knowledge and skills; experiencing regular participation in physical activity; and promoting healthy nutrition choices to achieve life-enhancing, health-related fitness (p. 5).

Health-related fitness, an essential component of physical fitness, is characterized by five components: cardiovascular endurance, muscle endurance, muscle strength, flexibility, and body composition (MDOE, 2011; SHAPE, 2014). Fitness assessments and testing procedures to determine health-related fitness are utilized throughout the United States as a measure of children's fitness development (NASPE, 2013; NASPE, 2004; United States White House Task Force on Obesity, 2010). The Presidential Fitness Challenge and Fitnessgram are the two protocols used most often for fitness assessment in Maine schools (MDOE, 2010).

Advocates of fitness testing in schools support a claim that assessments motivate youth to enhance their physical fitness and physical activity levels, facilitate self-monitoring and self-

testing, and promote a positive attitude (Light, 2010; Martin, Rudisill, & Hastie, 2009; Michaud, Nadeau, Martel, Gagnon, & Godbout, 2011; Strong, Malina, Blimpkie, Daniels, Dishman, Gutin, et al., 2005). Many researchers view fitness assessments as tools for students to self-identify strengths and weaknesses in terms of setting goals, to create an awareness of progress in terms of their capabilities, and also as a method to develop an individual plan to move forward in a physical nature (Palmer & Bycura, 2014; Metcalf, Henley, & Wilkin, 2012; Martin et al., 2009; Castelli & Valley, 2007).

However, a debate exists around the necessity of fitness assessment. The disagreement is connected to a theory that fitness tests lack validity and reliability in terms of the testing procedures, an impression that young people are not motivated by the tests, and a notion that students do not develop the knowledge and skills necessary to sustain engagement in physical activity (Cale & Harris, 2009; Corbin, 2002). Corbin (2002) also describes the behavioral impacts of scoring poorly on assessments, stating that low test results lead to individual disappointment and a sense that their efforts are not paying off in relation to their end product. However, Cale & Harris (2009) do identify fitness assessments as a tool for students to gain a better understanding in regard to their own fitness and bodies, but should not be included in overall student assessment.

According to the Maine Department of Education (2010), nearly 85% of Maine physical education teachers, grades K-8, utilized one or more fitness tests on an annual basis. The Presidential Fitness Challenge and The Cooper Institute's Fitnessgram were cited 41.88% and 32.14% respectively as being used on a regular basis in Maine schools, with some participants reporting a use of the two protocols in combination (MDOE, 2010). It is interesting to note that

15.58% of physical education teachers reported that fitness tests were not conducted at their school (MDOE, 2010). The following barriers were indicated for implementation of fitness testing: time, funding to purchase an assessment program, a limited availability to technology, and a decreased opportunity for training on the topic of fitness assessments (MDOE, 2010).

Through the employment of fitness testing in physical education, students can acquire a knowledge and understanding of health-related fitness, how to set developmentally appropriate goals and a plan to achieve their goals, a sense of self-management, and in the end, reinforce the value of physical activity (NASPE, 2010).

**Understanding of physical activity.** Physical activity is important to overall health and well-being, in children as well as adults (Active Living Research, 2011; AHA, 2013a; Beets, Beighle, Erwin, & White, 2009; Beets, Wallner, & Beighle, 2010; National Education Association, 2010; National Heart and Blood Institute, n.d.; Pate, Davis, Robins, Stone, McKenzie, & Young, 2006). Researchers have determined that physical inactivity, also described as a sedentary lifestyle, is a major factor that contributes to childhood obesity (AHA, 2013a; Elliot, Erwin, Hall, & Heidorn, 2013; Glickman, Parker, Sim, Cook, & Miller, 2012; United States White House Task Force on Obesity, 2010). Obesity is the result of caloric imbalance: too few calories are expended for the amount of calories consumed (CDC, 2010). The Centers for Disease Control and Prevention (2010) reported the rate of obesity in children has doubled in the past 30 years and that 18% of children age six to eleven were considered obese in 2010.

The definition of physical activity is a bodily action that enhances or maintains physical fitness and overall health and wellness (NASPE, 2013). The need for increased physical activity

at a minimum of 60 minutes per day is well documented (AHA, 2013a; NASPE, 2010; Partnership for Prevention, 2009; SHAPE, 2014). According to NASPE (2013), the following characteristics of physical activity should be offered by schools: 1) development of the skills to be a competent mover, 2) recognition that physical activity is valuable and enjoyable, and 3) development of the confidence in students' own physical activity. Most importantly, students should discover that physical activity nurtures the habits that lead to being active movers for their entire lives, and is a direct result of participation in physical education (USDHHS, 2010).

The United States Department of Health and Human Services (2010), in their document titled *Healthy People 2020*, suggests that schools make an effort toward students meeting the 60 minute physical activity guideline as part of daily participation in physical education and other physical activity opportunities (i.e. recess, after school programs and active school transport). Leading public health, medical, and government organizations/agencies also call upon schools to outline policies to assist children in high quality physical education participation, in addition to other physical activity opportunities before, during, and after school hours (NASPE, 2013).

**The time afforded to physical education.** The National Standards were written in terms of student success and achievement in physical education. A students' attainment of the standards is directly connected to class participation in physical education for 150 minutes per week at the elementary level, kindergarten to grade five (Castelli & Valley, 2007; NASPE, 2013; SHAPE, 2014). The time frame rises to 225 minutes of physical education for grades 6-8 (NASPE, 2004). California is the only state that meets the 150 minute per week standard set by NASPE (personal communication, July 2014). Maine schools are well below the recommended 150 minutes of physical education per week at the elementary level (MDOE, 2010).

In 2009, the Commissioner of Education for the State of Maine conducted a statewide assessment of the physical education capacities for K-8 elementary schools across the state (MDOE, 2010). Of the 510 certified physical education teachers who were invited to participate in this assessment, 315 responses were deemed usable and analyzed, representing 75.32% of Maine physical education teachers, grades K-8 (MDOE, 2010). The average amount of time a grade 2 student and grade 8 student receive physical education over the course of a school year in Maine is outlined in Table 1.

Table 1.

*Average Minutes of Physical Education in Maine, grades 2 and 8.*

| Grade Level | Amount of PE Per Week | Minutes/Hours Per Year |
|---|---|---|
| Grade 2 (36 weeks per year) | 1 day per week, 36 minutes | 1,296 minutes/21.6 hours |
| Grade 8 (36 weeks per year) | 2 days per week, 43 minutes | 3,096 minutes/51.6 hours |

Maine Department of Education (2010). A report to the Joint Standing Committee on Education and Cultural Affairs on the physical education capacity of elementary schools as requested through Public Law, Chapter 264 (LD 1407): An act to assess the physical education capacity of elementary schools in Maine and to establish the obesity and chronic disease fund within the Department of Education.

While over 90% of physical education teachers responded that their students receive physical education on a weekly basis throughout the school year, it is clear the numbers were extremely low compared to the NASPE recommendations for physical education and the time required for the achievement of the SHAPE National Standards. The information included in Table 1 is comparable to the amount of physical education offered in most school districts in Maine for grades K-5.

A majority of physical education teachers in Maine (53.02%) also reported they were not

aware of additional opportunities for their students to be physically active during school hours (MDOE, 2010). In cases where the teachers were aware of the possibilities in their schools, the types of physical activities being incorporated into the school day included adding physical activity into classroom lessons (23.61%), a school walking club/mileage program (14.58%), and a category titled other (28.82%), that included intramural programs and snowshoeing (MDOE, 2010).

Based on the information gathered as part of the survey conducted in 2009, the MDOE (2010) expected to utilize this information in the following manner:

> …continue work with schools, organizations and agencies to enhance current physical activity programming in schools as well as providing support to these organizations when applying for state and national grants (p. 9).

This specific research, conducted in Maine schools, was meant to be shared with administrators, school boards, communities, and the Department of Education, to maintain a focus on the physical health of Maine children. All of the organizations above could move forward in unison for the health of our K-8 generation of children. The Maine Department of Education had not followed up on their progress at the time of this study.

## The Movement to Increase Physical Activity

The goal of the physical activity interventions, for children to meet a moderate-to-vigorous level for 60 minutes or more each day, has been supported by a number of leading public health, medical, and educational organizations over the last 10 years (American Academy of Pediatrics, 2011; AHA, 2013a; Glickman et al., 2012; SHAPE, 2014; United States White House Task Force on Obesity, 2010). Prior to the introduction of physical activity interventions,

Trost, Pate, Dowda, Ward, & Felton (2002) reported that most children were meeting the 60 minutes of moderate-to-vigorous physical activity recommended daily. Recent publications from the CDC (2013) and USDHHS (2008) contradict this 12-year old Trost et al. (2002) statistic, reporting that one half of young people are not active on a regular basis. The quest to identify what factors must be present to foster habitual patterns of exercise continues to be of great importance.

In response to the rise in obesity rates, researchers and experts in the field of physical education recommended a shift to reduce the focus on teaching fundamental motor skills in favor of an increase in the amount of physical activity (Partnership for Prevention, 2009). Teachers responsible for physical education programs responded to this recommendation of increasing physical activity to at least 50% of each class session, with the goal that children would carry a disposition of valuing physical activity into adulthood (AHA, 2013b; Castelli & Valley, 2007; CDC, 2010; NASPE, 2013; Pangrazi, Beighle, & Pangrazi, 2009; Robert Wood Foundation, 2013; Tudor-Locke, Lee, Morgan, Beighle, & Pangrazi, 2006; United States White House Task Force on Obesity, 2010).

**Research Trends/Practices in the Field**

Physical education practitioners, researchers, and other experts in the fields of physical education and physical activity, have published empirical research studies originally designed to increase amounts of physical activity, lower obesity rates, and motivate students to develop a habit of exercise, and will be discussed in this section. A number of similar variables are included in the studies to be reviewed: duration of the study, the length of time for physical activity sessions, frequency of formative evaluation (pre- and post testing), and the use of peer

observations, records/logs, and surveys. This list of common variables is a reflection of the concerns and issues physical education specialists encounter regularly in their classrooms and gymnasiums. Progress is occurring in relationship to the variables above, while other variables continue to require attention in the field of physical education.

The duration of the studies, with physical activity sessions structured to supplement physical education lessons, ranged in length between 6-12 weeks. Sessions within this period of time were conducted 3-5 times per week. Each lesson could be as short as 15 minutes or extended to a 2-hour session for activity. The age and grade level of the intended participants was also considered in preparation for the studies in order to determine the length and frequency of sessions (Ericsson, 2011; Martin et al., 2009; Michaud et al., 2011; Price, 2011; Weirsma & Sherman, 2008).

Many researchers chose a formative evaluation approach, including pre- and post testing, in order to identify the changes connected to the amount of physical activity, motor skill, and development of physical fitness (Castelli & Valley, 2007; Eather, Morgan, & Lubaro, 2012; Ericsson, 2011; National Heart, Blood, and Lung Institute, n.d.). In Ericsson's study (2011), the intervention group of participants in grades 1-9 had physical education every day and one motor training session each week, as compared to two lessons of physical education each week for the control group. Participants in grade 1 began with 51% of participants attaining the good motor skill level (Ericsson, 2011). At the conclusion of the study in grade 9, 73% of the intervention participants were performing at a level representing good motor skills, while the control group did not exhibit a similar amount of growth (Ericsson, 2011).

Other researchers opted for a mid-study check, to assist them in determining a

participants' level of improvement at the conclusion of direct intervention from a trained professional. A post test was administered 6-8 weeks after the conclusion of the intervention, for the purpose of investigating the long-term effects or the level of support from the home environment (Martin et al., 2009; Michaud et al., 2011; Price, 2011). In the studies that were reviewed, participants in the intervention groups displayed marked improvements at the mid-point check-in, but did not maintain those gains through the time frame they were encouraged to exercise away from school and not under direct instruction (Michaud et al., 2011; Price, 2011; Stanley, Ridley, & Dollman, 2012).

Feedback measurements were common in a number of the studies, including surveys completed by students/parents, peer observations, direct interviews with participants, and daily logs. Castelli & Valley (2007) asked parents to reflect on the 7-days of activity for their grade 5 participants prior to beginning their study, to compare a current activity level to that of their child over the previous three months, and to describe any potential seasonal activity changes that might occur over the course of the study. Eather et al. (2012) utilized a set of questions with the participants at the end of their study, to determine participants' perceptions regarding physical fitness in general and how the children viewed fitness testing. Attitude changes that the participants experienced in response to their own fitness were also examined in relationship to their participation in the study. In a survey 10-weeks following the end of the intervention, Eather et al. (2012) questioned the participants a second time in regard to their experiences, thoughts, and feelings in relationship to their own physical fitness. Most participants (80.8%) reported that they enjoyed the fitness testing. Nearly all participants (95.3%) were eager to discover their fitness levels. Table 2 has a list of results from a satisfaction survey conducted by

Eather et al. (2012), with participants utilizing a rating scale of 0-6 to describe their experiences. The numbers in the right-hand column are the average ratings from all participants.

Table 2.

*Rating of Physical Fitness Satisfaction (scale of 0-6).*

| Variable | Average Score |
|---|---|
| Enjoyed physical fitness | 5.50 |
| Viewed physical fitness as practical | 5.20 |
| Interest in physical fitness | 5.23 |
| Program easy to understand | 4.63 |
| Agree that knowledge and skills had improved | 5.07 |
| Health-related fitness/physical activity improved | 5.62/5.20 |
| Likelihood to continue fitness/physical activity | 5.40 |

Eather, N., Morgan, P.J., & Lubans, D.R. (2012). Feasibility and preliminary efficacy of the Fit4Fun intervention for improving physical fitness in a sample of primary school children. Physical Education and Sport Pedagogy, 18(4), 389-411.

The Be a Fit Kid study, sponsored by the National Heart, Blood and Lung Institute (n.d.), also conducted a survey with the parents of their participants at the six month, post study period. In the survey responses, the parents shared that the experience of changing their children's physical activity pattern (a 12-week period, three sessions per week, for a time of 2-hours per

session) had been maintained.

Intervention studies rely heavily on feedback, whether through the results of a survey or a quantitative measure on fitness tests or a score of motor skill proficiency. Students' perceptions around the topic of fitness can be of great importance in relationship to improved scores when the motivation is to discover why children make a choice to be active or sedentary.

## Motor Competency, Self-Efficacy and the Habit of Exercise

Researchers are beginning to suggest that children who can demonstrate a mastery of motor skills, and perceive themselves as skilled in the area of motor competency, are more likely to be physically active (Barnett et al., 2008; Biddle & Wang, 2003; Castelli & Valley, 2007; Raudsepp & Liblik, 2002; Senne, 2013). While increasing the amount of time devoted to physical activity appeared to be the solution for lowering the rate of obesity in children, experts are suggesting that long-term success might also hinge on the mastery of fundamental motor skills and the opportunity to build self-efficacy (Senne, 2013; Stodden, Goodway, Langendorfer, Roberton, Rudisill, Garcia, & Garcia, 2008).

### Fundamental Motor Skill Competency

Castelli and Valley (2007) highlighted physical fitness and modifiable motor competency behavior as part of their summer physical activity intervention. Measurements of physical activity, physical fitness, and selected motor skills were conducted to establish a baseline as part of a 4-year study. Parents were asked to provide data pertaining to their child's physical activity routine prior to the start of the study. The baseline data was important to the overall results of the study.

The responses provided by the parents to describe their child's physical activity seven

days prior to starting the study revealed that 64% of the participants (age 7-12) fell short of the 60 minutes of activity-a-day recommended by the USDHHS (2008). In fact, 9% of the subjects recorded no physical activity during the 7-day period (Castelli & Valley, 2007). Additionally, only 41% of the students scored in the healthy fitness zone for their age and gender on all five baseline fitness tests (cardiovascular fitness, muscle endurance, flexibility, muscle strength, and body composition) that were administered during the first week of the study (Castelli & Valley, 2007). Baseline information was also collected regarding task performance on three activities of motor competence: basketball, striking with paddles, and throwing. The South Carolina Physical Education Assessment Program was utilized to measure initial motor competency and an 80% inter-rated reliability was established to rate proficiency. The results were as follows: only 59% of students were proficient in basketball, a lesser 47% for paddles, and an even smaller 42% for throwing (Castelli & Valley, 2007). The baseline data gathered at the beginning of the study indicated that the amount of physical activity and FMS competency on select skills were comparable and interrelated.

The research studies that included a motor skill component (Castelli & Valley, 2007; Ericsson, 2011; Light, 2010; Martin et al., 2009) chose a testing procedure based on the reliability and validity factor of the protocol. The Test of Gross Motor Development-2 (TGMD-2), created and validated by Ulrich (2000), was utilized for studies with primary level children. The Test of Gross Motor Development-2 is a criterion and norm-referenced assessment, and also process-oriented (Logan, Robinson, Rudisill, Wadsworth, & Morena, 2012; Mahar & Rowe, 2008). Quantitative evaluations for object control and locomotor skills can be completed with a typically developing K-3 student according to the review completed by Logan

et al. (2008).

The mastery motivational climate study conducted by Martin et al. (2009) utilized the Test of Gross Motor Development-2, resulting in significant success. A mastery motivational climate permits children to move freely and make their own decisions regarding what activities they want to choose, the length of time to spend on an activity, striving for a set performance level, and the choice of a partner (Martin et al., 2009). Two kindergarten classes, in separate schools that had similar demographics (class length-30 minutes, similar socio-economic status, gender similarities, and race representation), were part of the study. The intervention group utilized a mastery motivational climate and a low-autonomy, control group followed a teacher-directed format (Martin et al., 2009). At the conclusion of the 12-week study, mean scores were calculated regarding locomotor movement and object control. The mastery motivational climate group had mean scores that improved from 28.50 to 46.66, while the low autonomy group stayed virtually the same at approximately 31.00 (Martin et al., 2009). A similar result occurred with the object control mean scores. The mastery motivational climate mean scores rose from 22.06 to 31.94 and the low autonomy group saw limited improvement with scores moving from 27.89 to 32.90 (Martin, et al., 2009). The researchers from this study have determined that improvement in motor competency might not require additional time. A change in curricular program can contribute to positive gains (Martin et al., 2009; McKenzie & Lounsbery, 2009).

**Self-Confidence**

A belief in self, for the purpose to complete tasks, was a common thread in a significant number of studies (Castelli & Valley, 2007; Ericsson, 2011; Palmer & Bycura, 2014; Strong et al., 2005). Maintaining motivation and addressing meta-cognitive skills, such as commitment

and determination in the facilitation of excellence, are important in sport and non-sport domains (Abbott & Collins, 2004; Holt & Dunn, 2004). An individual can increase self-recognition and maintain confidence in their motor skills with a tracking program (MacNamera et al., 2011). Students see their progress in a clear manner, gain personal empowerment, and increase their likelihood to engage in activities for a short-term time frame and ideally through long-term periods (Castelli & Valley, 2007).

Learning and performance are often connected to a climate that motivates students and moves them to the point of mastery (Martin et al., 2009). Giving children a voice and being part of the decision-making process for personal gain will contribute to development of skills and fitness (Theeboom, deKnop, & Weiss, 1995; Valentini & Rudisill, 2004).

Programs exist and have been researched that encourage self-reinforcement, information for changing teaching methods, goal setting, self-instruction, and problem solving (Eather et al., 2012; Light, 2010; MacNamera et al., 2011; McKenzie, Sallis, & Rosengard, 2009; Michaud et al., 2011). The programs with marked success have been discussed as part of this chapter, in relationship to the participants' growth in the areas of fundamental motor skills and physical fitness development. Survey responses from participants and parents, along with teacher observation, are the two areas of data that are collected to determine self-efficacy benefits. Eather et al. (2012) conducted a comprehensive survey report on overall enjoyment of fitness and the likelihood of continuing exercise into the future. Other studies included post surveys to determine if the participants continued the same level of physical activity 6-12 weeks after the intervention was completed. While a number of the studies found that regular activity had declined post study (MacNamera et al., 2011; Michaud et al., 2011; Price, 2011), the reasons for

why the activity did not continue were not investigated in the studies that were reviewed.

## Conclusion

The meta-analysis articles and intervention studies included in this chapter all gave valid suggestions for research areas that should be further investigated in relationship to fundamental motor skills and developing a habit of physical activity. A strong belief continues to exist that physical activity and physical education interventions should continue to include fitness assessment, fundamental motor skills, and physical activity, for the purpose of keeping children active each day. In addition to the promotion of overall fitness and motor competency, a self-confidence factor and measures of success, along with goal setting, will engage and maintain the objective of being a physically literate individual for a lifetime.

The selection of a program to match the needs of students and one that is grounded with an evidence-based system is crucial (Carlson, Eisenmann, Pfeifer, Jager, Sehnert, Yee…Feltz, 2008; National Heart, Lung, and Blood Institute, n.d.; Strong et al., 2005). Fitness testing, individualizing the program, participating in a non-competitive manner, and involving the participants in development and implementation, provides a sense of ownership and pride with the participants (McKenzie et al., 2011; Michaud et al., 2011; National Heart, Lung, and Blood Institute, n.d.; Naylor & McKay, 2009). The children themselves must take an active role and be part of the overall process.

A focus on framing the benefits of developing a regular habit of exercise often reflects on the future of our children, something to take them into adulthood. We do need to consider how overall fitness relates to the demands they currently face as children (Strong et al., 2005). Physical growth, biological maturation, and behavior development are important considerations

when contemplating an intervention plan. Our youth are able to record and evaluate their own status and growth, giving them the tools necessary to continue this pattern at every stage of their lives (Strong et al.).

According to the American Heart Association (2013b), active efforts established in the present will give children the ability and knowledge to become active for life. Increasing the habitual level of physical activity in youth is a health promotion strategy (Strong et al., 2005). A number of states, communities, and schools have grasped the importance of what it means to become physically literate and more involved with physical activity. A significant number of school communities have added programs to change their school environment for the better in terms of physical fitness. The trend must grow and expand.

Children learn and absorb a great amount when they are young. Giving students the time to master fundamental motor skills, assisting them to accurately perceive their growth and improvement, and making sure they recognize their ability to become active participants must be addressed. Our children must be educated now in regard to the significance of all factors which affect their physical health for a lifetime.

# Chapter 3: Methodology

The purpose of this experimental design study is to examine the capacity of an evidence-based physical education curriculum and/or a complementary after school program to improve cardiovascular fitness assessment scores and fundamental motor skill (FMS) performance for students in grade 5. The Sports, Play and Active Recreation for Kids (SPARK) evidence-based curriculum and the SPARK after school program were utilized. A particular focus was placed on the health-related fitness component of cardiovascular endurance and the following fundamental motor skills: running, sliding, overhand throwing, horizontal jumping, kicking, and striking. The data collected as part of the physical education program from the fall of 2014 to the winter of 2015 were analyzed, comparing a control group to three intervention groups.

## Entry to the Setting

The purpose, design, and curriculum program for this research was discussed and approved by the superintendent of schools and the principal of the school where the study was conducted. A letter from the superintendent of schools is included in Appendix B.

## Study Participants

Grade 5 was selected for the implementation of the SPARK evidence-based curriculum, to be compared to the sports-based district curriculum. The students in grade 5 were chosen for the study due to their overall level of cognitive ability, familiarity with the fitness testing procedures, and in-class physical education experience with the fundamental motor skills that were listed. Prior experience in relationship to testing protocols assisted with correct and appropriate performance on the fitness assessments and fundamental motor skill tasks. Additionally, the grade 5 students had established the FMS basics of stepping in opposition and

the concept of a follow through, common factors in many areas of motor competence.

## Methodology

### Experimental Design

The study utilized an experimental design approach, with the purpose of establishing a cause and effect relationship among the variables (Fraenkel & Wallen, 2009). In the experimental design protocol, two groups with similar contexts and situations that are considered comparable are determined and a program is administered to one group and not given to a second group. In all respects, the groups are treated the same and the differences in scores between the two groups are analyzed. In this particular case, an evidence-based physical education curriculum and/or an after school activity program were implemented for three intervention groups, with a hypothesized outcome in relationship to fitness assessments and fundamental motor skills. The three intervention groups were compared to a control group that participated in physical education utilizing an established district curriculum. An inference was made that the intervention groups would not have the same outcome as the control group.

The experimental design approach is characterized by the use of the scientific method to establish a cause-effect relationship among variables (Creswell, 2009). An independent variable is manipulated to determine the effects on a dependent variable (Creswell, 2009). The intervention group receives the treatment and a control group does not receive treatment. All other aspects of the two groups are similar (participants, background, context, etc.). An observation and analysis of the differences between the groups was conducted.

The cause-effect relationship in this particular study examined the effect of utilizing an evidence-based physical education curriculum and/or an after school activity program with three

intervention groups of grade 5 students. The fitness assessment scores and fundamental motor skill performance levels of the intervention groups were compared to the fitness and fundamental motor skill data collected from a control group that was taught with the established grade 5 curricula. The purpose was to answer a pair of research questions through analysis of the data, to determine the impact of a change in curriculum and/or participation in an after school activity program.

**Research Design**

Quantitative data was collected pre- and post study. Scores on the fitness assessments and proficiency levels of FMS were recorded for every grade five student in the control group and the intervention groups (district curriculum and after school activity program, evidence-based curriculum only, and the combination of an evidence-based curriculum and after school activity).

Fitness assessment and FMS data were collected before and after the 12-week study, the same length as a trimester in this school district. Pre-testing occurred during the three weeks prior to the start of implementing the SPARK evidence-based physical education curriculum units and lessons, along with the district curriculum. The post tests were completed during the two weeks following the conclusion of the study.

Two classrooms utilized the SPARK evidence-based physical education curriculum. The participants of these two classrooms were taught the following units/lessons from the SPARK curriculum: running, sliding, overhand throwing, horizontal jumping, kicking, and striking. In addition to the selected fundamental motor skills, a promotion of physical activity at a moderate-to-vigorous level and fitness assessments were clear objectives. The participants in the

remaining three grade 5 classrooms were assigned to the district curriculum. The participants engaged in lessons on the same topics as the intervention participants, utilizing the district curriculum with a sports-based focus.

The final component of this study included all grade 5 participants, from any classroom, that opted to participate in the after school activity program. The after school activity was two days per week during the last 10 weeks of the study. The Sports, Play and Active Recreation for Kids (SPARK) After School Program guidelines were used to implement the after school activity.

Every grade 5 participant for the study was invited to be part of the after school activity. The addition of an after school activity determined the three intervention groups for this study: 1) the district physical education curriculum and participation in the after school activity (ASA), 2) the evidence-based physical education curriculum only (EBPE), and 3) the evidence-based physical education curriculum and the after school activity (EBASA). The number of overall participants for the intervention groups, and the control group, are outlined as part of Table 3.

Table 3.

*Intervention and Control Groups.*

| | |
|---|---|
| Control Group-traditional district curriculum-28 | EBPE Intervention Group-evidence-based physical education curriculum(SPARK)-30 |
| ASA Intervention Group-traditional curriculum and after school activity-12 | EBASA Intervention Group-evidence-based physical education curriculum (SPARK) and after school activity-25 |

The researcher sent a letter to the parents of grade 5 students the first week of the 2014/2015 school year (Appendix C). In the letter, the researcher advised parents in regard to the year-long use of the SPARK evidence-based physical education curriculum for the study, and the curriculum change that had been approved by the superintendent of schools. Parents were also informed about how the study would impact their children over the course of the school year, along with an explanation regarding the grade 5 participation throughout the academic year. The letter was sent home with the students and was also sent electronically to parents utilizing the Blackboard Connect electronic correspondence system for the district. A description of the SPARK evidence-based curriculum was included in the letter, as well as the role that an evidence-based curriculum could play in the district's movement toward standards-based education. In addition, the researcher sought the approval of the Plymouth State University Institutional Review Board to collect data in anticipation of this study (Appendix D).

## Measures

### Data Collection

Two separate measurement tools were chosen to determine change and growth over the course of this study. The Fitnessgram protocol was utilized to the determine fitness levels for participants as part of this study. The Test of Gross Motor Development-2 (TGMD-2) was the tool used to determine fundamental motor skill proficiency.

The Cooper Institute (2010) has developed a comprehensive, health-related fitness reporting system. The Fitnessgram program is a set of criterion-referenced standards designed with a direct association to good health for children and youth. A complete battery of health-related fitness items are scored using the criterion-referenced standards (The Cooper Institute,

2010). Each health-related fitness component includes a Healthy Fitness Zone (HFZ), with criteria according to gender and age, that have been researched, validated, and refined over years of study (The Cooper Institute, 2010). The Fitnessgram is used to collect data on cardiovascular endurance, muscle endurance, flexibility, muscle strength, and body composition. In this particular study, data was collected for the fitness areas of cardiovascular endurance and muscle endurance.

The Fitnessgram protocol does not assess fundamental motor skill development, therefore a second assessment tool was implemented. The Test of Gross Motor Development-2 was developed by Dr. Dale A. Ulrich, a professor for the School of Kinesiology at the University of Michigan (Ulrich, 2012). Dr. Ulrich designed the testing protocols and scoring criteria for 12 fundamental motor skills: run, gallop, hop, leap, horizontal jump, skip, slide, two-hand strike, stationary bounce, catch, kick, and overhand throw. The performance criteria for all fundamental motor skills were established to be met by children between the ages of 3-10, regardless of gender (Ulrich, 2000). All of the protocols and scoring criteria for the TGMD-2 have been determined to be reliable and valid (Ulrich, 2000). Data for 6 of the 12 fundamental motor skills were compared for this study: run, slide, overhand throw, horizontal jump, kick, and strike. Six fundamental motor skills were chosen due to the time frame for the study (12 weeks).

Data were collected pre- and post study in regard to scores on a battery of fitness assessments (curl-ups, push-ups, one-mile run) and FMS proficiency performance (run, slide, overhand throw, horizontal jump, kick, and strike). The researcher also recorded observational data through the examination of participants as they engaged in moderate-to-vigorous physical activity, prepared for fitness assessments, and practiced fundamental motor skills to proficiency

in physical education classes over the 12-week period.

Two data sources guided the organization of this study: fitness assessment scores and proficiency levels on the selected fundamental motor skills. Table 4 gives a summary of the two data sources for the study.

Table 4.

*Summary of data sources.*

| **Data Collection Method** | **When** | **Who** | **How** |
|---|---|---|---|
| Fitness Assessments -muscle endurance -cardiovascular endurance | 1 week prior to the start of the study and the first week post study | Researcher and student partners | Partners to count and measure, teacher monitored, timed and scored based on Healthy Fitness Zone standards (The Cooper Institute, 2010) |
| Fundamental Motor Skill Assessments -running, sliding, overhand throwing, horizontal jumping, kicking, striking | 2 and 3 weeks prior to the start of the study and the second week post study | Researcher | Direct observation by the researcher, video scored by the researcher, and matched to TGMD-2 established protocols (Ulrich, 2000) |

Preliminary data collection for the fitness assessments began in the spring of 2014. The collection of data extended into fall 2014/winter 2015. Fitness assessment data continued to be compiled during the 12-week study, along with specific fundamental motor skill data.

The fitness and FMS data were collected at two intervals. First, fitness assessments were conducted as follows: pre-testing one week prior to the implementation of the SPARK

curriculum for 12-weeks (September, 2014) and post testing one week following the 12-week implementation (December, 2014). Appendix E includes the descriptions for the battery of fitness assessments.

Second, the fundamental motor skill assessments were completed as follows: pre-testing three weeks prior to SPARK implementation (September, 2014) and the second week post implementation of the SPARK curriculum (January, 2015). The locomotor and object control fundamental motor skills are listed and outlined as part of Appendix F.

**Fitness assessments and fundamental motor skill assessments.** The fitness assessment battery included the following: curl-ups, push-ups, and one-mile run. Past physical education records at the school indicated that 80% or more of the fifth grade students at the elementary level, from the fall of 2012 to the spring of 2014, had performed at-or-above the HFZ for curl-ups and push-ups (The Cooper Institute, 2010). A high percentage of students were able to demonstrate adequate or above average abdominal and upper body strength, as measured through curl-ups and push-ups respectively. The percentage of fifth grade students that scored at-or-above the HFZ for the cardiovascular assessment of the one-mile run (The Cooper Institute, 2010) during the same time frame was 70% on average, a noteworthy difference as compared to the muscle endurance assessments.

Fundamental motor skills are an essential element in physical education standards (SHAPE, 2014). The Test of Gross Motor Development-2, previously mentioned as the FMS assessment utilized for collection of data in this study, is used to measure student skill level for children between the ages of three and ten. This norm-referenced testing procedure is used to evaluate common gross motor skills that develop early in life (CDC, 2012; Ulrich, 2000; Wong

& Cheung, 2010). The researcher followed the guidelines for the National Youth Survey (CDC, 2012) and provided an accurate description of the FMS task to each participant, allowed each student a practice trial, and administered three trials to each participant pre-study and post study. The criterion for each of the fundamental motor skills are described in Appendix G.

**Data Analysis**

A spreadsheet was used to record the data for the intervention groups and the control group on the fitness assessments and FMS proficiency results. The participants, according to intervention group or control group, were identified on the spreadsheets. Sample spreadsheets for the collection of data are included in Appendices H and I.

**Inclusion/Exclusion of data.** Data was collected from all participants in attendance during the class sessions when fitness assessments and fundamental motor skill assessments were administered. The data for the participants not present at each collection point (pre- and post) for all assessments were excluded from the analysis portion of the study.

**Statistical Analysis**

An independent t-test, a statistical hypothesis test, was used to determine whether the data from the grade 5 physical education participants in the intervention groups and the control group were significantly different. The values from the t-tests were used to determine a *p*-value. A *p*-value was established to discover any statistical hypotheses. A threshold value that was equal to or smaller than 5% ($\leq 0.05$) was established for this study. A *p*-value at this level solidifies a significance to the observed results. Additionally, a 2 x 2 factor analysis of variance test for repeated measures (ANOVA) was conducted to determine any significant data changes that were due to gender. A post-hoc test, the Tukey's range test, utilized the significant ANOVA

values to determine the gender most affected by the intervention. Mean scores and standard deviation were used to calculate effect sizes ($g_{Hedges}$) for the data collected.

**Usefulness of the study.** A study becomes useful in other situations based on how rigorously the study was planned and conducted, and how accurately it can be reproduced (Trolley, 2009). Documentation of the design and content of the study protected the reliability and increased the possibility for reproduction. The description of the setting, a clear explanation of the protocols/ procedures for FMS and fitness assessment data collection, provided the necessary components for a useful study.

Accurate and detailed records for the duration of the study ensured internal reliability. Data from the fitness assessments and FMS proficiency were recorded on a spreadsheet and checked for accuracy.

**Confidentiality.** The data collected were recorded and stored on a computer that had a password known only to the researcher. As the data were collected, participants were de-identified. Each grade 5 participants' name was translated into a unique and random number. The parents were made aware that the findings would be published in a dissertation, could be published as part of scientific/educational journals, and/or presented at conferences. Parents were also informed that all participants' identities would be kept strictly confidential in these sources.

**Risks.** The likelihood of adverse reactions to the fitness assessments and fundamental motor skill practice and assessment was minimal for this generally healthy population. Each child was monitored for signs of distress during the 12-week portion of the intervention, along with the pre and post assessments. None of the children displayed any distress when performing

any activity.

A school nurse or nurse practitioner was present at the school for the duration of the school day when the data was collected. None of the participants required access to nursing services while participating in physical education.

# Chapter 4: Analysis and Findings

This quantitative study was conducted to determine the impact of an evidence-based physical education curriculum and/or an after school activity program on grade 5 participants' fitness in relationship to cardiovascular endurance and their fundamental motor skill (FMS) proficiency.

Chapter four is divided into two sections: a) fitness assessments, and b) fundamental motor skill assessments. Each section includes an analysis and the findings of a control group (28 participants-17 girls/11 boys) that was taught using an established district curriculum, along with the analysis and findings of three intervention groups: 1) a group that participated in the after school activity and utilized the established district curriculum (ASA) (12 participants-6 girls/6 boys), 2) a group that participated in physical education using an evidence-based curriculum (EBPE) (30 participants-13 girls/17 boys), and 3) a group that was taught using an evidence-based physical education curriculum and participated in the after school activity program (EBASA) (25 participants-13 girls/12 boys).

Assessment data for three fitness protocols (curl-ups, push-ups, one mile run) and the FMS proficiency data on six movement skills (run, slide, overhand throw, horizontal jump, kick, strike) were compared pre- and post study. Data analysis tables for every fitness assessment and all fundamental motor skills are included in the text. The data analysis includes the following information: mean, t-score, *p*-value, standard deviation, and effect size ($g_{Hedges}$). The mean scores were utilized in a independent t-test to determine t-scores, that were used to determine *p*-values for every fitness assessment and the FMS at the two data collection points of the study. The significant *p*-value of $\leq 0.05$ would confirm a 95% probability that the changes over the 12-

week study were due to the effect of the after school activity, the implementation of an evidence-based curriculum, or the combination of the evidence-based curriculum and the after school activity.

In addition to the independent t-test and the calculation of *p*-values, a 2 x 2 factor analysis of variance test for repeated measures (ANOVA) was conducted for every fitness assessment and fundamental motor skill. This test was utilized to discern if the after school activity and/or the evidence-based curriculum had an effect with the participants according to gender. A $p$-value of $\leq 0.05$ on the ANOVA indicated that a post hoc analysis was necessary to determine the gender group that was affected most significantly by the intervention(s). The Tukey's range test was utilized for this purpose.

## Data Analysis and Findings

### Fitness Assessments

The Fitnessgram protocols were administered for the following fitness assessments over the course of the study: curl-ups (muscle endurance), push-ups (muscle endurance), and the one-mile run (cardiovascular endurance). A description of the protocol for each fitness assessment, and the score to meet the Healthy Fitness Zone (HFZ), can be found in Appendix E. An independent t-test was utilized to determine whether the mean data changes pre- to post study met the significant $p$-value ($\leq 0.05$) that was established. The 2 x 2 factor analysis of variance for repeated measures (ANOVA) was conducted to discern any changes on fitness assessments and FMS proficiency specific to gender as a result of the study. The Tukey's range test, a post hoc analysis, was conducted to determine if the data from the two-factor ANOVA test for repeated measures met the $p \leq 0.05$ benchmark.

In accordance with research completed by MacNamera et al. (2011) and McKenzie & Sallis (2009), the researcher had a certain expectation that the participants would improve on each fitness assessment (curl-ups, push-ups, and the one-mile run) over the course of the 12-week study.

The pre-study fitness assessments were conducted one week prior to the start of the 12-week study (September 2014). All post study assessments in the area of fitness were completed the week following the end of the study (December 2014).

In this section, the data tables for the fitness assessments (mean, t-score, *p*-value, standard deviation, and effect size) are outlined by control group (district curriculum only) and intervention groups: 1) after school activity and district curriculum (ASA), 2) evidence-based physical education curriculum only (EBPE), and 3) evidence-based physical education curriculum and after school activity (EBASA).

**Curl-Ups.** The curl-up assessment is a procedure that determines muscle endurance in the abdominal area of the body. Ninety-eight percent of the participants, regardless of participation in the control or intervention groups, met the HFZ standard for curl-ups over the course of the study.

*Curl-Up Data Analysis*. The control group and the intervention groups were all inconsistent in relationship to point of the study when the participants met their best curl-up score. Each of the four groups (the control and three intervention groups) had participants with high scores at the pre- and post study assessment points. The variance around the point of the study when high scores were achieved for curl-ups resulted in *p*-values that did not meet the significant value of $\leq 0.05$ pre to post study. The curl-up data is shown in Table 5.

The two-factor ANOVA test for repeated measures was conducted, using the curl-up data, to determine any differences according to gender on the curl-up fitness assessment for the control group and the intervention groups. The data collected did not indicate that the treatments of change in curriculum and/or participation in the after school activity had an impact on curl-up performance by gender.

Table 5.

*Boys' and Girls' Data Analysis for Curl-Ups, Pre- to Post Study (mean, t-score, p-value, standard deviation [SD], effect size).*

| | **mean pre/post** | **t-score** | **p-value** | **SD pre/post** | **effect size** |
|---|---|---|---|---|---|
| **Control** | | | | | |
| Boys | 29.18/30.00 | -0.22 | 0.41 | 8.89/9.62 | N/A |
| Girls | 26.71/26.94 | -0.07 | 0.47 | 10.91/8.03 | |
| **ASA** | | | | | |
| Boys | 34.50/36.17 | -0.43 | 0.34 | 7.77/5.34 | 0.731 |
| Girls | 27.33/28.33 | -0.31 | 0.38 | 5.13/6.09 | 0.183 |
| **EBPE** | | | | | |
| Boys | 34.76/33.06 | +0.75 | 0.23 | 7.34/5.84 | 0.407 |
| Girls | 29.92/27.15 | +1.11 | 0.14 | 6.18/6.12 | 0.029 |
| **EBASA** | | | | | |
| Boys | 29.67/30.92 | -0.38 | 0.35 | 8.86/7.25 | 0.109 |
| Girls | 28.23/27.08 | +0.38 | 0.35 | 8.59/6.66 | 0.019 |

*The *p*-value scores at the $p \leq 0.05$ significance are indicated in bold.

*Curl-Up Findings*. While 98% of the participants had met the HFZ for curl-ups either pre- or post study, one participant from the girls' control group was not able to meet the HFZ standard, in addition to a single participant in the boys' control group (≥15 curl-ups). The pre- and post study scores of the two control group participants that were not able to meet the HFZ did not impact the *p*-value significance for either control group, as determined by data

calculation.

The inconsistency on curl-up performance over the course of the study was unexpected. One of the national goals for a physical education program is to improve the fitness performance for students on multiple fitness assessments (Maine Parameters for Learning, 2011; SHAPE, 2014). A change in curriculum only and/or the addition of physical activity as part of an after school program did not result in steady improvement on curl-ups for the intervention groups.

**Push-Ups.** The push-up assessment is a procedure that determines muscle endurance for the upper body. A high number of participants (94%), regardless of being in the control group or an intervention group, achieved their best push-up score post study.

*Push-Up Data Analysis*. The data collected as part of the push-up assessment for the boys' and girls' control groups and intervention groups did not translate into the *p*-value (≤0.05) of significance that was established for this study. The data for push-ups is included in Table 6.

The intervention groups and the control group did not include push-up data to support differences according to gender. Therefore, the *p*-value for the two-way ANOVA for repeated measures was not at the established significance value (≤0.05).

*Push-Up Findings*. Ninety-seven percent of the participants in this study, regardless of intervention or control group, were consistent in meeting the HFZ for push-ups at the two assessment points for this study (boys≥8 and girls≥7). The majority of the girls (67%) and the boys (63%) posted their best score post study.

However, two girls in the control group and one girl in the EBASA group were not able to meet the HFZ (≥7) at any point during the study. The three outliers did not alter the *p*-value significance of the girls' control group or the EBASA group, as determined with data analysis.

Additionally, it is important to note that one girl in the EBPE only group was able to raise her pre- study push-up score from the Needs Improvement level to a score that met the HFZ by post study. This one outlier did not alter the significance value for the EBPE group.

Table 6.

*Boys' and Girls' Data Analysis for Push-Ups, Pre- to Post Study (mean, t-score, p-value, standard deviation [SD], effect size).*

| | **mean pre/post** | **t-score** | **p-value** | **SD pre/post** | **effect size** |
|---|---|---|---|---|---|
| **Control** | | | | | |
| Boys | 28.73/28.64 | +0.01 | 0.41 | 18.77/15.01 | N/A |
| Girls | 17.41/23.18 | -1.32 | 0.10 | 10.70/14.43 | |
| **ASA** | | | | | |
| Boys | 28.67/27.33 | +018 | 0.43 | 13.23/11.94 | 0.093 |
| Girls | 23.50/23.33 | +0.03 | 0.49 | 12.85/4.76 | 0.012 |
| **EBPE** | | | | | |
| Boys | 29.06/34.65 | -1.14 | 0.13 | 13.34/15.21 | 0.397 |
| Girls | 17.92/22.77 | -1.09 | 0.14 | 12.45/9.98 | -0.032 |
| **EBASA** | | | | | |
| Boys | 28.33/33.42 | -0.85 | 0.20 | 12.24/16.72 | 0.614 |
| Girls | 25.62/25.23 | +0.07 | 0.47 | 14.64/12.74 | 0.149 |

*The *p*-value scores at the $p \leq 0.05$ significance are indicated in bold.

Sixty-three percent of the participants gave their best push-up performance during the post study check. However, the percentage of participants that did not improve over the course of the study (37%) must be analyzed as well. Physical education teachers should strive for improved fitness levels for their students on all assessments (SHAPE, 2014). The change in curriculum and/or implementing an after school activity did not have the impact on push-ups as hypothesized.

**One-Mile Run.** The one-mile run is a fitness assessment that determines the level of cardiovascular endurance for students. Over 90% of the participants were able to achieve their

best mile time post study. In fact, 91% of the boys and 92% of the girls, regardless of control or intervention group, achieved their best one mile time post study.

Past performance for grade 5 students on this assessment had been of great concern to the researcher (Appendix C). Historically, 70% (+/-) of grade 5 students have met the HFZ level for the one-mile run. With 30% of students unable to meet the HFZ, it was clear a plan needed to be established for improvement on this particular assessment.

*One-Mile Run Data Analysis*. The data collected for the one-mile run assessment did reflect trends and significance for the control and intervention groups. Implications also emerged in relationship with two of the intervention groups according to gender.

The boys' intervention groups all indicated measured growth and/or trends pre- to post study. Table 7 outlines the mean, t-score, *p*-value, standard deviation, and effect size for the control and intervention groups. While the EBPE group and EBASA group did meet the $p \leq 0.05$ significance, the ASA group value ($p=0.06$) did support the trend that emerged among the boys' groups.

The girls' control group, along with the girls' EBPE and EBASA intervention groups, did indicate a *p*-value data to support significant growth on the one-mile assessment. However, the girls' ASA group did not reflect the same growth as compared with the two other intervention groups.

A two-factor ANOVA test for repeated measures was used to examine the significance of gender, as it related to one-mile run performance for the control group and intervention groups over the course of the study. The EBPE group (MS=45.65, F=5.96, $p=0.02$) had a significant *p*-value as compared by gender. Figure 1 shows the mean score differences of the EBPE group for

the boys' and girls' mean scores pre- and post study. The Tukey's range test, a post hoc analysis, indicated that the boys' EBPE group was impacted by the intervention, as compared to the girls' EBPE group.

Table 7.

*Boys' and Girls' Data Analysis for the One-Mile Run, Pre- to Post Study (mean, t-score, p-value, standard deviation [SD], and effect size).*

| | **mean pre/post** | **t-score** | **p-value** | **SD pre/post** | **effect size** |
|---|---|---|---|---|---|
| **Control** | | | | | |
| Boys | 12.63/11.09 | +0.93 | 0.18 | 3.98/3.83 | N/A |
| Girls | 13.37/11.60 | +1.66 | **0.05** | 3.56/2.58 | |
| **ASA** | | | | | |
| Boys | 10.13/8.62 | +1.72 | 0.06 | 1.86/1.09 | -0.774 |
| Girls | 13.13/10.88 | +1.34 | 0.10 | 2.96/2.87 | -0.272 |
| **EBPE** | | | | | |
| Boys | 13.37/10.48 | +3.32 | **0.001** | 2.92/2.09 | -0.211 |
| Girls | 10.78/9.47 | +1.97 | **0.03** | 1.99/1.34 | -0.996 |
| **EBASA** | | | | | |
| Boys | 9.90/8.34 | +2.58 | **0.009** | 1.69/1.22 | -0.987 |
| Girls | 12.42/10.14 | +3.46 | **0.001** | 1.71/1.64 | -0.656 |

*The *p*-value scores at the $p \leq 0.05$ significance are indicated in bold.

Additionally, the EBASA group also had significant ANOVA data (MS=58.23, F=13.39, *p*=.001) according to gender. Figure 2 includes the EBASA mean score improvement for the boys and the girls in this group. The Tukey's range test, a post hoc analysis, indicated that while both the boys' and girls' in the EBASA group improved their one-mile times over the course of the study, the data shows that the girls had a greater improvement pre- to post study as compared to the boys.

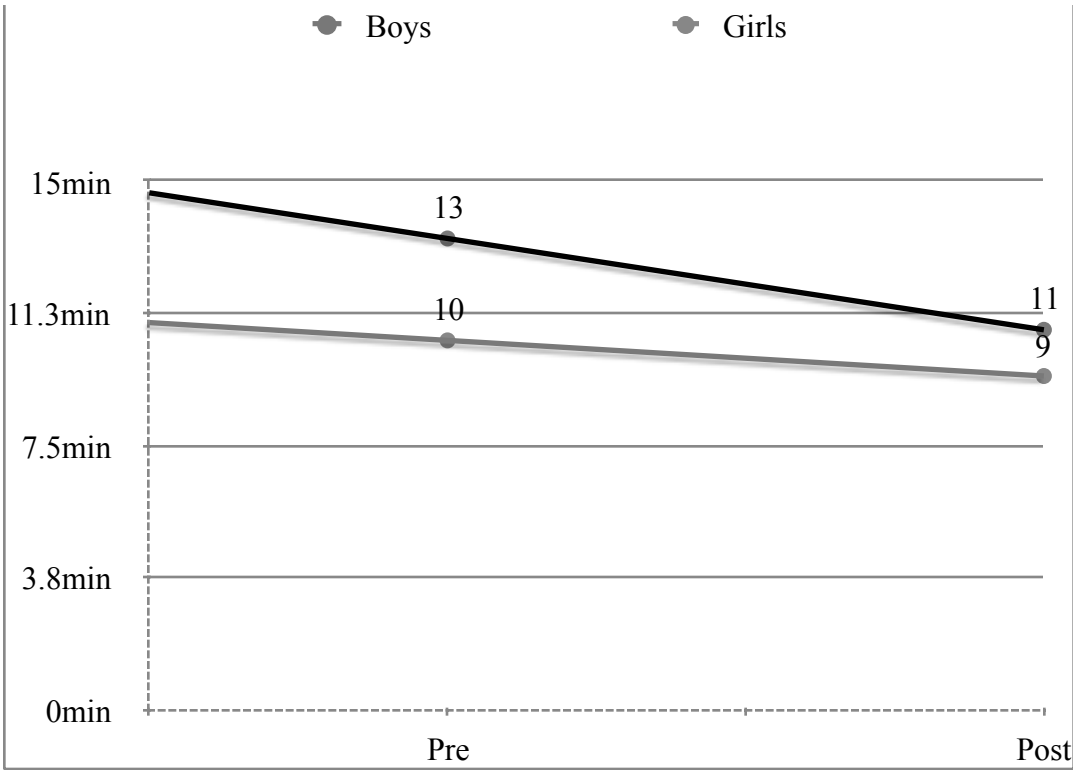


Figure 1. *Pre- and post study mean scores for the EBPE group (boys' and girls') one-mile run, 2014. The graphic shows that the boys' mean scores (top line) improved significantly as compared to the girls' mean scores (low line) pre- to post study.*

*One-Mile Run Findings*. Of the 95 participants (49 girls/46 boys), 52% of the participants did not reach the HFZ one-mile standard pre-study. At the post study mark, the percentage had improved to 82% of the participants meeting the HFZ standard. Separated by gender, 82% of the girls were able to reach the HFZ one-mile run time (≤12:30) post study and 78% of the boys met the HFZ one-mile run time (≤11:30) at the post study point (The Cooper Institute, 2010).

In the control group, 8 of the 17 girls were at the Needs Improvement level pre-study, with all other participants in this group within the Healthy Fitness Zone. Three of the eight girls at the Needs Improvement level were able to improve their mile time to meet the HFZ guidelines post study. Five of the seventeen girls did not meet the HFZ for the one-mile run at any point

during the study. However, the same 5 girls did improve their one mile time from pre-study to post study. Five of the eleven boys in the control group started the study at the Needs Improvement level. Two boys in this group were able to improve their mile time to meet the Healthy Fitness Zone. Three boys were unable to meet the HFZ for the one-mile run.

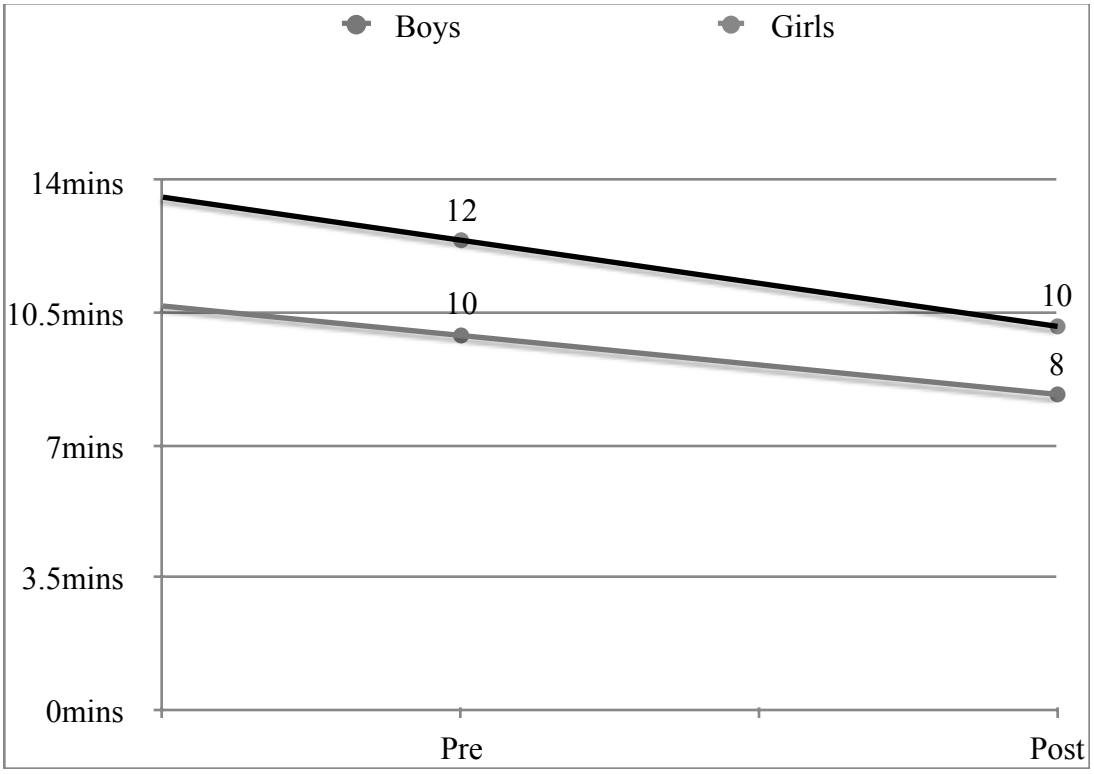


Figure 2. *Pre- and post study mean scores for the EBASA group (boys' and girls') one-mile run, 2014. The graphic shows that the girls' mean scores (top line) improved significantly over the course of the study, as compared to the boys' mean scores (lower line).*

Two of the six girls in the ASA intervention group started the study at the Needs Improvement level. One girl improved to meet the HFZ standard post study and another girl had a one-mile time at the Needs Improvement level the entire study. This group of six boys started with two participants within the HFZ and four boys at the Needs Improvement level. All of the participants in this intervention group improved to the HFZ by post study.

Ten of the thirteen girls in the EBPE intervention group began the study with one-mile

times that were within the Healthy Fitness Zone. Post study data indicated that every girl in the EPBE group met the HFZ standard. Thirteen of the seventeen boys in the EBPE group were at the Needs Improvement level pre-study. At the post study point, eight of these boys had moved up to the HFZ, with 5 remaining at the Needs Improvement level.

In terms of the EBASA group, seven of the thirteen girls were at the Needs Improvement category pre-study. By the post study point, eleven girls had met the standard set for the Healthy Fitness Zone. Of the twelve boys in this group, three participants were at the Needs Improvement level to begin the study. By the post study point, these three participants were able to reach the HFZ threshold.

Every group, regardless of being a control or intervention group, had participants that did not meet the HFZ pre-study. The number of boys and girls meeting the HFZ was varied according to group. Three gender groups had every participant meeting the HFZ post study: girls' EBPE, boys' ASA, and boys' EBASA.

**Fundamental Motor Skills**

The Test of Gross Motor Development-2 (TGMD-2) was administered to determine the fundamental motor skill proficiency level of participants in this study. A scale of 1-4 was utilized, with a score of 4 indicating the highest proficiency level (Ulrich, 2000). The following fundamental motor skills were included in the study: run, slide, overhand throw, horizontal jump, kick, and strike. Any changes in performance for all groups, in terms of FMS performance (pre- to post study), were calculated with an independent t-test to determine significant *p*-value ($p \leq 0.05$). The 2 x 2 factor ANOVA test for repeated measures was also utilized to determine changes in performance connected to gender. Any significant *p*-values ($\leq 0.05$) on the ANOVA

indicated a necessity to conduct a post hoc Tukey's range test, to identify the gender that was most impacted by the intervention. There was an expectation by the researcher that the participants would improve or maintain their fundamental motor skills pre-study to post study, as indicated by the research of Castelli & Valley (2007) and Ericcson (2011). The six fundamental motor skill are described in Appendix F.

The pre-study FMS assessments were conducted 2-3 weeks prior to the start of the 12-week study (August/September 2014). All post study assessments in the area of FMS were completed after the 2-week holiday break (January 2015).

In this section, the data tables for the fitness assessments (mean, t-score, *p*-value, standard deviation, and effect size) are outlined by control group (district curriculum only) and intervention groups: 1) after school activity and district curriculum (ASA), 2) evidence-based physical education curriculum only (EBPE), and 3) evidence-based physical education curriculum and after school activity (EBASA).

**Fundamental Motor Skill-Run.** The running assessment was the first FMS administered to the participants. This type of running assessment differs from the one-mile run fitness assessment, as the FMS of running examines the mechanics of running, not how fast a person can run a specific distance.

*Overall FMS Running Data*. The control group and intervention groups, regardless of gender, had 99% of the participants achieving Level 4 proficiency by post study. Arm motion and torso lean were the running criteria that most participants were able to adjust pre- to post study to meet Level 4 proficiency.

The data collected to determine *p*-values for the control and intervention groups is

included in Table 8. This data indicates that the treatments of curriculum and/or participation in the after school activity did impact running performance for two girls' groups (control and EBASA) and two boys' groups (EBPE and EBASA). The 2 x 2 factor ANOVA test for repeated measures was conducted on the running data to determine growth according to gender, but no significant differences or trends were noted.

Table 8.

*Boys' and Girls' Data Analysis for the FMS of Running, Pre- to Post Study (mean, t-score, p-value, standard deviation [SD],and effect size).*

| | **mean pre/post** | **t-score** | ***p*-value** | **SD pre/post** | **effect size** |
|---|---|---|---|---|---|
| **Control** | | | | | |
| Boys | 3.55/3.82 | -1.13 | 0.14 | 0.52/0.60 | |
| Girls | 3.71/4.00 | -2.58 | **0.007** | 0.47/0.00 | N/A |
| **ASA** | | | | | |
| Boys | 4.00/4.00 | NaN | NaN | NaN | NaN |
| Girls | 4.00/4.00 | NaN | NaN | NaN | NaN |
| **EBPE** | | | | | |
| Boys | 3.76/4.00 | -2.22 | **0.02** | 0.44/0.00 | 0.484 |
| Girls | 4.00/4.00 | NaN | NaN | NaN | NaN |
| **EBASA** | | | | | |
| Boys | 3.75/4.00 | -1.91 | **0.03** | 0.45/0.00 | 0.435 |
| Girls | 3.77/4.00 | -1.90 | **0.03** | 0.44/0.00 | NaN |

*The *p*-value scores at the $p \leq 0.05$ significance are indicated in bold.

*FMS Running Findings*. A large number of the participants (79%) met Level 4 proficiency pre-study, signifying that the district curriculum did prepare a large number of participants for this assessment prior to grade 5. While 21% of the participants were at a Level 3 proficiency pre-study, the evidence-based curriculum and district curriculum were both equally efficient in terms of assisting those at Level 3 pre-study to reach a Level 4 proficiency by post

study. One boy from the control group was inconsistent between pre-study and post study, declining from Level 4 to Level 2 proficiency.

Table 9 shows that 94 of the 95 participants were able to reach Level 4 proficiency for the FMS of running, indicating the one boy from the control group that was below the desired Level 4 standard.

**Fundamental Motor Skill-Slide.** Sliding was the second FMS assessed during the study. Sliding, also known as sideways galloping or a defensive slide, is a skill that was familiar for most participants, but was not executed correctly on a consistent basis. While a majority of the participants (over 88%) were able to meet Level 4 proficiency by post study (girls=86%/ boys=91%), some participants remained at Level 3 for the entire study and a small number were inconsistent between Level 4 and Level 3 proficiency. Improper foot direction did prevent some participants from achieving Level 4 proficiency on the FMS of sliding.

Table 9.

*Proficiency Level Attained for the FMS of Running, Control and Intervention Groups.*

| | **Level 4** | **≤Level 3** | **Total** |
|---|---|---|---|
| **Control**<br>Boys<br>Girls | <br>10<br>17 | <br>1<br>0 | <br>11<br>17 |
| **ASA**<br>Boys<br>Girls | <br>6<br>6 | <br>0<br>0 | <br>6<br>6 |
| **EBPE**<br>Boys<br>Girls | <br>17<br>13 | <br>0<br>0 | <br>17<br>13 |
| **EBASA**<br>Boys<br>Girls | <br>12<br>13 | <br>0<br>0 | <br>12<br>13 |

*Overall Sliding Data.* The boys' control group and the three boys' intervention groups, along with the girls' control and two girls' intervention groups, had data of significance in relationship to the FMS of sliding. The mean, t-score, *p*-value, standard deviation (SD), and effect sizes for all groups, outlined by gender, are included in Table 10.

Table 10.

*Boys' and Girls' Data Analysis for the FMS of Sliding, Pre- to Post Study (mean, t-score, p-value, standard deviation [SD], effect size).*

| | **mean pre/post** | **t-score** | ***p*-value** | **SD pre/post** | **effect size** |
|---|---|---|---|---|---|
| **Control** | | | | | |
| Boys | 3.36/4.00 | -4.18 | **0.0002** | 0.50/0.00 | N/A |
| Girls | 3.35/3.65 | -1.74 | **0.05** | 0.49/0.49 | |
| **ASA** | | | | | |
| Boys | 3.50/4.00 | -2.24 | **0.02** | 0.55/0.00 | 0.367 |
| Girls | 3.67/3.83 | -0.62 | 0.27 | 0.52/0.41 | 0.381 |
| **EBPE** | | | | | |
| Boys | 3.53/3.82 | -1.87 | **0.04** | 0.51/0.39 | -0.588 |
| Girls | 3.54/4.00 | -3.21 | **0.002** | 0.52/0.00 | 0.945 |
| **EBASA** | | | | | |
| Boys | 3.58/3.92 | -1.96 | **0.03** | 0.51/0.29 | -0.381 |
| Girls | 3.62/4.00 | -2.74 | **0.006** | 0.51/0.00 | 0.945 |

*The *p*-value scores at the $p \leq 0.05$ significance are indicated in bold.

The boys' control, ASA, EBPE, and EBASA groups each indicated *p*-values that met the significance value of ≤0.05 pre- to post study. There were also three girls' groups with data resulting in the *p*-value set for the study and included the girls' control group, the girls' EBPE group, and the girls' EBASA group. The 2 x 2 factor ANOVA test for repeated measures was conducted on the sliding data to determine if a change in curriculum and/or participation in the after school activity had an impact on performance according to gender. There were no groups

with data of the significant value.

*FMS Sliding Findings*. Each of the four groups, control and intervention, included at least one outlier that did not reach Level 4 proficiency, or dropped from Level 4 to Level 3 proficiency, over the course of the study. The outliers were of both genders.

While the district curriculum and the SPARK evidence-based curriculum did have an impact on most of the control and intervention groups for the FMS of sliding (excluding the girls' ASA group), the girls' EBPE and EBASA groups made significant progress. The girls' control group included six girls that ended the study with a Level 3 proficiency score on sliding and one girl from the ASA group remained at Level 3 post study. In contrast, the girls' EBPE and EBASA groups had both improved from 54% and 62% up to the 100% mark for participants at Level 4 proficiency post study.

Table 11 has the data indicating that the intervention groups were successful in meeting Level 4 proficiency, with small number of outliers in the combined groups. Table 11 also shows that the girls' control group struggled with sliding, with 6 of the 17 unable to attain Level 4 proficiency.

Every boys' group, control and intervention, had data resulting in significant *p*-values. In contrast to the girls' data results, the boys' control and ASA groups were the two groups with 100% of the participants achieving Level 4 proficiency post study, after starting the study at 36% and 50%. In fact, the EBPE and EBASA groups each had participants that ended the study at Level 3 proficiency.

Table 11.

*Proficiency Level Attained for the FMS of Sliding, Control and Intervention Groups.*

| | **Level 4** | **≤Level 3** | **Total** |
|---|---|---|---|
| **Control** | | | |
| Boys | 11 | 0 | 11 |
| Girls | 11 | 6 | 17 |
| **ASA** | | | |
| Boys | 6 | 0 | 6 |
| Girls | 5 | 1 | 6 |
| **EBPE** | | | |
| Boys | 14 | 3 | 17 |
| Girls | 13 | 0 | 13 |
| **EBASA** | | | |
| Boys | 11 | 1 | 12 |
| Girls | 13 | 0 | 13 |

**Fundamental Motor Skill-Overhand Throw.** The fundamental motor skill of overhand throwing was the third skill assessed as part of the study. Overhand throwing is assessed as part of the grade 3 report of progress in the district, yet meeting the specific criteria for overhand throwing has been challenging for students on a consistent basis beyond grade three. The action of not stepping in opposition (stepping with the opposite foot of the throwing hand), and poor execution of a follow through, prevented some participants from reaching Level 4 proficiency on the FMS of overhand throwing.

*Overall FMS Overhand Throwing Data*. All four groups, regardless of gender, had at least 67% of participants that were able to achieve Level 4 proficiency post study. Additionally, nearly every control group and intervention group had one participant that remained consistent at a Level 3 proficiency for the entirety of the study or participants that dropped in proficiency level over the course of the study. The single group that had 100% of participants at Level 4 post

study was the girls' EBASA group. One girl in the control group remained at Level 1 proficiency for the entire study. This outlier did not have an impact on the data analysis.

The data collected for the girls' control group, the girls' EBPE group, and the girls' EBASA group did indicate that there was an impact on the FMS of overhand throwing pre- to post study and translated into a significant *p*-value. Table 12 has the mean, t-score, *p*-value, standard deviation (SD), and effect size for the girls' and boys' groups pre- to post study.

The boys' ASA group data also translated into *p*-values that were significant for the study. The two remaining boys' intervention groups (EBPE and EBASA), and the boys' control group, did not have the data to support significant changes for overhand throwing over the course of the study.

Table 12.

*Boys' and Girls' Data Analysis for Overhand Throwing, Pre- to Post Study (mean, t-score, p-value, standard deviation [SD], effect size).*

| | **mean pre/post** | **t-score** | ***p*-value** | **SD pre/post** | **effect size** |
|---|---|---|---|---|---|
| **Control** | | | | | |
| Boys | 3.18/3.72 | -1.54 | 0.07 | 1.08/0.47 | |
| Girls | 2.53/3.53 | -3.33 | **0.001** | 0.87/0.87 | N/A |
| **ASA** | | | | | |
| Boys | 3.17/3.83 | -1.91 | **0.04** | 0.75/0.41 | 0.222 |
| Girls | 3.33/3.67 | -1.12 | 0.14 | 0.52/0.52 | 0.175 |
| **EBPE** | | | | | |
| Boys | 3.65/3.82 | -1.01 | 0.16 | 0.61/0.39 | 0.213 |
| Girls | 3.23/3.85 | -2.05 | **0.03** | 0.93/0.55 | 0.427 |
| **EBASA** | | | | | |
| Boys | 3.25/3.83 | -1.58 | 0.06 | 1.22/0.39 | 0.233 |
| Girls | 3.31/4.00 | -2.63 | **0.007** | 0.95/0.00 | 0.715 |

*The *p*-value scores at the $p \leq 0.05$ significance are indicated in bold.

The 2 x 2 factor ANOVA test for repeated measures was also conducted utilizing the overhand throwing data to determine any changes that may have emerged according to gender. No significant differences or trends emerged.

*FMS Overhand Throwing Findings*. Every group had participants at varying proficiency levels pre-study, ranging from Level 1 to Level 4 proficiency. The girls' EBASA group was the single group that included every participant at Level 4 proficiency by post study. Each of the other three groups, separated by gender, included at least one participant that was unable to reach Level 4 proficiency over the course of the study.

Table 13 includes the number of participants from the control and intervention groups that were able to meet Level 4 proficiency on the FMS of overhand throwing. It is clear that the control group and the ASA intervention group had a high number of participants that were not able to meet Level 4.

Table 13.

*Proficiency Level Attained for the FMS of Overhand Throwing, Control and Intervention Groups.*

| | **Level 4** | **≤Level 3** | **Total** |
|---|---|---|---|
| **Control** | | | |
| Boys | 9 | 2 | 11 |
| Girls | 12 | 5 | 17 |
| **ASA** | | | |
| Boys | 5 | 1 | 6 |
| Girls | 4 | 2 | 6 |
| **EBPE** | | | |
| Boys | 14 | 3 | 17 |
| Girls | 12 | 1 | 13 |
| **EBASA** | | | |
| Boys | 10 | 2 | 12 |
| Girls | 13 | 0 | 13 |

While certain groups had a single participant at Level 3 proficiency on the FMS of overhand throwing, the girls' control group and the girls' ASA group had two or more participants at Level 3 proficiency post study. In fact, 5 participants in the control group remained at Level 3 through post study. The inconsistency of these two groups on the FMS of overhand throwing indicates that the district curriculum and the evidence-based physical education curriculum might not be equal in assisting students to be successful with the FMS of overhand throwing. Incorporating overhand throwing into the curriculum on a consistent basis, a strategy typical of an evidence-based physical education curriculum, might make a difference in the maintenance of this skill.

**Fundamental Motor Skill-Horizontal Jump.** The horizontal jump was the fourth FMS assessment conducted as part of this study. Horizontal jumping is not assessed as part of the district curriculum. A high percentage of participants (girls-76%/boys-91%) were able to meet Level 4 proficiency by post study. The lack of appropriate arm movement during the pre-jump phase and landing with straight knees were the two criteria of horizontal jumping that prevented participants from achieving a Level 4 proficiency.

*Overall FMS Horizontal Jump Data*. The data collected for the FMS of horizontal jumping was significant for the girls' control group and all three intervention groups, in addition to the boys' control group and two intervention groups. The *p*-values for the girls' groups, that were determined from the mean data and t-scores, along with standard deviation and effect size, are included in Table 14.

The 2 x 2 factor ANOVA test for repeated measures was conducted on the horizontal jumping data to determine whether the treatment of change in curriculum and/or participation in

the after school activity program impacted performance by gender. No trends emerged.

*FMS Horizontal Jumping Findings*. The data for most of the groups, divided by gender, revealed data specific to the significant *p*-value (≤0.05) established for this study (excluding the boys' ASA group). There were no outliers for the FMS of horizontal jumping.

The control group, that utilized the district curriculum, had the highest number of participants that concluded the study at a Level 3 proficiency. Eight of the seventeen girls were at Level 3 proficiency post study, with three of the eleven boys at Level 3 proficiency by the end of the study. Conversely, the 6 girls in the ASA group were all at Level 4 proficiency post study. The EBPE and EBASA groups combined had three girls not able to attain Level 4 proficiency and only one boy that did not meet Level 4 proficiency. The boys' data can be found in Table 15.

Table 14.

*Girls' Data Analysis for Horizontal Jumping, Pre to Post Study (mean, t-score, p-value, standard deviation [SD], effect size).*

| | **mean pre/post** | **t-score** | ***p*-value** | **SD pre/post** | **effect size** |
|---|---|---|---|---|---|
| **Control** Girls | 2.94/3.47 | -1.99 | **0.03** | 0.90/0.62 | N/A |
| **ASA** Girls | 3.00/3.83 | -2.71 | **0.01** | 0.63/0.41 | 0.624 |
| **EBPE** Girls | 3.38/3.85 | -1.76 | **0.05** | 0.87/0.38 | 0.716 |
| **EBASA** Girls | 3.23/3.92 | -3.22 | **0.001** | 0.73/0.28 | 0.894 |

*The *p*-value scores at the p≤0.05 significance are indicated in bold.

The attainment of a proficiency level of 4 for the FMS of horizontal jumping was a challenge for the control group. As shown inTable 16, 11 of the 28 participants scored at less

than the expected Level 4 proficiency.

The information suggests that extra practice and/or an alternative method to teach horizontal jumping is beneficial for this particular motor skill. Of course, the ultimate goal is to have every student achieve Level 4 proficiency. It appears that the SPARK evidence-based physical education lessons and/or the after school program better prepare students to meet Level 4 proficiency for horizontal jumping, as compared to the district curriculum.

Table 15.

*Boys' Data Analysis for Horizontal Jumping, Pre- to Post Study (mean, t-score, p-value, standard deviation [SD], effect size).*

| | **mean pre/post** | **t-score** | ***p*-value** | **SD pre/post** | **effect size** |
|---|---|---|---|---|---|
| **Control** Boys | 2.82/3.73 | -2.56 | **0.009** | 1.08/0.47 | N/A |
| **ASA** Boys | 3.50/4.00 | -1.46 | 0.09 | 0.84/0.00 | 0.704 |
| **EBPE** Boys | 3.24/3.94 | -3.68 | **0.0004** | 0.75/0.24 | 0.605 |
| **EBASA** Boys | 3.33/4.00 | -2.47 | **0.004** | 0.78/0.00 | 0.832 |

*The *p*-value scores at the $p \leq 0.05$ significance are indicated in bold.

**Fundamental Motor Skill-Kicking.** The kick was the fifth FMS that was assessed as part of this study. Kicking a stationary ball is assessed during grade 3, but the students struggle consistently with two specific kicking criteria: contacting the ball with the instep and the execution of a follow through. A majority of the participants (56%) were able to meet Level 4 proficiency post study (girls-61%/boys-50%).

*Overall Kicking Data*. The data collected for the FMS of kicking did show increased

proficiency for the control and intervention groups over the course of the study. Important progress has been noted in relationship to intervention groups and the control group.

Every girls' group included data with marked implications for the FMS of kicking pre- to post study and had data to support the *p*-value (≤0.05). Table 17 outlines the mean, t-score, *p*-value, standard deviation, and effect size for the control group and the three intervention groups.

Table 16.

*Proficiency Level Attained for the FMS of Horizontal Jumping, Control and Intervention Groups.*

| | **Level 4** | **≤Level 3** | **Total** |
|---|---|---|---|
| **Control** | | | |
| Boys | 8 | 3 | 11 |
| Girls | 9 | 8 | 17 |
| **ASA** | | | |
| Boys | 6 | 0 | 6 |
| Girls | 5 | 1 | 6 |
| **EBPE** | | | |
| Boys | 16 | 1 | 17 |
| Girls | 11 | 2 | 13 |
| **EBASA** | | | |
| Boys | 12 | 0 | 12 |
| Girls | 12 | 1 | 13 |

The boys' control group and the boys' EBASA group had significant *p*-values (≤0.05) pre- to post study for kicking. The data for every boys' group is included in Table 18.

The boys' ASA and EBPE groups each had 2 or more participants that showed a decline pre- to post study. As a result, there were no *p*-values of significance determined from the data for the two intervention groups.

Table 17.

*Girls' Data Analysis for Kicking, Pre- to PostStudy (mean, t-score, p-value, standard deviation [SD], effect size).*

| | **mean pre/post** | **t-score** | ***p*-value** | **SD pre/post** | **effect size** |
|---|---|---|---|---|---|
| **Control** Girls | 3.00/3.47 | -2.70 | **0.005** | 0.50/0.51 | N/A |
| **ASA** Girls | 3.00/3.67 | -2.00 | **0.04** | 0.63/0.52 | 0.39 |
| **EBPE** Girls | 3.08/3.62 | -3.36 | **0.001** | 0.28/0.51 | 0.294 |
| **EBASA** Girls | 3.00/3.77 | -6.32 | **<.0001** | 0.00/0.44 | 0.623 |

*The *p*-value scores at the $p \leq 0.05$ significance are indicated in bold.

The 2 x 2 factor ANOVA test for repeated measures was conducted using the kicking data from the four groups and in accordance to gender. There was no measured difference according to gender.

*FMS Kicking Findings.* While every participant attained a Level 4 or Level 3 proficiency at the post study point, the proficiency level data can be examined further. Table 19 includes information in regard to the groups and proficiency levels that were attained post study. It is important to note that the EBPE group and the EBASA group had a higher number of participants achieve Level 4 proficiency when compared to the control or ASA groups.

Table 18.

*Boys' Data Analysis for the FMS of Kicking, Pre- to Post Study (mean, t-score, p-value, standard deviation [SD], effect size).*

| | **mean pre/post** | **t-score** | ***p*-value** | **SD pre/post** | **effect size** |
|---|---|---|---|---|---|
| **Control** Boys | 3.10/3.64 | -2.10 | **0.02** | 0.52/0.50 | N/A |
| **ASA** Boys | 3.00/3.50 | -1.46 | 0.09 | 0.63/0.55 | -0.271 |
| **EBPE** Boys | 3.29/3.29 | 0.00 | 0.50 | 0.47/0/47 | -0.727 |
| **EBASA** Boys | 3.17/3.67 | -2.76 | **0.006** | 0.38/0.49 | 0.061 |

*The *p*-value scores at the $p \leq 0.05$ significance are indicated in bold.

The EBPE group had the highest number of participants at Level 3 proficiency post study (5 of 13 girls/12 of 17 boys=17 total). Eight girls and five boys were at Level 4 proficiency. The control group had 54% of participants at Level 4 proficiency (8 of 17 girls at Level 4 and 7 of 11 boys reaching the same level). With the smallest number of participants (12 total), the ASA group split the boys with three at Level 3 proficiency and three at Level 4 proficiency, while four of the six girls met Level 4 proficiency. The girls' and boys' EBASA groups had the highest number of participants at Level 4 proficiency post study (10 girls and 8 boys=18 total), with only three girls and four boys remaining at Level 3 proficiency.

The number of participants that were able to reach Level 4 proficiency according to control group or intervention group is of interest. The *p*-values indicate significance for most of the groups on this fundamental motor skill. However, meeting the Level 4 proficiency is of great importance as well. The girls' control group, boys' ASA, and the boys' EPBE group did not have

majority of participants able to attain Level 4 proficiency (47%, 50%, and 29% respectively).

Table 19.

*Proficiency Level Attained for the FMS of Kicking, Control and Intervention Groups.*

| | **Level 4** | **≤Level 3** | **Total** |
|---|---|---|---|
| **Control** | | | |
| **Boys** | 7 | 4 | 11 |
| Girls | 8 | 9 | 17 |
| **ASA** | | | |
| Boys | 3 | 3 | 6 |
| Girls | 4 | 2 | 6 |
| **EBPE** | | | |
| Boys | 5 | 12 | 17 |
| Girls | 8 | 5 | 13 |
| **EBASA** | | | |
| Boys | 8 | 4 | 12 |
| Girls | 10 | 3 | 13 |

A Level 4 proficiency indicates mastery of a skill and would be the criteria for meeting standards on a reporting/grading system. Therefore, the percentage of participants reaching Level 4 status would be significant to physical education teachers.

**Fundamental Motor Skill-Strike.** Striking was the sixth and final FMS assessment conducted as part of this study. The fundamental motor skill of striking had not been assessed as part of the district curriculum. While only 37% of the girls were at a Level 4 proficiency post study, a majority of the boys (57%) were able to meet Level 4 proficiency at the same point.

*Overall FMS Striking Data*. The data collected for the FMS of striking did indicate significance for the control group and all three intervention groups at the post study collection point. Every girls' group, regardless of control or intervention status, had data that translated into significant *p*-values (≤0.05). Table 20 outlines the mean, t-scores, *p*-values, standard

deviation, and effect size for all of the girls' groups.

Table 20.

*Girls' Data Analysis for Striking, Pre- to Post Study (mean, t-score, p-value, standard deviation [SD], and effect size).*

| | **mean pre/post** | **t-score** | **p-value** | **SD pre/post** | **effect size** |
|---|---|---|---|---|---|
| **Control** Girls | 1.53/3.00 | -6.93 | **<.0001** | 0.62/0.62 | N/A |
| **ASA** Girls | 2.00/3.50 | -4.39 | **0.0007** | 0.63/0.55 | 0.839 |
| **EBPE** Girls | 1.62/3.31 | -6.74 | **<.0001** | 0.51/0.75 | 0.460 |
| **EBASA** Girls | 1.69/3.46 | -9.02 | **<.0001** | 0.48/0.52 | 0.803 |

* The p-value scores at the $p \leq 0.05$ significance are indicated in bold.

The boys' control group and intervention groups all had marked growth on the FMS of striking as well. The mean, t-scores, *p*-values, standard deviation, and effect size pre- and post study are included in Table 21.

The 2 x 2 factor ANOVA test for repeated measures was conducted using the striking data from the four groups. There was no measured difference according to gender.

*FMS Striking Findings*. There was an expectation that every group would have data to support significant *p*-values for this fundamental motor skill, as the fundamental motor skill of striking was new for the participants. While there are many pieces of sports' equipment that can be used to teach the FMS of striking, a tennis racket was utilized for this skill. This motor skill is not included in the district curriculum and had never been assessed.

Table 21.

*Boys' Data Analysis for Striking, Pre- to Post Study (mean, t-score, p-value, standard deviation, effect size).*

| | **mean pre/post** | **t-score** | ***p*-value** | **SD pre/post** | **effect size** |
|---|---|---|---|---|---|
| **Control** Boys | 1.64/3.36 | -5.44 | **<.0001** | 0.81/0.67 | N/A |
| **ASA** Boys | 1.67/3.33 | -4.23 | **0.0009** | 0.82/0.52 | 0.612 |
| **EBPE** Boys | 2.06/3.71 | -7.14 | **<.0001** | 0.83/0.61 | 0.123 |
| **EBASA** Boys | 2.08/3.58 | -6.16 | **<.0001** | 0.67/0.51 | 0.119 |

*The *p*-value scores at the $p \leq 0.05$ significance are indicated in bold.

While the data for all of the groups did indicate the *p*-value significance set for the study, there is importance to the percentage of participants that were able to attain Level 4 proficiency. Table 22 indicates the number of participants in the control group and intervention groups that were able to reach Level 4 proficiency for the FMS of striking.

The Level 4 proficiency column, as compared to the ≤Level 3 column, has key information. It is noted that there were participants in every group that were able to reach the Level 4 proficiency mark. However, it is also clear to see that the EBPE and EBASA groups had a higher number of participants achieve Level 4 proficiency. Therefore, the SPARK curriculum, the common factor for these two intervention groups, could have an impact that is not revealed according to the calculated *p*-value data.

Table 22.

*Proficiency Level Attained for the FMS of Striking, Control and Intervention Groups.*

| | **Level 4** | **≤Level 3** | **Total** |
|---|---|---|---|
| **Control** | | | |
| **Boys** | 5 | 6 | 11 |
| Girls | 3 | 14 | 17 |
| **ASA** | | | |
| Boys | 2 | 4 | 6 |
| Girls | 2 | 4 | 6 |
| **EBPE** | | | |
| Boys | 12 | 5 | 17 |
| Girls | 6 | 7 | 13 |
| **EBASA** | | | |
| Boys | 7 | 5 | 12 |
| Girls | 6 | 7 | 13 |

## Conclusion

Ninety-five students were assessed at the pre- and post points of a 12-week study. Three fitness assessments and six fundamental motor skills were assessed at the key points for this study. A control group (n=28) followed the district physical education curriculum over the course of the study. The remaining 67 participants were separated into three intervention groups, based on their random placement into classrooms for the school year and/or the option to participate in an after school physical activity program. The following are the three intervention categories: 1) instruction using the district curriculum during the 12-week study and participation in an after school activity over the last 10-weeks of the study (ASA) (n=12), 2) instruction with an evidence-based physical education curriculum (EBPE) over the 12-weeks of the study (n=30), and 3) instruction with an evidence-based curriculum for the 12-week study and participation in the after school activity for the last 10-weeks of the study (EBASA) (n=25).

The Healthy Fitness Zone of the Fitnessgram protocol, and the ability to meet the established HFZ levels, were of importance to this study. Curl-ups, push-ups, and the one-mile run scores were compared to the Healthy Fitness Zone standards and in turn, were used to determine any changes in regard to performance over the course of the study. There was a particular focus on the participants that were at the Needs Improvement level pre-study and the ability of these participants to achieve the Healthy Fitness Zone post study. This information was utilized when analyzing the results.

The Test of Gross Motor Development-2 and meeting the set proficiency levels was a second significant piece to the study. The fundamental motor skills of running, sliding, overhand throwing, horizontal jumping, kicking, and striking were scored pre- and post study. In particular, the researcher wanted to determine any changes or growth according to the three categories of interventions (ASA, EBPE, and EBASA) as compared to the control group.

Differences did emerge on the fitness assessments and the fundamental motor skills for the control and intervention groups on select tasks. Similarities were also noted. The changes were due, in part, to participation in the three intervention groups. Other participants met standards as a result of their experiences outside of the school physical education program and after school opportunities.

Additionally, some of the variations in relationship to performance and data were due to gender. There were marked differences according to gender in the area of cardiovascular endurance. In this chapter, the data from the participants was presented according to performance on fitness assessments and proficiency levels for fundamental motor skills to answer the overarching question: Does the implementation of an evidence-based physical

education curriculum and/or after school activity program have an impact on grade 5 fitness assessment scores and fundamental motor skills? The information in this chapter, outlined with figures and tables, did verify that participants did show marked changes in relationship to their performance. Some participants recorded positive growth and other exhibited decline over the course of the study. The final chapter will discuss the results, findings, limitations, and suggestions for further research.

# Chapter 5: Findings, Conclusions, and Recommendations

Note: As encouraged by Plymouth State University, the final chapter is written to meet the standards for the *Journal of Teaching Physical Education*.

## Abstract

The purpose of this study was to examine the effect of an evidence-based physical education curriculum and/or an after school activity program on the improvement of a cardiovascular fitness assessment and the attainment of fundamental motor skills (FMS) for grade 5 students. The participants ($n$=95) included 49 girls and 46 boys. The Fitnessgram (The Cooper Institute, 2010) one-mile run Healthy Fitness Zone (HFZ) standards were utilized to determine cardiovascular endurance performance. The level of fundamental motor skill proficiency was determined utilizing the Test of Gross Motor Development-2 standards (Ulrich, 2000). The two intervention groups that included students in the after school activity program had a higher percentage of participants that met the HFZ standards on the one-mile run cardiovascular fitness assessment than the control group that used the district physical education curriculum and the intervention group that utilized the evidence-based physical education curriculum . Grade five participants taught utilizing the evidence-based physical education curriculum had a higher percentage that were able to meet Level 4 proficiency on four of the six fundamental motor skills than the two groups that were taught utilizing the district physical education curriculum. The findings suggest that a combination of an evidence-based physical education curriculum and an after school activity provide students with the best opportunity to be successful in elementary school physical education on the key areas of cardiovascular fitness and fundamental motor skills.

*Keywords:* evidence-based physical education, cardiovascular endurance, fundamental motor skills

## Introduction

Physical education classes in public schools are considered to be the optimal settings for the acquisition of fundamental motor skills (Blankenship, 2013; Castelli & Valley, 2007; Lund, 2013; NASPE, 2013; Penney & Jess, 2004; SHAPE, 2014) and the promotion of physical activity (AHA, 2013a; CDC, 2012; Institute of Medicine of the National Academies, 2013; McKenzie & Lounsbery, 2009; NASPE, 2013; Pate et al, 2006; SHAPE, 2014; USDHHS, 2008).

Studies conducted by the Academy of Pediatrics (2011), the American Heart Association (AHA) (2013a), the United States Department of Health and Human Services (USDHHS) (2010), and the White House Task Force on Obesity (2010) all indicate that there are schools and groups in the United States engaging in the effort to increase physical education and physical activity. An appeal from the AHA (2013a), the Society of Health and Physical Educators (SHAPE) (2014), and the USDHHS (2010), calls upon school administrators and school districts across the United States to increase both physical education and physical activity during the school day, to assist our children in the fight against health-related diseases. Currently, the experts recommend 60 minutes of health-enhancing physical activity every day (American Academy of Pediatrics, 2011; AHA, 2013a; CDC, 2010; NASPE, 2013; SHAPE, 2014; USDHHS, 2010).

These studies support an increase in time for physical education, while other researchers have described components of successful physical education programs. These components include: a curriculum that matches the physical education environment, the time to teach

fundamental motor skills, the incorporation of moderate-to-vigorous physical activity (MVPA), and instruction in the area of health-related fitness (AHA, 2013a; McKenzie & Lounsbery, 2009; NASPE, 2013; Rink & Hall, 2008; SHAPE, 2014; United States White House Task Force on Obesity, 2010). When utilized together, these components promote a physically active lifestyle. However, many physical education programs are not aligned with the recommendations from the research. Therefore, all children are not meeting the health-related fitness standards and attaining fundamental motor skill proficiency (AHA, 2013a; CDC, 2013; USDHHS, 2008). Students at all levels: elementary, secondary, and post-secondary, have shown low health-related fitness results (Brusseau, Kulinna, & Cothran, 2011; Castelli & Williams, 2007; Keating, Harrison, Dauenhauer, & Lambdin, 2010).

Despite having access to this research knowledge base, most public schools in the United States are experiencing a reduction in physical education classes (CDC, 2013; USDHHS, 2008; United States Task Force on Obesity, 2010). The time once devoted to physical activity is being reduced due to a trend toward increased classroom instruction, for the improvement of scores on academic achievement tests (American Academy of Pediatrics, 2011; CDC, 2012; NASPE, 2013; Trost & van der Mars, 2010; USDHHS, 2010). In fact, a mere 4% of elementary schools are providing physical education to students on a daily basis (CDC, 2010). Additionally, a reduction in school-related physical activity has resulted in the present struggle for children to become proficient in the fundamental motor skills (FMS) that would contribute to continued participation in physical activity outside of the school environment (Castelli & Valley, 2007; MacNamera, et al., 2011; Martin et al, 2009; McKenzie & Lounsbery, 2009; Senne, 2013; Stodden et al., 2008).

Research to investigate an increase in time devoted to the content area of physical

education and physical activity during the school day has been conducted (Carlson et al., 2008; Castelli & Valley, 2007; Ericsson, 2011; Martin et al., 2009; USDHHS, 2010; Weirsma & Sherman, 2008). While the American Heart Association (2013a), the American Academy of Pediatrics (2011), NASPE (2012), and SHAPE (2014), have all been a part of the campaign to promote 60 minutes of moderate-to-vigorous physical activity (MVPA) for elementary students on a daily basis, reports confirm that one half of school-aged children are not meeting this goal (CDC, 2013; USDHHS, 2008). Despite the fact that schools have been identified as a critical environment in which to promote physical activity, the factor of time continues to limit what public schools can do to assist students to meet the 60 minute physical activity standard.

A number of research studies have been conducted examining the role that increased time plays in the development of fundamental motor skill proficiency (Castelli & Valley, 2007; Eather et al., 2012; Ericsson, 2010). A 9-year study was conducted with children grades 1-9 in Sweden (Ericsson, 2010). The students participated in physical education daily, in addition to a one hour motor training session each week. This group was compared to a control group that attended physical education two times a week and were not offered any motor training. Beginning in grade 1, 51% of the children were proficient with selected skills that required motor competence. The daily physical education schedule, with a motor training session each week, was utilized through grade 9 for the same group of children. At the end of Ericsson's study, 73% of the children showed the desired proficiency level for motor competence and activity (2011). Daily physical education and motor training sessions were determined as the keys for improvement in terms of physical activity levels and skill acquisition. From a different perspective, Eather et al. (2012) examined an increase in physical activity for the purpose of enjoyment and the desire to

improve motor performance with primary students. Eighty percent of the participants recorded an enjoyment of the fitness activities and 95% reported an eagerness to improve on their performance and a desire to meet motor training goals. While an improvement on motor skills and fitness are important, the desire to grow in physical ability and the enjoyment in physical activities are also important factors. Each of these studies examined a single, established curriculum.

Limited research has been conducted comparing a new curriculum to an established one, but three studies have been published prior to this one. Eather et al. (2012), Martin et al. (2009), and Michaud et al. (2011) each examined a change in program for elementary students. Each study had similar results, with fundamental motor proficiency rising over the course of their study. Additionally, students that were able to view their progress with tracking systems, along with self-motivation, began to demonstrate confidence and greater personal empowerment in terms of fundamental motor skill success (Eather et al., 2012; Martin et al., 2009, Michaud et al., 2011). In the three studies, a change in the curriculum contributed to the mastery of motor skills and long-term success with sustained physical activity (McKenzie & Lounsbery, 2009; Senne, 2013; Stodden et al., 2008).

Researchers have also examined the implementation of after school activity programs and the amount of time they devote to physical activity. These programs are general after school activity programs that include various games, academic work time, and some physical activity. Most are not designed specifically to reinforce physical education concepts. One exception is the Sports, Play and Active Recreation for Kids (SPARK) program, which is designed to increase physical activity and improve fundamental motor skill proficiency (Beets, Beighle, Erwin, &

White, 2009; Beets, Wallner, & Beighle, 2010; McKenzie & Lounsbery, 2009; Sports, Play and Active Recreation for Kids [SPARK], 2014). According to the researchers, who did not find that after school programs increased physical activity and fundamental motor skills, additional studies are needed to establish a rationale for the inclusion of physical activity in after school programs and to establish policies for program implementation. (Beets et al., 2009; Beets et al., 2010).

## Evidence-Based Curriculum

As noted, schools are devoting a decreased amount of time to physical education classes and physical activity as part of the school day, despite the recommendations of experts to provide a minimum of 60 minutes of daily physical education and physical activity (American Academy of Pediatrics, 2011; AHA, 2013a; CDC, 2010; NASPE, 2013; SHAPE, 2014; USDHHS, 2010). Burdened by a curriculum that was designed prior to the reduction in allotted physical education class time, physical education teachers are struggling to meet the updated state and national standards that call for 150 minutes of physical education per week for elementary students. One solution to this dilemma is to implement an evidence-based physical education curriculum, that has the potential to reduce the impact of decreased physical education time, while meeting updated standards (McKenzie & Lounsbery, 2009). An evidence-based physical education (EBPE) curriculum is linked to positive student outcomes. Evidence-based physical education also has a clear focus on activity level, fitness performance, and fundamental motor skill development (SPARK, 2014). Programs that are focused on EBPE also emphasize providing enjoyable experiences that encourage the learning of general movement and behavioral objectives that can transfer to an array of physical activity opportunities offered at school, in the

community, and throughout life (Lounsbery, McKenzie, Trost, & Smith, 2010)

Lounsbery et al. (2010) administered a questionnaire with physical education teachers and principals on the topic of utilizing an evidence-based physical education curriculum. The principals and physical education teachers represented 154 schools in 34 different states, with 79 schools that had adopted EBPE and 79 that did not. On the whole, the educators and administrators in the non-EBPE schools were less satisfied with their curricula than those working in EBPE schools. They found that though there are barriers to implementing EBPE (the number of physical education teachers, financial resources, and time in the school day), educators and administrators in EBPE schools reported that using this type of curriculum has proven to be significant for lifetime learning activity, working cooperatively with others, increasing physical fitness, and improving motor skills (Lounsbery et al., 2010). Additionally, a significant number of schools that had adopted EBPE reported a greater satisfaction with their program outcomes in relationship to providing healthy physical activity, the learning of lifetime activities, and teaching cooperative behavior.

Physical education teachers and administrators play key roles in the adoption of physical education programs (Lounsbery, et al., 2011, Partnership For Prevention, 2008). This key research places a focus on continued advocacy in the area of EBPE for the improvement of physical education outcomes, motor competency, and the promotion of physical activity for a lifetime of overall health. In schools that have been using a non-EBPE curriculum, the necessity of determining the benefits of an EBPE curriculum, along with any challenges to implementation, is evident.

**Curriculum Change and Increased Physical Activity**

The purpose of this study, which took place in a single elementary school in southern Maine, was to measure the effect of an evidence-based physical education curriculum and/or after school activity program on the cardiovascular fitness levels and the fundamental motor skill proficiency of grade 5 students.

While a majority of the grade 5 students (54%) were meeting or exceeding the national physical fitness outcomes and demonstrating proficiency for fundamental motor skill competency, 46% of students were below the established national physical education standards for at least one portion of the fitness and fundamental motor skill standards. Despite the fact that a majority of students were able to meet the established national standards, the expectation is for 100% of the population to meet the standards of physical fitness and motor competency. At this school, the physical education teacher, who is also the principal investigator of this study, approached the administration to propose a study to compare the results from the traditional curriculum with results from a new EBPE curriculum, or an after school program, or a combination of the two.

The evidence-based physical education program chosen for implementation and comparison was the Sports, Play and Active Recreation for Kids (SPARK) curriculum. Three grade 5 classrooms received instruction utilizing the SPARK curriculum and the other two classrooms continued coursework with the traditional district curriculum. An optional complementary after school program was also designed and offered to all grade 5 students, two days per week.

## Methods

The study utilized an experimental design approach, examining the outcomes for 95 students that provided the pre- and post study data on fitness assessments and FMS proficiency levels. The control group adhered to the traditional, non-evidence-based, district physical education curriculum and did not participate in the after school activity program. This control group was compared to three intervention groups: (a) a group that participated in the traditional district curriculum and the after school activity program (ASA); (b) a group that was instructed utilizing the SPARK evidence-based curriculum only and did not participate in the after school activity (EBPE); and (c) a group that was instructed using the SPARK evidence-based curriculum and were participants in the after school activity (EBASA).

Quantitative data was collected pre- and post study from every participant in the control and intervention groups. Fitness assessments (curl-ups, push-ups, and the one-mile run) and fundamental motor skills (run, slide, overhand throw, horizontal jump, kick, strike) were scored and the data were analyzed to determine *p*-values ($\leq 0.05$) and effect sizes ($g_{Hedges}$), to indicate whether there were significant differences according to participation in any of the intervention groups.

### Setting and Participants

The study was conducted in a large suburban school district in southern Maine. The participants were from a single elementary school. Students from the participating school attended physical education one time per week, 40 minutes per session. Institutional Review Board approval was obtained from Plymouth State University and the school district. Parents provided consent for participation.

The participants were grade 5 students, randomly assigned to five classrooms, two of which utilized a district sport education curriculum and three others were taught using the Sports, Play and Active Recreation for Kids (SPARK) evidence-based physical education curriculum. Regardless of curricular assignment, each participant was afforded the opportunity to join the after school activity program that was conducted two days per week (a total of 3.0 hours of physical activity).

**Data Analysis**

Descriptive statistics (mean, standard deviation [SD], t-scores, *p*-values, as well as effect sizes using $g_{Hedges}$) were calculated across the intervention/control groups and according to gender for the three fitness assessments and the six fundamental motor skills. A t-test for independent samples was utilized to conduct the data analysis, with the *p*-value threshold set at $\leq 0.05$. The 2 x 2 two-factor ANOVA with repeated measures was utilized to determine any changes pre- to post study according to gender. A post hoc analysis (Tukey's range test) was utilized with the ANOVA data ($p \leq 0.05$), to determine significance according to gender. Due to the varying sizes of control and intervention groups, mean and standard deviation were calculated to examine effect size using $g_{Hedges}$ calculation procedures.

## Results and Discussion

In the final analysis, the total number of participants across all groups was 95. The breakdown of participants is shown in Table 19. This section has three portions: physical fitness, fundamental motor skills, and an overall discussion section.

**Physical Fitness**

*Results.* Ninety-three of the ninety-five participants (98%) met the Fitnessgram Healthy Fitness Zone (HFZ) standard for curl-ups from pre- study to post study, regardless of intervention or control group status, and gender groups. Every participant in all three intervention groups maintained HFZ status or improved to the HFZ standard pre- to post study. The control group had two outliers at the post study point that were not able to attain the HFZ status (1 girl/1 boy).

Table 19.

*Number of Participants in the Control Group and Intervention Groups.*

| **Group** | **Boys** | **Girls** | **Total** |
|---|---|---|---|
| Traditional Curriculum with no After School Activity (control) | 11 | 17 | 28 |
| Traditional Curriculum and After School Activity (ASA) | 6 | 6 | 12 |
| SPARK Curriculum with no After School Activity (EBPE) | 17 | 13 | 30 |
| SPARK Curriculum and After School Activity (EBASA) | 12 | 13 | 25 |

The push-up assessment, with 92 of the 95 participants (97%) that met the HFZ standard, was similar to the curl-up overall results. The control group included two outliers unable to attain a HFZ score (2 girls). Nearly all of the participants from the three intervention groups met the HFZ standard, with one outlier from the girls' EBASA group.

In the one-mile run, 78 of the 95 (82%) participants met the standard at the conclusion of the study, regardless of control or intervention group. This data indicated an improvement from the 51% of the participants that were meeting the HFZ prior to the start of the study. However, the participants in the two intervention groups that were afforded additional physical activity time during the after school activity (ASA and EBASA) had a 92% success rate for achieving the HFZ on the one-mile run. In fact, 100% of the boys in both of these groups were able to meet the HFZ over the course of the study. While the control group and the EBPE intervention group had growth from pre- to post study (68% and 83% respectively), it is evident that extra activity time is essential to a higher number of students meeting the Healthy Fitness Zone.

*Discussion.* According to research conducted by Castelli & Valley (2007), Eather et al. (2012), and Ericsson (2011), an increase in time devoted to physical activity and fundamental motor skills can foster significant and positive gains in relationship to fitness levels and performance. Data from the one-mile run validates this research. Two intervention groups (ASA and EBASA) were engaged in physical activity for an additional 3 hours per week as part of the after school program. Ninety-two of these participants met the HFZ standard for the one-mile run. When compared to participants that did not take part in the after school activity (control-68% and EBPE-83%), it is evident that the common factor between these two groups, that of increased physical activity, was the contributing factor for improvement on the cardiovascular fitness assessment. While the control group and the intervention groups all made statistically significant gains that met or exceeded the established $p$-value of $\leq 0.05$ (control=0.04/ASA=0.05/EBPE=0.0004/EBASA=0.0004) for the one-mile run, a measure of cardiovascular fitness, the bottom line for state and national standards is whether

students are performing at the levels of muscular endurance and cardiovascular fitness that the experts for the Fitnessgram and other assessment programs have determined lead to healthy living.

The curl-up and push-up scores, used to determine muscular endurance, were unexpected. While most of the participants in the intervention and control groups maintained the HFZ standard or improved to this level during the study, the gains that were made were not of significance and thus contrary to what the researcher had hypothesized. Additionally , the outliers for the curl-ups and push-ups were from girls' groups.

One major focus for this study was to improve grade 5 performance on cardiovascular fitness and this goal was met with success on a number of levels. Past research indicates additional time for physical activity can assist to increase performance (Castelli & Valley, 2007; Ericsson, 2011), but in relationship to the curl-up and push-up assessment data, the additional activity time did not impact the post study results. Evidence-based physical education places a focus on goal-setting for improvement in the areas of fitness and motor skills (Lounsbery et al., 2010). The evidence-based physical education program, as part of physical education class, did have a goal-oriented focus. However, the after school activity did not focus on the same areas of health-related fitness (muscle endurance). While understanding that additional practice time was instrumental in improving cardiovascular fitness, the time to practice and cultivate increased levels of performance on muscle endurance activities should be examined for the after school program. Implementing an evidence-based system that includes goal setting, in conjunction with the increased time for practice, would be a logical step forward for the district in terms of overall fitness assessment.

**Fundamental Motor Skills**

*Results.* Ninety-nine percent of the participants (*n*=95) met a Level 4 proficiency for running by the end of the study. The control (0.009), EBPE (0.04), and EBASA (0.004) groups met the significance level of ≤0.05 outlined for the study, while the ASA group was at Level 4 proficiency at pre- and post study points. The single outlier for the FMS of running was in the control group (boy).

Eighty-four of the ninety-five participants demonstrated Level 4 proficiency on the FMS of sliding. While the overall scores for all three intervention groups (boys and girls combined) were at 90% (+) for participants that met Level 4 proficiency, the boys' EBPE group had three outliers at Level 3 proficiency. In addition, the girls' control group had 6 outliers unable to attain Level 4 proficiency, while the boys' control group was at 100% for Level 4. The inconsistency between the boys' and girls' control groups resulted in a drop to 79% attainment for Level 4 proficiency for the control group.

Overhand throwing had a sharp division between the two groups utilizing the district curriculum (control and ASA) and the two groups that had instruction with the evidence-based curriculum (EBPE and EBASA). Twenty-nine of the forty participants (73%) that were taught physical education with district lessons (control and ASA) met Level 4 proficiency post study. In contrast, 50 of 55 participants (91%) that practiced overhand throwing with the evidence-based curriculum lessons attained Level 4 at the post study mark. In fact, the girls' EBASA group was at 100% capacity. Outliers were of both genders for this particular motor skill.

Horizontal jumping results were quite different when comparing control and intervention groups. Sixty-two of sixty-seven participants (93%) in the intervention groups combined

mastered the skill of horizontal jumping, at Level 4. The control group had only 17 of 28 (61%) attain Level 4 status. The control group and intervention groups had outliers from both genders.

The skill of kicking was the FMS with the most sporadic results. The EBASA groups (girls', boys', and combined) had the highest percentages of participants meeting Level 4 proficiency at post study (77%, 67%, and 72% respectively). The girls' control, ASA, and EBPE groups were were all below 67% and the boys' control, ASA, and EBPE were also below 64% in regard to Level 4 proficiency. Oddly, the boys' EBPE group had 29% meeting Level 4 proficiency pre- study and did not improve at the post study point, despite the fact that they had significant gains in performance on four of the other fundamental motor skills.

Every participant (n=95) scored between Level 1 and Level 3 for the FMS of striking pre-study. While the data from every control and intervention group indicated significant *p*-values pre- to post study, the percentage of participants able to attain Level 4 proficiency post study gives a different perspective. Specifically, the EBPE and EBASA intervention groups had the highest percentages of participants at Level 4 post study (50% and 67% respectively). Additionally, the girls' intervention groups were all between 46% and 50% of participants at Level 4 proficiency post study. The boys' EBPE and EBASA groups were similar to the overall group, with 66% of the participants attaining Level 4 proficiency.

*Discussion.* Fundamental motor skill performance and proficiency was one of two priorities for this study. The research of McKenzie & Lounsbery (2009) indicates that the implementation of a new curriculum could impact fundamental motor skill performance by 18% and for most intervention groups in this study, this was the case.

While the intervention group with increased practice time only (ASA) did meet the

established significance values as an indicator of improvement on many of the fundamental motor skills, the *p*-values did not translate to a higher number of participants meeting Level 4 proficiency. In fact, the two groups taught utilizing lessons from the evidence-based physical education curriculum (EBPE and EBASA) had a higher percentage of participants meeting Level 4 proficiency in four of the six fundamental motor skills as compared to the control and ASA groups.

The Sports, Play and Active Recreation for Kids evidence-based physical education curriculum includes warm-ups and structured lessons that incorporate skills learned from previous lessons into new lessons. This instructional objective affords students the opportunity to review and apply concepts in a spiraling nature. The participants in the EBPE and EBASA groups had the opportunity to review skills and grow these skills with a number of lessons. The implementation of an evidence-based physical education curriculum is a step in the right direction to positively impact proficiency levels in elementary physical education programs.

**Overall Discussion**

In response to the hypotheses indicated by the researcher, the findings for this study are mixed. The researcher expected meaningful growth for the intervention groups as compared to the control group for every fitness assessment and fundamental motor skill. While the participants did have marked growth and improvement on particular fitness assessments and fundamental motor skills, and included data that met the significance established for the study, the Healthy Fitness Zone attainment and fundamental motor skill proficiency gave a new perspective to the data collected.

This study, according to the knowledge and study of the researcher, represents the first of its kind: one that combines a shift to an evidence-based physical education curriculum in combination with increased physical activity as part of an after school activity program. While the data collected from the participants that followed the district curricular model and those that followed the evidence-based physical education curriculum style indicated similar outcomes in two areas of the fitness assessments (curl-ups and push-ups) and two fundamental motor skills (running and kicking), a third area of fitness (one-mile run) and the remaining four fundamental motor skills (sliding, overhand throwing, horizontal jumping, and striking) were significantly impacted by the use of an evidence-based physical education curriculum and an increase in the opportunity to practice, by way of an after school activity program.

During the 12-week study, the SPARK evidence-based physical education curriculum lessons incorporated a review of previous skills in the warm-up portion, specifically designed to build upon prior knowledge as part of presenting new information and challenges. The development of cardiovascular fitness and the review of past fundamental motor skill concepts simultaneously as part of the after school program proved to be essential components as well.

The after school activity program, sponsored in conjunction with a cardiovascular health intervention research project through a local college, added a level of depth to the study. Participants were able to engage in physical activity for 3 additional hours each week by participating in two after school sessions. Additionally, after school activities focused on the concepts being taught during physical education classes and increasing levels of cardiovascular endurance. The coordinator for the after school program and the physical education

teacher/researcher worked together to make clear connections between the physical education units and the after school program, for overall improvement in many areas of physical fitness and fundamental motor skill competency. Participant engagement in the after school sessions, and the utilization of an evidence-based physical education curriculum paired together, translated to an increase in the number of students that were able to meet the cardiovascular fitness HFZ standards and the number of participants that were able to achieve Level 4 proficiency for fundamental motor skills.

The data collected from the intervention groups and the control group indicate that the addition of an after school program at the school impacted the cardiovascular fitness assessment results, with the data from the two groups that participated in the after school program (ASA/EBASA) reflecting significance and scores that met the Fitnessgram Healthy Fitness Zone expectations. In relationship to the fundamental motor skills, the incorporation of an evidence-based physical education curriculum was the important factor. The fundamental motor skills of sliding, overhand throwing, horizontal jumping, and striking indicated significant *p*-value data and a higher percentage of participants meeting Level 4 proficiency as compared to those utilizing the district curriculum. While the FMS of running and kicking did not reflect significant growth for each gender, these skills were maintained over the course of the study.

In conclusion, the results from this study indicate that the implementation of an evidence-based physical education curriculum and an after school activity program concurrently provide the best of both worlds: the improvement of cardiovascular endurance and fundamental motor skills, with both areas being of great importance in terms of state and national standards in the content area of physical education. Furthermore, physical education professionals that desire to

change student performance on the specific assessment of cardiovascular endurance can clearly see that an after school program can augment results, while fundamental motor skills can be improved via the cyclical nature of an evidence-based physical education curriculum.

**Implications and Limitations for Practice**

*Implications.* The Sports, Play and Active Recreation for Kids curriculum included well-developed units and lessons that included clear standards and objectives. The lessons included a connection to past movement experiences, and introduced participants to new information. While some portions of the SPARK units and lessons were similar to the district sport education curriculum, there are portions of the SPARK protocol that distinguish it from the traditional curriculum to improve fitness and FMS performance: the incorporation of cardiovascular fitness into every lesson and the repetition of motor skills in a cyclical nature through a number of lessons. The integration of an after school program to match the objectives of the SPARK units and lessons was a key factor to the development of improved cardiovascular fitness and fundamental motor skills. While two of the fundamental motor skills had similar outcomes regardless of curriculum and/or after school practice, four FMS were clearly impacted with the use of an evidence-based curriculum and/or after school activity. Ultimately, meeting the HFZ standards and achieving FMS proficiency was the priority. Goal setting must also be considered and implemented to address success for all students. If the utilization of an evidence-based physical education curriculum, incorporating goal setting, and continued practice through participation in after school activity are all important components to raise the number of students able to meet the standards and proficiency levels, as compared to the curriculum that is currently in place, it is obvious that a change should be considered.

*Limitations.* The limitations for this study are connected to the sample size, the length of the study, and the potential application to varied situations. There were a total of 95 participants in this study. While this is an adequate sample size, the number of participants was further broken down into four groups: a control group and three intervention groups (ASA, EBPE, and EBASA). The numbers ranged from 12-30 per group and when sub-divided by gender, the group sizes were 6-17. The limited numbers made it challenging to determine trends and the significance of outliers in certain cases.

The length of other studies examined as part of the research literature averaged 6-12 weeks. In order to determine whether fitness levels or FMS were maintained as a lifestyle change, a significantly longer study would be necessary. The maintenance of fitness performance and fundamental motor skills past the time frame of the study was not a factor for this study. This aspect of fitness and motor performance would be important to examine in future research.

While this study focused on the implementation of an evidence-based physical education curriculum and incorporation of an after school activity simultaneously, the results could be challenging to reproduce for some schools. Due to overall costs or staff availability, a school might not be able to change a curriculum and offer an after school program together. However, two of the intervention groups in this study incorporated a single change: either an evidence-based physical education curriculum or an after school activity. Comparisons could be made by a school or group that had an interest in making a single change. A school interested in improving fitness assessments would be best served to add an after school component, while educators with an interest in increasing proficiency levels and the confidence to perform at

higher levels would want to examine an evidence-based physical education curriculum. Additionally, a school with a smaller enrollment or having a desire to pursue one grade level could make comparisons in accordance with the numbers included in this study.

**Suggestions for Future Research**

The findings from this research demonstrate the effectiveness of alternative approaches to improve the quantitative nature of fitness assessments and fundamental motor skills at an elementary school level. At the conclusion of the study, the participants moved to a middle school physical education setting. The middle school physical education specialists in the district were transitioning to a standards-based protocol, with many similarities to the SPARK evidence-based curriculum utilized as part of this study.

While this particular study did not focus on the retainment of skills acquired from participation utilizing an evidence-based physical education curriculum or a district curriculum past the post study timeframe, that type of data collection would be the next logical step. The participants from this study advanced to a middle school setting that included increased physical education class time on a weekly basis and a new level of national/state standards and fitness goals, a significant change from the purpose for this study. However, a start of data collection with grade 3 or grade 4 at the elementary level would give a researcher the time necessary to determine the retainment of fundamental motor skills and cardiovascular fitness over the course of three grade levels. The weekly timeframe for physical education would remain constant over the three years, in addition to the use of a consistent curriculum.

The impact of an after school/daycare program on physical activity could also be investigated further. Former published research that had a focus on after school programs

covered the topics of appropriate daycare, academic connections, and the learning of new activities. A priority for fitness and physical activity was absent. New research would focus on the appropriate number of minutes to assist children in meeting the daily 60 minutes of physical activity (AHA, 2013a; CDC, 2013; White House Task Force on Obesity, 2010) to impact their fitness levels. Another area to investigate would be the preparation and training to incorporate physical activity into after school/daycare programs.

## Conclusion

A combination of effective instruction utilizing an evidence-based physical education program and providing additional time for physical activity through an after school activity program is key to developing the habit of exercise early in life. The students that participated in the after school activity, in addition to their regular physical education class, were physically active for 200 minutes per week as part of their school day (recess, physical education, and after school programs). While this number falls short of the recommended number of minutes to exercise weekly, at 60 minutes per day, or 300 minutes per school week (AHA, 2013a; CDC, 2010; NASPE, 2013; SHAPE, 2014; United States Task Force on Obesity, 2010), by combining an after school activity and in-school evidence-based physical education, we are getting closer to this goal for children. A greater effort to regularly involve students in physical activity, including fundamental motor skills and creating a climate of success, must occur to ensure the health and well-being of our youth.

Nationwide efforts are needed to increase the physical education minutes and physical activity time required in schools, toward the purpose of students becoming confident in their physical ability. This type of change could dramatically alter the face of physical education and

physical activity in public schools for the good of all children. Healthy children are ready to learn and grow academically. This study assisted in the demonstration of how important it is to continue efforts to provide educational support in physical education and physical activity, through the factor of time and choice of curriculum, that will provide an opportunity for every student to be healthy in mind and body.

# References

Abbott, A., & Collins, D. (2004). Eliminating the dichotomy between theory and practice in talent identification and development: Considering the role of psychology. *Journal of Sport Sciences, 22(5), 395-408.*

Active Living Research. (2006a). Moving more at school-increasing physical activity before, during and after school. Retrieved from: www.activelivingresearch.org

Active Living Research. (2007). Using evidence to prevent childhood obesity and create active communities. Retrieved from: www.activelivingresearch.org

Active Living Research. (2011). *School policies on physical education and physical activity.* Retrieved from www.activelivingresearch.org/files

American Academy of Pediatrics. (2011). Expert panel on integrated guidelines for Cardiovascular health and risk reduction in children and adolescents: Summary report. *Pediatrics, 128, Supplement 6.*

American Heart Association. (2013a). Healthier kids. Retrieved from: www.heart.org/HEARTORG/GettingHealthy/HealthierKids

American Heart Association. (2013b). Policy position statement on physical education in schools. Retrieved from www.heart.org

Barnett, L.M., Morgan, P.J., van Beurden, E., & Beard, J.R. (2008). Perceived sports competence mediates the relationship between childhood motor skill proficiency and adolescent physical activity and fitness: A longitudinal assessment. *International Journal of Behavioral Nutrition and Physical Activity, 5(40).*

Beets, M.W., Beighle, A., Erwin, H.E., & White, J. (2009). Review of after-school programs to increase physical activity: A meta-analysis. *American Journal of Preventive Medicine, 36, 527-537.*

Beets, M.W., Wallner, M., & Beighle, A. (2010). Defining standards and policies for promoting physical activity in after school programs. *Journal of School Health, 80, 411-417.*

Beighle, A., Morgan, C.F., LeMasurier, G., & Pangrazi, R.P. (2006). Children's physical activity during recess and outside of school. *Journal of School Health, 76(10), 516-520.*

Bevans, K., Fitzpatrick, L., Sanchez, B., & Forest, C.B. (2010). Individual and instructional determinant of student engagement in physical education. *Journal of Teaching in Physical Education, 29, 399-416.*

Biddle, S., & Wang, C. (2003). Motivation and self-perception profiles and links with physical activity in adolescent girls. *Journal of Adolescence, 26, 687-701.*

Blankenship, B. (2013). Knowledge/skills and physical activity: Two different coins, or two sides of the same coin? *The Journal of Physical Education, Recreation & Dance, 84(6), 5-6.*

Brusseau, T.D., Kulinna, P.H., & Cothran, D.J. (2011). Physical activity content knowledge of Native American children. *The Physical Educator, 68, 66-77.*

Cale, L., & Harris, J. (2009). Fitness testing in physical education-a misdirected effort in promoting healthy lifestyles and physical activity? *Physical Education and Sport Pedagogy, 14(1), 89-108.*

Carlson, Eisenmann, Pfeiffer, Jager, Sehnert, Yee, Klavinski, & Feltz. (2008). Partners for health: A school-based program for enhancing physical activity and nutrition to promote cardiovascular health in 5th grade students. *Public Health, 8, 420.*

Castelli, D.M., & Valley, J.A. (2007). Chapter 3: The relationship of physical fitness and motor competence to physical activity. *Journal of Teaching in Physical Education, 26, 358-374.*

Castelli, D.M., & Williams, L. (2007). Health-related fitness and physical education teachers' content knowledge. *Journal of Teaching in Physical Education, 26, 2-19.*

Centers for Disease Control. (2010). *Strategies to improve the quality of physical education.* Atlanta, GA: Author.

Centers for Disease Control and Prevention. (2012). *NHANES national youth fitness survey.* Retrieved from www.cdc.gov/nchs/nhanes.htm

Centers for Disease Control and Prevention. (2013). Healthy People 2020. Retrieved from www.healthypeople.gov/2020/default.aspx

Colorado Connections for Healthy Schools. (2005). *A closer look: Denver Public Schools.* Retrieved from: www.sparkpe.org

Corbin, C.B. (2002). Physical activity for everyone: What every physical educator should know about promoting lifelong physical activity. *Journal of Teaching Physical Education, 21(2), 128-144.*

Cote, J., Baker, J., &Abernethy, B. (2007). *Handbook of sport.* Hoboken, NJ: Wiley.

Creswell, J.W. (2009). *Research design: qualitative, quantitative, and mixed methods approaches.* Los Angeles, CA: Sage.

Daniels, S.R., Pratt, C.A., & Hayman, L.L. (2011). Reduction of risk for cardiovascular disease in children and adolescents. *Circulation, October 2011, 1673-1686.*

Eather, N., Morgan, P.J., & Lubans, D.R. (2012). Feasibility and preliminary efficacy of the Fit4Fun intervention for improving physical fitness in a sample of primary school children. *Physical Education and Sport Pedagogy, 18(4), 389-411.*

Elliot, E., Erwin, H., Hall, T., & Heidorn, B. (2013). Position statement: Comprehensive school physical activity programs: Helping all students achieve 60 minutes of physical activity each day. *Journal of Physical Education, Recreation and Dance, 84(9), 9-15.*

Ennis, C.D. (2011). On their own: Preparing students for a lifetime. *Journal of Physical Education, Recreation and Dance, 81(5), 17-22.*

Ericsson, I. (2011). Effects of increased physical activity on motor skills and marks in physical education: An intervention study in school years 1 through 9 in Sweden. *Physical Education and Sport Pedagogy, 16(3), 313-329.*

Fraenkel, J.R. & Wallen, N.E. (2009). *How to design and evaluate research in education.* New York, NY: McGraw-Hill.

Glickman, D., Parker, L., Sim, L.J., Cook, H., & Miller, E.A. (Eds.) (2012). *Accelerating progress in obesity prevention: Solving the weight of the nation.* Committee on Accelerating Progress in Obesity Prevention. Food and Nutrition Board. Institute of Medicine.

Graham, G., Holt/Hale, S.A., & Parker, M. (2009). *Children moving: A reflective approach to teaching physical education* (8th ed.). New York, NY: McGraw Hill.

Hardman, K. & Marshall, J.J. (2008). *World-wide survey II of school physical education.* Final Report. Berlin, ICSSPE.

Holt, N.L., & Dunn, J.G.H. (2004). Toward a grounded theory of the psychosocial competencies and environmental conditions associated with soccer success. *Journal of Applied Sport Psychology, 16, 199-219.*

Human Kinetics (2014). Fitnessgram program review. Retrieved on March 1, 2014 from: www.fitnessgram.net

Institute of Medicine of the National Academies. (2013). *Educating the student body: Taking physical activity and physical education to school-Report.* Washington, DC: Academy Of Science.

Keating, X.D., Harrison, L., Dauenhauer, B., & Lambdin, D. (2010). Changes in K-12 physical education programs from 2001-2006. *Research Quarterly in Exercise and Sport, 81(2), 180-188.*

Light, R.L. (2010). Opening up learning theory to social theory in research on sport and physical education through a focus on practice. *Physical Education and Sport Pedagogy, 16(4), 369-382.*

Logan, S.W., Robinson, L.E., Rudisill, M.E., Wadsworth, D.D., & Morena, M. (2012). The comparison of school-aged children's performance on two motor assessments: The Test of Gross Motor Development and the Movement Assessment Battery for Children. *Physical Education and Sport Pedagogy, 19(1), 48-59.*

Lounsbery, M.D.F., McKenzie, T.L., Trost, S., & Smith, N.J. (2011). Facilitators and barriers to adopting evidence-based physical education in elementary schools. *Journal of Physical Activity and Health, 8(Suppl. 1), S17-S25).*

Lund, J. (2013). Activity in physical education: Process or product? *The Journal of Physical Education, Recreation & Dance, 84(7), 16-17.*

MacNamera, A., Collins, D., Bailey, R., Toms, M., Ford, P., & Pearce, G. (2011). Promoting lifelong physical activity and high level performance: Realizing an achievable aim for physical education. *Physical Education and Sport Pedagogy, 16(3), 265-278.*

Mahar, M.T. & Rowe, D.A. (2008). Practical Guidelines for valid and reliable youth fitness testing. *Measurement in Physical Education and Exercise Science, 12, 126-145.*

Maine Department of Education (2010). *A report to the Joint Standing Committee on Education and Cultural Affairs on the physical education capacity of elementary schools as requested through Public Law, Chapter 264 (LD 1407): An act to assess the physical education capacity of elementary schools in Maine and to establish the obesity and chronic disease fund within the Department of Education.*

Maine Department of Education. (2011). *Learning Results: Parameters for Essential Instruction.* Retrieved from: www.maine.gov/education/lres/pei

Maine Department of Education (2014). *Data standards document.* Retrieved from: www.maine.gov/reducation/medms/standards/student/student-data-standards.pdf

Martin, E.H., Rudisill, M.E., & Hastie, P.A. (2009). Motivational climate and fundamental motor skill performance in a naturalistic physical education setting. *Physical Education and Sport Pedagogy, 14(3), 227-240.*

McKenzie, T.L., & Lounsbery, M.A. (2009). School physical education: the pill not taken. *American Journal of Lifestyle Medicine, 3(3), 219-225.*

McKenzie, T.L., Sallis, J.F., & Rosengard, P. (2009). Beyond the stucco tower: Design, development, and dissemination of the SPARK physical education programs. *Quest, 61, 114-127.*

Metcalf, B., Henley, W., & Wilkin, T. (2012). Effectiveness of intervention on physical activity of children: Systematic review and meta-analysis of controlled trials with objectively measured outcomes. *Journal of Sport Medicine, 47(4), 226.*

Michaud, V., Nadeau, L., Martel, D., Gagnon, J., & Godbout, J. (2011). The effect of team pentathlon on ten- to eleven-year-old children's engagement in physical activity. *Physical Education and Sport Pedagogy, 17(5), 543-562.*

National Association for Sport and Physical Education (2004). *Moving into the future: National standards for physical education (*2nd Ed.). Reston, VA: Author.

National Association for Sport and Physical Education. (2009). *Appropriate instructional practice guidelines for elementary school physical education* (3rd ed.). Reston, VA: Author.

National Association of Sport and Physical Education. (2010). *Appropriate uses of fitness measurement* (position statement). Reston, VA: Author.

National Association for Sport & Physical Education. (2013). *Comprehensive school physical education programs: Helping all students achieve 60 minutes of physical activity each day* [Position Statement]. Reston, VA: Author.

National Education Association. (2010). Position statement on physical activity. Retrieved from http://www.educationvotes.nea.org/wp-content/uploads/2010/05/StudentHealth-PhysEdOnepager.pdf

National Education Association. (2013). Healthy kids are better students. Retrieved from: www.nea.org

National Heart, Lung and Blood Institute. (n.d.). Be a fit kid intervention. Retrieved from www.beafitkid.org

National Heart, Lung and Blood Institute. (n.d.). Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents: summary report. Retrieved on July 12, 2013 from www.nhlbi.nih.gov/guidelines/cvd_ped/summary.htm

Naylor, P.J., & McKay, H.A. (2009). Prevention in the first place: School setting for action on physical inactivity. *Journal of Sports Medicine, 43(1), 10-13.*

Palmer, S., & Bycura, D. (2014). Beyond the gym: Increasing outside of the school physical activity through physical education. *Journal of Physical Education, Recreation, and Dance, 85(1), 28-35.*

Pangrazi, R.P., Beighle, A., & Pangrazi, D.L. (2009). *Promoting physical activity and health in the classroom.* San Fransisco, CA: Benjamin Cummings.

Partnership for Prevention (2009). *Physical activity guidelines.* Retrieved on September 1, 2014 from: www.health.gov/paguidlines

Pate, R.R., Davis, M.G., Robins, T.N., Stone, E.J., McKenzie, T.L., & Young, J.C. (2006). Promoting physical activity in children and youth: A leadership role for schools. *Circulation: Journal of the American Heart Association, 114, 1214-1224.*

Penney, D., & Jess, M. (2004). Physical education and physically active lives: A lifelong approach to curriculum development. *Sport, Education and Society, 9(2), 269-287.*

Price, K. (2011). *Implementing a summer fitness program to enhance test scores.* Dissertation, Linwood University.

Puhse, U., & Gerber, M. (Eds.) (2005). *International comparison of physical education: concepts, problems, projects.* Oxford, UK: Meyer & Meyer Sports.

Raudsepp, L., & Liblik, R. (2002). Relationship of perceived and actual motor competence in children. *Perceptual and Motor Skills, 94, 1059-1070.*

Regional School Unit Administration Team. (2014). *Elementary school handbook.* York County, Maine: Author.

Rink, J.E., & Hall, T.J. (2008). Research on effective teaching in elementary school physical education. *Elementary School Journal, 108(3), 207-218.*

Robert Wood Foundation (2013). Healthy kids, healthy communities. Retrieved from www.healthykidshealthycommunities.org

Senne, T.A. (2013). A better path toward ensuring lifelong physical activity participation. *Journal of Physical Education, Recreation, & Dance, 85(4).*

Society of Health and Physical Educators. (2014). *National standards & grade-level outcomes for K-12 physical education.* Champaign, IL: Human Kinetics.

Sport, Play and Active Recreation for Kids. (2014). Mission statement. Retrieved from www.sparkpe.org/about-us/our-mission

Stanley, R.M., Ridley, K., & Dollman, J. (2012). Correlates of children's time-specific physical activity: A review of the literature. *International Journal of Behavioral Nutrition and Physical Activity, 9(50).*

Stodden, D.F., Goodway, J.D., Langendorfer, S.J., Roberton, M.A., Rudisill, M.E., Garcia, C., & Garcia, L.E. (2008). A developmental perspective on the role of motor skill competence in physical activity: An emergent relationship. *Quest, 60(2), 290-306.*

Strong, W.B., Malina, R.M., Blimpke, C.J., Daniels, S.R., Dishman, R.K., Gutin, B., ...Trudea, F. (2005). Evidence based physical activity for school aged youth. *Journal of Pediatrics, 146, 732-737.*

Texas Heart Institute. (2015). Risk factors for children and teenagers. Retrieved from: www.texasheart.org/HIC/Topics/HSmark/children_risk

The Cooper Institute. (2010). *FITNESSGRAM & ACTIVITYGRAM: Test administrative model* (4th Ed.). Champaign, IL: Human Kinetics.

Theeboom, M., de Knop, P., & Weiss, M.R. (1995). Motivational climate, psychological responses, and motor skill development in children's sport: A field-based intervention study. *Journal of Sport and Exercise Psychology, 17(3), 294-311.*

Tolley, C.B. (2009). *The role of trust and care in the implementation of a social constructivist curriculum in physical education.* Thesis, University of Maryland, College Park.

Trost, S.G., Pate, R.R., Dowda, M., Ward, D.S., Felton, G., & Saunders, R. (2002). Psychosocial correlates of physical activity in white and African-American girls. *Journal of Adolescent Health, 31, 226-233.*

Trost, S.G., & van der Mars, H. (2010). Why we should not cut PE. *Health and Learning, 67(4), 60-65.*

Tudor-Locke, C., Lee, S., Morgan, C.F., Beighle, A., & Pangrazi, R.P. (2006). Children's pedometer determined physical activity patterns during the segmented school day. *Medicine and Science in Sports and Exercise, 38(1), 1732-1738.*

Ulrich, D.A. (2000). *The test for gross motor development-2.* Austin, TX: Prod-Ed.

Ulrich, D.A. (2012). Curriculum vitae. Retrieved on March 1, 2014 from: www.kines.edu/profile/dale-ulrich.phd

United States Department of Health and Human Services. (2008). *2008 physical guidelines for Americans.* Retrieved from http://www.health.gov/paguidelines/default/aspx

United States Department of Health and Human Services. (2010). *Healthy People 2020.* Retrieved July 14, 2013, from www.healthypeople.gov

United States Department of Health and Human Services. (2013). *A healthy and fit nation.* Retrieved on July 15, 2013, from www.surgeongeneral.gov/initiatives/healthy-fit-nation

United States White House Task Force on Childhood Obesity. (2010). *Solving the problem of childhood obesity within a generation.* Washington, DC: Executive Office of the President of the United States.

Valentini, N.C., & Rudisill, M.E. (2004). An inclusive mastery climate intervention and the motor skill development of children with and without disabilities. *Adapted Physical Activity Quarterly, 21, 330-347.*

Weirsma, L.D. & Sherman, C.P. (2008). The responsible use of youth fitness testing to enhance student motivation, enjoyment, and performance. *Measurement in physical education and Exercise Science, 12, 167-183.*

Wong, K.Y.A. & Cheung, S.Y. (2010). Confirmatory factor analysis of the Test of Gross Motor Development-2. *Measurement in Physical Education and Exercise Science, 14(3), 209.*

World Health Organization. (2014). What is moderate-intensity and vigorous-intensity physical activity? Retrieved from: www.whoint/dietphysicalactivity/physical_activity.intensity/en

# Appendix A

Fitness Assessment Data: Fall 2012-Spring 2014

Table 1A.

*Curl-Up Muscle Endurance Fitness Assessment.*

| **GRADE 5** | **2013-2014** | **2012-2013** |
|---|---|---|
| Healthy Fitness Zone | 99% | 97% |
| Needs Improvement | 1% | 3% |

Table 2A.

*Push-Up Muscle Endurance Fitness Assessment.*

| **GRADE 5** | **2013-2014** | **2012-2013** |
|---|---|---|
| Healthy Fitness Zone | 92% | 92% |
| Needs Improvement | 8% | 8% |

Table 3A.

*One Mile Run Cardiovascular Endurance Fitness Assessment.*

| **GRADE 5** | **Spring 2014** | **Fall 2013** | **Spring 2013** | **Fall 2012** |
|---|---|---|---|---|
| Healthy Fitness Zone | 62% | 61% | 71% | 62% |
| Needs Improvement | 38% | 39% | 29% | 38% |

Appendix B

July 24, 2014

Dear Researcher;

It was a pleasure to meet with you in June. During this meeting, we discussed your plans to pilot the SPARK 3-6 Physical Education curriculum with grades four and five at an elementary school for completion of your doctoral research.

As mentioned in our meeting, the first portion of this pilot is to be conducted with an intervention group comprised of two grade four classes and two grade five classes. The initial intervention phase of the study will be the first trimester of the 2014/2015 school year (trimester 1). All students will do similar units during this trimester, with the intervention group using the SPARK curriculum and the control group following the district curriculum. The students will be assessed at three points during the trimester (pre-, mid-, and post-intervention) to determine any changes with the selected fundamental motor skills and cardiovascular endurance based on following the SPARK evidence-based program.

The control group classes from trimester one will become the intervention group for trimester two, while the intervention group from trimester one will be the control group during trimester two. Assessments will be conducted in the same manner during trimester two. All students will utilize the pilot curriculum during the third and final trimester of the school year.

We agreed in our meeting that you, as the primary researcher, will send a letter to the parents of the grade four and five students. The purpose of this letter is to make the parents aware of the pilot program for grades four and five. The letter content will include information regarding the evidence-based nature of the SPARK curriculum and how it could be a great match for the direction the district is moving in terms of evidence-based assessment. The letter will be sent home on the first day of school.

The pilot you are conducting is great research for the district and is very important to the evidence-based focus for the district. I look forward to the results from your doctoral research.

Superintendent of Schools

Appendix C

Dear parents/guardians;

Welcome to the start of a new school year! The purpose for this letter is to inform you and your fourth/fifth grade student about a physical education curriculum pilot for the 2014/2015 school year. This pilot initiative has been approved by our superintendent.

Grade four and five students at the school will be piloting the Sport, Play and Active Recreation for Kids (SPARK) physical education curriculum guide for grades 3-6. The SPARK program guide is an evidence-based curriculum. Substantial research has been completed for this program guide as it relates to improving health-related behaviors and outcomes. According to the Robert Wood Foundation, implementation of evidence-based physical education programs in schools have been shown to raise physical activity levels for students as much as 18%.. As part of this pilot, the fourth and fifth graders will focus on improved cardiovascular fitness and fundamental motor skill growth.

During the first trimester, some classes will follow the SPARK program curriculum and other classes will use the district curriculum. All classes will be exposed to the same unit topics for the trimester. When we move into the second trimester, the classes will switch and use the opposite curriculum from the first trimester. A schedule for the classes and trimesters is shown below:

| Trimester | SPARK | District |
|---|---|---|
| Trimester 1 | 5th-Class 1/Class 2<br>4th-Class 3/Class 4 | 5th-Class 5/Class 6/Class 7<br>4th-Class 8/Class 9/Class 10 |
| Trimester 2 | 5th-Class 5/Class 6/Class 7<br>4th-Class 8/Class 9/Class 10 | 5th-Class 1/Class 2<br>4th-Class 3/Class 4 |
| Trimester 3 | All grade 4 and 5 classes | None |

As you can see, all of the students will use the SPARK program for a full trimester and the current curriculum for an entire trimester through the first and second trimesters. During the third trimester, all of the students from both grade levels will be instructed using the SPARK program.

It is the goal for the students at the school to be confident in their physical ability and to develop a desire to be active in physical education and physically active outside of school as well. Evidence-based physical education has been proven to have many benefits in relationship to physical activity. It is a goal to discover the effect of an evidence-based curriculum on cardiovascular endurance fitness scores, along with achieving a level of proficiency for a number of fundamental motor skills.

Results from the pilot study will be shared with the district curriculum committee, administration, and the school board. Significant results will become part of a dissertation document and could be presented at conferences. Participant and school confidentiality will be maintained as part of all presentations of the information gathered as part of the pilot study.

If you have any questions regarding the grade four and five curriculum plan for the coming school year, please feel free to contact me at school. My contact information is listed below. I am excited about embarking on this exciting experience in physical education.

Sincerely,

Physical Education Specialist
Phone
E-mail

Appendix D

Plymouth State University
Institutional Review Board

June 4, 2014

Dear Carolyn M. Gross:

On behalf of the Institutional Review Board (IRB), your project entitled "Developing Fundamental Motor Skills to Mastery and Building Self Confidence to Influence a Habit of Physical Activity: A Recess/Summer Intervention" has been granted approval for one year effective June 4, 2014. If, during the course of you project you intend to make changes which may significantly affect the human subjects involved (particularly methodological changes), you must obtain IRB approval prior to implementing these changes. Any unanticipated problems related to your use of human subjects must be promptly reported to the IRB. The IRB may be contacted through Dr. David Mackey, Chair of the IRB. This is required so that the IRB can update or revise protective measures for human subjects as may be necessary.

You are expected to maintain as an essential part of your project records, any records pertaining to the use of humans as subjects in your research. This includes any information or materials conveyed to and received from the subjects as well as any executed forms, data and analysis results. If this is a funded project (federal, state, private, other), you should be aware that these records are subject to inspection and review by authorized representatives of the University, State of New Hampshire, and/or the federal government.

Please note that IRB approval cannot exceed one year. If you expect your project to continue beyond this approval period, you must submit a request for continuance to the IRB for renewal of IRB approval. IRB approval must be obtained and maintained for the entire term of your project or award. Please notify the IRB in writing when the project is completed. We may ask that you provide information regarding your experiences with human subjects and with the IRB review process. Upon notification we will close our files pertaining to your project. Any subsequent reactivation of the project will require a new IRB application.

Please do not hesitate to contact the IRB if you have any questions or require assistance. We will be happy to assist you in any way we can. Thank you for your cooperation and efforts throughout this review process. We wish you success in this endeavor.

Sincerely,
David Mackey
David A. Mackey, Chair
Institutional Review Board
Plymouth State University
damackey@plymouth.edu

Appendix E

**Fitness Assessment Protocols**

*Curl-ups* were used to evaluate muscle endurance of the abdominal area. A mat was used for the student to perform their curl ups. Each participant was asked to lie on their back on a mat in a supine position, with their legs bent at a 140 degree angle, feet flat on the floor, arms straight and parallel with their body, palms resting on the mat with fingers extended, and the head resting on the mat (The Cooper Institute, 2010). A measuring strip was placed under the knees, perpendicular to their body. The student curled up slowly, sliding their fingers across the measuring strip under their knees until their fingertips reach the opposite side of the measuring strip, and then they curled back down until their head touched the mat. This motion is repeated for one minute. Participants were stopped after: 1) completing 75 curl-ups, 2) if two form corrections were made or 3) they could no longer continue. A test score was determined once finished. This assessment was administered two times: 3 weeks prior to the 12-week study and post study during week two. The healthy fitness zone standards are as follows: boys equal to or greater than 15 and girls equal to or greater than 15.

*Push-ups* were used to evaluate muscle endurance of the upper body. Each participant was asked to hold their body in a prone position, with their hands placed under or slightly wider than their shoulders, fingers stretched out, legs straight and slightly apart, and toes tucked under (The Cooper Institute, 2010). The student lowered their body by bending their elbows. The student touched their chin to an object that was 6-inches tall, causing their elbows to bend at a 90 degree angle, and back up to the starting position. The participant repeated this action as many times as possible in one minute. Participants were stopped when two form corrections were

made or the minute ended, and a test score was determined. This assessment was administered two times: 3 weeks prior to the 12-week study and post-study week 2. The healthy fitness zone standards are as follows: boys equal to or greater than 8 and girls equal to or greater than 7.

The *one-mile run* is one of two assessments, as part of the Fitnessgram, to evaluate cardiovascular endurance. Students were asked to run a mile at their fastest pace possible and walking was allowed (The Cooper Institute, 2010). A flat running course was required and measured using a meter wheel (The Cooper Institute). As students crossed the finish line, their time was called out and recorded on a score sheet. The one-mile run was scored in minutes/ seconds. The objective of the assessment was to practice pacing (The Cooper Institute). This assessment was administered two times: 1 week prior to the 12-week study and post study, week one. The healthy fitness zone standards are as follows: boys equal to or less than 11:30 and girls equal to or less than 12:30.

Appendix F

**Fundamental Motor Skill Protocol**

The first FMS was the locomotor skill of running. Running is defined as the action or movement of a runner (Haywood & Getchell, 2001). Two cones were placed 50 feet apart. Each participant was asked to run as fast as he or she could from one cone to the other on a "go" signal. Two trials were administered. Performance was assessed on four criteria (Appendix G). This assessment was administered two times: 2-weeks prior to the 12-week study and post study week two.

The second FMS was the locomotor skill of sliding. Sliding is an asymmetrical gait that starts with a step on one foot, then a leap/step on the other foot, with the same foot always leading (Haywood & Getchell, 2001). It is also described as sideways galloping or defensive stance. Two cones were placed 25 feet apart on a black line of the gym floor. Each participant was asked to slide from one cone to the other and back to the first cone. Two trials were administered. Performance was assessed on four criteria (Appendix G). This assessment was administered two times: 2-weeks prior to the 12-week study and post study week two.

The third FMS was the object control skill overhand throwing. Overhand throwing is propelling an object forward with the hand at shoulder height at a target (Society of Health and Physical Educators, 2014). A four-inch diameter ball was used for this assessment. The participant threw the ball to a target on a wall 20' away from them. Two trials were administered. Performance was assessed on four criteria (Appendix G). This assessment was administered two times: 2-weeks prior to the 12-week study and post study week two.

The fourth FMS was the locomotor skill of horizontal jumping. Horizontal jumping is described as the ability for an individual to propel themselves forward from a flat surface with both feet and landing on both feet (Haywood & Getchell, 2001). A starting line was marked on the floor. Each participant was asked to start behind the line and to jump as far as they could, taking off and landing on two feet. Two trials were administered. Performance was assessed on four criteria (Appendix G). This assessment was administered two times: 2-weeks prior to the 12-week study and post-study week two.

The fifth FMS was the object control skill of kicking. Kicking is propelling an object forward using the foot (Haywood & Getchell, 2001). An 8- to 10-inch playground ball was used for this assessment. The ball was placed on a line 10 feet away from the child. Each participant was asked to run up to the ball 10 feet away and kick the ball hard toward the wall. Two trials were administered. Participant performance was assessed on four criteria (Appendix G). This assessment was administered two times: 2-weeks prior to the 12-week study and post study week two.

The sixth and final FMS was the object control skill of striking. Striking is the use of one object to propel another object forward (Haywood & Getchell, 2001). A four inch lightweight Volley tennis ball and a tennis racket were used for this assessment. The participant was asked to bounce the ball in front of the foot on their dominant side, swing racket from low to high as they stepped forward on the opposite foot from the hand holding the racket. Each participant was asked to hit the ball as hard as they are able, uncoiling their trunk and showing the follow through completion of the striking action. Two trials were administered. Performance was

assessed on four criteria (Appendix G). This assessment was administered two times: 2-weeks prior to the 12-week study and post-study week two.

Appendix G

**Fundamental Motor Skill Performance Criteria**

| Skill | Performance Criteria |
|---|---|
| 1. Run | a. Arms move in opposition to legs, elbows bent.<br>b. Brief period where both feet are off the ground.<br>c. Narrow foot placement landing on heel or toe<br>d. Nonsupport leg bent approximately 90 degrees |
| 2. Horizontal Jump | a. Preparatory movement includes flexion of both knees with arms extended behind body.<br>b. Arms extend forcefully forward and upward reaching full extension above the head.<br>c. Take off and land on both feet simultaneously.<br>d. Arms are brought downward during landing. |
| 3. Sideways Gallop | a. Body turned sideways to desired direction of travel.<br>b. A step sideways followed by a slide of the trailing foot to a point next to the lead foot.<br>c. A short period where both feet are off the floor.<br>d. Able to slide to the right and left side. |
| 4. Tennis Forehand Hit | a. Dominant hand grips the tennis racket handle.<br>b. Non-dominant side of body faces the target.<br>c. Hip and spine rotation.<br>d. Weight is transferred by stepping with front foot. |
| 5. Kick | a. Rapid continuous approach to the ball.<br>b. The trunk is inclined backward during ball contact.<br>c. Forward swing of the arm opposite kicking leg.<br>d. Follow-through by hopping on non-kicking foot. |
| 6. Overhand Throw | a. A downward arc of the throwing arms initiates the windup.<br>b. Rotation of hip and shoulder to a point where the non-dominant side faces an imaginary target.<br>c. Weight is transferred by stepping with the foot opposite the throwing hand.<br>d. Follow-through beyond ball release diagonally across body toward side opposite throwing arm. |

*Ulrich, D. (2000). The Test for Gross Motor Development. Austin, TX: Prod-Ed.*

Appendix H

**Fitness Assessment Scores Spreadsheet**

*Grade 5 Fitness Assessment-Control Group (Pre- and Post Test).*

| Student ID # | One Mile (pre-) | One Mile (post) | Push-Ups (pre-) | Push-Ups (post) | Curl-Ups (pre-) | Curl-Ups (post) |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

***Each participant is scored based on the Healthy Fitness Zone (HFZ). The Healthy Fitness Zone (HFZ) for each assessment is listed below the chart.*

**Curl-ups:** boys ≥15/girls≥15

**Push-ups:** boys≥8/girls≥7

**One-mile run:** boys≤11:30/girls≤12:30

Appendix I

**Spreadsheet Used to Record Fundamental Motor Skills**

*Grade 5 Fundamental Motor Skill-Intervention Group (Pre-Test).*

| Student ID # | Running | Horizontal Jumping | Sliding | Kicking | Striking | Overhand Throwing |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**Each skill is scored on a proficiency Level of 1-4, based on the Fundamental Motor Skill Performance Criteria in Appendix G.*