EFFECTS OF A HEALTH-RELATED PHYSICAL FITNESS INTERVENTION ON STUDENTS' PHYSICAL ACTIVITY, CARDIOVASCULAR FITNESS, MOTIVATION, AND ACADEMIC LEARNING TIME

by

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ABSTRACT

The purpose of this dissertation was to examine the effects of Sports, Play and Active Recreation for Kids (SPARK), a health-related physical fitness school program, on middle school students' in-class physical activity levels, cardiovascular fitness levels, motivation, and academic learning time compared to the traditional physical education program. Two quantitative studies were conducted to address this purpose. In study 1, in-class physical activity levels (step counts measured by pedometer), cardiovascular fitness levels (measured by PACER of FITNESSGRAM), and motivation (perceived competence and enjoyment) were assessed among 174 middle school children from SPARK and traditional physical education groups over a period of 11 weeks. Change scores for each outcome variable were used for data analysis. Results from a MANOVA yielded that the SPARK program was more effective in increasing students' in-class physical activity and cardiovascular fitness levels compared to the traditional physical education program, achieving a statistically significant greater increased change score on in-class physical activity levels (Mean $\Delta = 9.33$) compared to the traditional physical education group (Mean $\Delta = 1.30$) ($p < .05$). Study 2 examined the impact of SPARK and traditional physical education on students' percentage of time spent in academic learning in physical education over the course of 9 weeks. The results suggested that the SPARK program was more effective in augmenting students' percentage of time spent in subject matter motor, especially in skill practice and fitness, compared to the traditional physical

education program. This finding is consistent with previous research regarding the in-class physical activity levels in study 1. In conclusion, these studies support that SPARK is an effective pedagogical strategy to increase middle school children's physical activity levels, cardiovascular fitness, and academic learning time in school physical education settings. Physical educators may consider SPARK as an alternative instructional program in order to sustain elevated levels of physical activity, cardiovascular fitness and academic learning time in their classes. By employing SPARK children will have a greater probability of achieving recommended physical activity and cardiovascular fitness levels suggested by various health agencies.

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CHAPTER 1

INTRODUCTION

The health of American children is a major public concern with obesity rates steadily increasing in prevalence (Robinson, Yardy, & Carter, 2012; Welk & Blair, 2000) due, in part, to low levels of physical activity (U.S. Department of Health & Human Services [USDHHS], 2008; 2001). Sedentary habits and low physical fitness levels in adolescents can track into adulthood, which manifests potential significant consequences for both individuals and society as a whole (Malina, 2007). As a consequence of the increased recognition on the importance of optimal levels of physical activity and fitness in children, numerous research studies have been conducted on the youth population to examine effective strategies to increase healthy behaviors in school settings (McKenzie, 2003; Sallis et al., 1997).

It has been reported that regular physical activity participation has a positive influence on individuals' health and well-being (Roberts & Barnard, 2005). Children and adolescents who participate in optimal levels of physical activity on a daily basis are at less risk in developing early onset chronic diseases such as type II diabetes and cardiovascular disease (Strong et al., 2005). In response to the link between physical activity and health, it has been recommended by various health agencies that children and adolescents should participate in moderate to vigorous intensity physical activity for at least 60 minutes per day (Biddle, Gorely, & Stensel, 2004; National Association for Sport

and Physical Education [NASPE], 2004; Strong et al., 2005). Despite these recommendations, research indicates 90% of the school children and adolescents do not engage in the recommended levels, which contributes to the increased prevalence in overweight and obesity in this population (Troiano et al., 2008; USDHHS, 2008). Therefore, effective interventions designed to promote physical activity participation and physical fitness are of critical importance.

Physical fitness refers to a set of personal characteristics that correlates to ability and performance (Caspersen, Powell, & Christenson, 1985). Optimal levels of physical fitness has long been a primary goal of physical education, therefore it is commonly assessed in school settings (McKenzie, 2003). In general, physical fitness consists of two primary components: health-related physical fitness and skill-related physical fitness. A recent trend has focused on health-related fitness, which includes the domain of cardiovascular fitness (Payne & Isaacs, 2007). Cardiovascular fitness, also called aerobic fitness, or cardiovascular endurance, is considered by many professionals to be one of the most important domains of health-related physical fitness due to its links to cardio-metabolic health. Indeed, cardiovascular fitness has been shown to identify youth with less than optimal cardio-metabolic clinical markers (Welk et al., 2011). Optimal levels of cardiovascular fitness have also been shown to have a protective effect on cardio-metabolic risk, even if a child is overweight (Eisenmann, Laurson, & Welk, 2011). Longitudinal research has shown that cardiovascular fitness tracks reasonably well through childhood and adolescence and into adulthood (Malina, 2007). Therefore, children who have low levels of cardiovascular fitness will also tend to have lower levels of cardiovascular fitness in adulthood, which consequently may adversely affect health

status. Therefore, it is imperative that children achieve optimal fitness levels during childhood to improve long-term health outcomes.

Approximately 80% of schools in the U.S. mandate physical education, therefore schools have a major responsibility for promoting children and adolescents' physical activity and cardiovascular fitness levels (NASPE, 2005). Indeed, evidence has suggested that school physical education programs are viable venues to provide children and adolescents the opportunities to participate in physical activity (Centers for Disease Control and Prevention [CDC], 2001). Consequently, school physical education programs play a critical role in promoting school students' health and fitness (Wallhead & Buckworth, 2004; Wright, Patterson, & Cardinal, 2000). However, as previously stated, school physical education programs do not provide sufficient physical activity levels for students (Biddle et al., 2004; McKenzie, Marshall, Sallis, & Conway, 2000). Less than optimal physical activity may be a factor in the decline in students' cardiovascular fitness, which may affect morbidity and mortality later in life (Malina, 2007). An important psychometric correlate of physical activity that contributes to the decline in optimal levels is motivation, which has shown in previous studies to decline during the developmental years (Fredricks & Eccles, 2002; Gao, 2009).

Students' motivation for physical education has long been recognized as a significant contributor to active participation in physical education (Lee, 1997). Despite this, school physical education professionals and researchers have reported a dramatic decline in children's motivation to participate in physical education programs, particularly during the middle school years (Bell, 1997; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002). Because of the importance of motivation on physical activity

outcomes in youth, more research is required to obtain a better understanding of the relationship between children's motivational beliefs and in-class physical activity levels in physical education.

Perceived Competence and Enjoyment

Researchers have concluded that theory-based interventions are more effective in increasing health-related behaviors compared to nontheoretical interventions (Michie & Abraham, 2004). This is because theories provide a framework to describe the development of interventions as well as offer the evaluation of these interventions (The Improved Clinical Effectiveness through Behavioral Research Group, 2006). Competence Motivation Theory (Harter, 1978) is a helpful resource in determining and predicting what factors inspire individuals to engage in particular activities. It has been widely used to investigate students' motivation in sports and physical education settings over the past several decades. The theory proposes that individuals' achievement behaviors can be explained by perceived competence and enjoyment, and that individuals are motivated to achieve competence in several achievement fields such as athletics, academics, and peers interactions (Klint & Weiss, 1987). Successfully mastering tasks boosts perceived competence and enjoyment, which, in turn, increases motivated behaviors and performance (Harter, 1981).

There are several major reasons why children are motivated to engage in physical activity (Harter, 1978). Perceived competence and enjoyment have been identified as significant contributors to physical activity participation and continuous engagement in sport activities (Carroll & Loumidis, 2001; Gao, 2008; Reeve & Weiss, 2006; Weiss & Williams, 2004). As a major construct of motivation, perceived competence is the

perception a person has of his or her ability to accomplish certain tasks resulting from cumulative interactions with the environment (Harter, 1985). Perceived competence represents the key idea that most individuals will choose to do a task or continue to engage in a task when they expect to be successful. Specifically, children who have high levels of perceived competence want to develop and demonstrate physical abilities, such as athletic skills and physical fitness.

In addition to perceived competence, enjoyment is also a dimensional construct of motivation (Wankel, 1997). Enjoyment derived from physical activity participation maximizes positive and minimizes negative experiences related to the behavior. Therefore, children are more inclined to participate in physical activity if they find it to be enjoyable, and the odds of continued participation will be increased as well (Kremer, Trew, & Ogle, 1997).

Researchers must consider both perceived competence and enjoyment when investigating how children's motivation relates to optimal physical activity behaviors and cardiovascular fitness. Accordingly, this research adopted the Competence Motivation Theory as the guiding theoretical construct when investigating how youth's motivation beliefs (e.g., perceived competence, enjoyment) affect physical activity and cardiovascular fitness in physical education settings.

Academic Learning Time in Physical Education (ALT-PE)

The amount of time students spend in academic learning is a key element that contributes to the quality of teaching and learning processes in physical education. Optimal time spent in academic learning is also highly correlated with the student's achievement (Lee, 1996; Paese, 1985). Therefore, academic learning time is one of the

most significant determinants of students' academic achievement (Gettinger & Seibert, 2002). Academic Learning Time-Physical Education (ALT-PE) is an application of academic learning time in school physical education setting, which has been extensively studied as a measure of teaching effectiveness and students' learning achievements in school physical education settings (Barrett, 2000; Derri, Emmanouilidou, Vassiliadou, Kioumourtzoglou, & Olave, 2007; Siedentop, Tousignant, & Parker, 1982). In particular, it also has been reported that ALT-PE is an important mediator between teaching behavior and learning achievement, and the improvement in this mediator could result in students' improved performance (Godbout, Brunelle, & Tousignant, 1983).

Problem Statement

In recent years, multiple programs have been developed to promote school children's physical activity and health-related physical fitness levels (e.g., SPARK). There are a number of studies that have examined the effects of health-related physical fitness programs on school children's physical activity behaviors and motivation, however, little is known about the effect of a health-related physical fitness program on middle school students' physical activity levels, and cardiovascular fitness when compared to the traditional physical education program (a control group).

Relevant research and reviews (Gao, 2008; Kalaja et al., 2010; Stein, Fisher, Berkey, & Colditz, 2007) have summarized Competence Motivation Theory as effective in predicting physical activity behaviors and cardiovascular fitness levels. However, among the intervention studies aimed to investigate the relationship between competence motivation and physical activity behaviors (Barnett, Morgan, Beurden & Beard, 2008; Gao, 2008; Kalaja et al., 2010), few research focused on the differences in adolescents'

motivation changes in various school physical education settings. Therefore, it is still unclear whether school children's motivation can be changed when a health-related physical fitness program is employed as an intervention. Thus, the relationship between physical activity behaviors and motivation using different instructional models in this population needs further examination. Finally, there is limited research comparing the differences on middle school students ALT-PE between health-related physical education and traditional physical education programs.

Study Purpose

This research undertook a two-study approach. The purpose of each study was as follows:

1. To investigate the effects of SPARK on middle school students' in-class physical activity levels and cardiovascular fitness levels compared to the traditional physical education program (study 1).
2. To examine whether SPARK will have a positive influence on middle school students' perceived competence and enjoyment (study 1).
3. To examine the effects of SPARK on middle school students' ALT-PE compared to the traditional physical education program (study 2).

Hypotheses

Hypotheses for purpose 1:

a. SPARK will increase in-class physical activity and cardiovascular fitness levels following the 9-week intervention period.

b. Students in the SPARK group will have significantly increased change scores

on in-class physical activity and cardiovascular fitness levels compared to the traditional physical education group over the intervention period.

Hypothesis for purpose 2:

a. SPARK will be more effective at increasing perceived competence and enjoyment compared to the traditional program over the 9-week intervention period.

Hypotheses for purpose 3:

a. The target students in the SPARK group will spend significantly more time in the ALT-PE categories of motor and knowledge, but significantly less time in the category of general content compared to the traditional group.

b. The SPARK program will provide students significantly more opportunities for participation in the ALT-PE subcategories of fitness, skill practice, and games, but significantly less time spent in transition/break time compared to the traditional group.

Significance

First, this study provided further examination of a health-related physical fitness physical education program's effect in influencing physical activity behaviors among adolescents, which provides evidence for the use of SPARK in physical education. The results of this study provided information regarding how to develop appropriate interventions in physical education to promote adolescents' physical activity and cardiovascular fitness levels based upon motivational theory, thus potentially facilitating professionals to develop more effective interventions. Second, the results from the examined physical education models in this study (SPARK, traditional) may help

professionals decide whether they need to use different instructional approaches when developing interventions for adolescents. Third, the ALT-PE results from this study provided information about what categories of ALT-PE adolescents spent in various physical education models and how long they spent in each of the category and subcategory. This would help physical educators understand adolescents' behavior constructs, and thus develop better intervention and lesson plans to compensate the categories that need to be improved. Finally, the results of this research support the overall importance of health-related physical fitness programs in physical education, and strengthen the point of focus in physical education from the traditional model to the health-related physical fitness model.

Assumptions

It was assumed in this study that:

1. Participants understood the questionnaire items and responded to them truthfully to the best of their ability.
2. Participants represented a normal population of grade 6 to grade 8 students.
3. Participants understood and followed the SPARK activities developed for the intervention.
4. Participants were not interfered by the investigators or assistants.
5. Participants' responses were not influenced by their peers.

Delimitations

The elements controlled in this study were:

1. Participants were delimited to grade 6 to grade 8 students enrolled at middle

schools in the Mountain West Region of the U.S.

2. Individuals with serious health conditions, injuries or illnesses that may limit physical activity participation and individuals with cognitive or decisional impairment or who are mentally disabled were excluded from participating in this study.

3. Participants answered the questionnaires on a voluntary basis.

Limitations

Limitations in this study were:

1. Participants were selected only from grade 6 to grade 8 students enrolled at school in the Mountain West Region of the U.S., which may limit the generalizability of the results of this study.

2. Different levels of participants' motor skill levels may have influenced student responses.

3. Variation may exist in race and social economic status among the participants of the present research.

4. The intervention was of relatively short duration.

5. Some measurement issues existed. For instance, students' motivational belief levels were assessed via voluntary self-reported responses and the participants may have not answered truthfully. Children's in-class physical activity levels were measured via pedometers; therefore, the intensity of activity was not assessed.

6. Finally, the data were analyzed using change scores for the physical and psychometric variables. Therefore, the overall time effects from pre- to post-

intervention could not be assessed using this statistical approach.

Definition of Terms

Academic Learning Time (ALT)

ALT is the amount of time a student spends in attending to relevant academic tasks while performing those tasks with a high rate of correct responding (Berliner, 1984; Caldwell, Huitt, & Graeber, 1982). Relevant academic tasks are activities that are likely to lead to desired educational outcomes. A high rate of correct responding means the student is achieving the appropriate outcome successfully with low error rate for a large amount of time.

Academic Learning Time in Physical Education (ALT-PE)

The portion of physical education time when the student is involved in activities that are appropriate to their ability, resulting in high success rates and low error rates.

Enjoyment

Enjoyment is the intrinsic pleasure derived from the activity that people are engaging in (Harter, 1985).

Health-related physical fitness

Health-related physical fitness consists of those specific components of physical fitness that have a relationship with good health, including cardiovascular endurance, muscular endurance, muscular strength, body composition, and flexibility (Williams & Wilkins, 2010).

Perceived competence

Perceived competence is the perception a person has of his or her ability to accomplish certain tasks resulting from cumulative interactions with the environment (Harter, 1985). Perceived physical competence is defined as one's overall perceptions of personal physical abilities (Bell, 1997).

Physical activity

Physical activity is any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level (USDHHS, 2008).

Physical fitness

Physical fitness is a set of attributes or characteristics that people have or achieve that relates to the ability to perform physical activity. The most frequently cited components of physical fitness fall into two groups: one related to health and the other related to skills that pertain more to athletic ability (Caspersen et al., 1985).

SPARK

SPARK is a health-oriented physical education program that teaches carry-over activities and behavioral skills to elementary and middle school children. The SPARK curriculum is designed to promote school students' health-related physical fitness components, and let students enjoy and promote physical activity (McKenzie et al., 2004; 2009).

CHAPTER 2

LITERATURE REVIEW

In this chapter, a summary is presented of the research examining the influential factors of adolescents' physical activity participation and cardiovascular fitness, including an explanation of the Competence Motivation Theory and a review of its application in pediatric health-related research. The SPARK and traditional physical education models are then introduced and previous works are reviewed, examining their application in the context of school physical education. Finally, ALT-PE is introduced and studies examining the significance of this measure in school physical education settings are reviewed and summarized.

Influential Factors of Childhood Physical Activity and Fitness

By reviewing the previous research (Bell, 1997; Gao, 2009; Gao, Newton, & Carson, 2008; McKenzie, 2003; McKenzie, Sallis, & Rosengard, 2009), several crucial influential factors of physical activity and physical fitness have been identified. These influential factors include but are not limited to: perceived competence, enjoyment, significant others, health status, ethnicity, socioeconomic status, gender, age, and physical education curricula. These factors were further divided by two categories, such as fixed factors including gender, age, and ethnicity, and flexible factors such as motivational and interpersonal variables (USDHHS, 1996).

Motivational beliefs that support optimal levels of physical activity are important for assuring positive health and developmental outcomes. As stated previously, Harter (1978) reported several major reasons why youth are motivated to engage in physical activity in the Competence Motivation Theory. Indeed, motivational components of perceived competence and enjoyment have been recognized as the most significant contributors to physical activity participation and continuous engagement in sport activities (Reeve & Weiss, 2006; Weiss & Williams, 2004). It has also been concluded that children with high perceived competence and enjoyment participated in significantly higher physical activity levels (Bell, 1997; Carroll, & Loumidis, 2001; Jacobs et al., 2002; Reeve & Weiss, 2006; Weiss & Williams, 2004). Recently, the positive association of motivation with individuals' self-reported physical activity and cardiovascular fitness levels has also been reported (Gao, Lodewyk, & Zhang, 2009; Martin et al., 2005; Shen McCaughtry, & Martin, 2007).

Perceived competence refers to the perception a person has of his or her ability to accomplish certain tasks resulting from cumulative interactions with the environment (Harter, 1985). Researchers stated that perceived competence is directly related to physical activity participation motivation (e.g., Chambers, 1991). Several studies have reported a significant positive association between students' perceived competence and physical activity levels (Bagoien & Halvari, 2005; Carroll & Loumidis, 2001; Gao, 2008; Kalaja et al., 2010; Stein et al., 2007; Telama, 1998; Williams & Gill, 1995). Specifically, in Carroll and Loumidis's study, a sample of 922 British middle school students responded to questionnaires assessing perceived competence regarding their physical education programs. The results suggested that children of high perceived competence

participated in significantly more physical activity (quantity and intensity) outside school compared to those of low perceived competence.

Other studies also have concluded a positive relationship between perceived competence and students' health-related physical fitness performance (Gao, 2008; Gao, Lee, Solmon, & Zhang, 2009). For example, in a study using a sample of 300 middle school students in fitness activity physical education classes, it was reported that perceived competence was a significant contributor to physical activity and cardiovascular fitness levels (Gao, 2008). Another study also concluded that middle school students had higher cardiovascular fitness levels when they believed that they would do well in fitness and physical education (Gao et al., 2009).

The concept of enjoyment has been defined as a multidimensional model consisting of factors associated with excitement, affect, competence, attitude, and cognition (Crocker, Bouffard, & Gessaroli, 1995; Wankel, 1997). According to Scanlan and Simons (1992), enjoyment is an important influential factor to physical activity participation. Researchers suggested that an individual's experience of enjoyment has a positive association with physical activity participation (Borra, Schwartz, Spain, & Natchipolsky, 1995) and plays a crucial role in determining their participation (Kremer et al., 1997; Wankel, 1993). It has been reported that physical activities providing fun for children are more attractive than boring activities (Craig, Goldberg, & Dietz, 1996; DiLorenzo, Stucky-Ropp, VanderWal, & Gotham, 1998; Sallis & Owen, 1999).

A longitudinal study suggested there was a positive relationship between enjoyment and physical education during childhood (Shephard & Trudeau, 2000). To promote positive physical education experiences, the Centers for Disease Control and

Prevention (CDC) recommended that physical education curricula should emphasize student's enjoyment (CDC, 1997). Kalaja et al. (2010) stated in their study that providing enjoyable experiences is a potential strategy for increasing physical activity levels in middle school students, and perceived competence was another predictor of physical activity engagement. Wallhead and Buckworth (2004) found that enjoyment in school physical education was related to the motivational factors associated with the adoption of a physically active lifestyle outside school hours. Additionally, enjoyment has been linked with physical activity engagement in school physical education settings (Gao, 2008; Hashim, Grove, & Whipp, 2008; Yli-Piipari, Watt, Jaakkola, Liukkonen, & Nurmi, 2009).

However, enjoyment declines as children age. In a longitudinal study, Prochaska et al. (2003) found a consistent decrease in physical education enjoyment among 4th to 6th grade school children. Similar results were found in another study with Australian 8th grade to 10th grade students during an intervention period for 5 weeks. For the grade 8 students, enjoyment levels declined from 82% to 71%, and enjoyment level fell from 70% to 62% among the grade 10 students (Booth et al., 1997). Another study observed Greek students in grade 5, 7, and 10 (Digelidis & Papaioannou, 1999), and confirmed that physical education enjoyment levels were negatively related with the grade level.

Gender and age are the most powerful determinants in influencing physical activity and fitness levels. In fact, gender and age differences have been frequently reported when studying physical activity and fitness patterns in children and adolescents. The majority of research has suggested boys were more active than girls, and boys had higher self-reported and observed physical activity levels and physical fitness levels at 9-

13 years old (Bois, Sarrazin, Brustad, Trouilloud, & Cury, 2005; Gao, Hannon, Newton, & Huang, 2011; Hobin, Leatherdale, Manske, Dubin, Elliott, & Veugelers, 2012; Hovell, Sallis, Kolody, & Mckenzie, 1999; Kalaja et al., 2010; Kamtsios, 2010; Trost et al., 2002). The finding from a youth review study suggested that the decline in physical activity and physical fitness was greater in girls than boys (Sallis, 1993).

In terms of the gender differences on the motivational beliefs which highly correlate with physical activity, several studies reported that boys perceived higher levels of perceived competence than girls did (Gao et al., 2009; Jacobs et al., 2002), and boys also tended to have higher enjoyment level during physical activities than girls (Bois et al., 2005; Gao, Zhang, & Podlog, 2013; Kalaja et al., 2010; Kamtsios, 2010). Generally speaking, research findings have consistently shown that boys are more likely to demonstrate higher levels of physical activity, cardiovascular fitness, and motivational beliefs in physical education classes.

Unlike the age-related changes in academic domains, researchers have documented inconsistent findings for grade/age differences in physical activity levels, physical fitness, and motivational beliefs in physical education settings. The majority of research has reported that children's physical activity and physical fitness levels decline across school years in physical education (Parish & Treasure, 2003; Sallis, 1993, 2000; Trost et al., 2002), whereas some have found the opposite results to the previous studies. For example, in a 9-year longitudinal study, Telama and his colleagues (Telama & Yang, 2000) have indicated that school children's self-reported intensity of physical activity increases with age, in particular among boys. Nevertheless, few research studies have been conducted to examine the gender and grade difference in school children's physical

fitness levels among various physical education instructional models. This lack of congruence calls for more research, particularly considering that middle school students are less studied by researchers in the field of physical education.

Previous research has also reported that school children's motivation for physical activity declines over the years as school students progress in age (Fredricks & Eccles, 2002; Gao, 2009; Jacobs et al., 2002). For example, one longitudinal study aimed to examine gender and domain differences in perceived competence and values for 761 children across grades 1 through 12. The most significant finding across all domains was that children's self-reported sport perceived competence declined as they aged, and the decline accelerated during the high school years (Jacobs et al., 2002).

In summary, children and adolescents' physical activity and cardiovascular fitness levels are influenced by several factors, such as motivational beliefs, impact of significant others, and variations in gender and age. Because current focus on physical education in the U.S. is to promote school children's health, we ought to have a better understanding of the relationships and interactive associations of those influential factors in health-related physical education programs in order to increase school children's physical activity and cardiovascular fitness levels.

Physical Education Curricula

Research evidence has shown that various physical education instructional models have different effects upon children's physical activity behaviors, cardiovascular fitness, and motivational beliefs (Gao, Zhang, & Podlog, 2013; Spittle & Byrne, 2009; Wallhead & Ntoumanis, 2004).

School children's physical activity levels and motivations have been found to

vary in different curricular activities (Fairclough & Stratton, 2006; Gao et al., 2011). Generally, students demonstrate higher physical activity levels in team games, particularly invasion games (e.g., flag football, basketball, and soccer) than health-related fitness activities. MacFarlane and Kwong (2003) found that students demonstrated higher heart rates during ball games and free play than athletics and gymnastics, and direct observation of students' activities further supported that result. However, another study using systematic observation reported inconsistent findings. Specifically, Simons-Morton, Taylor, Snider, and Huang (1993) observed that students achieved the most moderate and vigorous intensity of physical activity during walking/jogging, football, and dodge ball, whereas students had the least physical activity intensity during rope climbing and tag games. One study used accelerometers to evaluate the effects of curricula activity on students' physical activity levels, and reported that students spent significantly higher percentage of time in moderate to vigorous intensity of physical activity in fitness and football classes than they did in Dance Dance Revolution classes (Gao et al., 2011).

It has been documented that students' motivation could be affected by curricular activity (Lee, 1997). For example, perceived competence and enjoyment of the activities emerge as important indicators of students' positive motivation (Gao, 2008; Harter, 1978). However, the potential effects of curricular activities on motivation has been substantially neglected due to the fact that most motivation-based empirical research concentrated on individuals' psychological temperaments rather than on learner-content reciprocities (Gao et al., 2011). Therefore, examining the relation between physical education curricular activity and students' motivation toward physical education is imperative.

SPARK was initially designed as a research-based elementary physical education program, it currently also includes preschool, middle school, and high school physical education. Considering the seriousness and prevalence of childhood obesity due to the poor physical activity participation, the SPARK programs were designed with the imperative need to fight against low levels of children's physical activity and cardiovascular fitness in mind (Sallis et al., 1997). It has been reported that the current predominant physical education programs focus more on school children's sport capabilities, thus interventions with the aim of promoting children's health-related outcomes need to be created (Sallis & McKenzie, 1991). Therefore, SPARK is a comprehensive school-based physical education program that is concerned not only with increasing physical activity, but also with promoting the generalization of physical activity and fitness beyond school environments (McKenzie, Sallis, & Rosengard, 2009).

SPARK was developed by the National Heart, Lung, and Blood Institute of the National Institutes of Health and San Diego State University, and is a health-oriented physical education program that teaches carry-over activities and behavioral skills to school children (McKenzie, Sallis, & Rosengard, 2009). SPARK curriculum is a comprehensive program designed to promote school students' health-related physical fitness components, and lets students enjoy and engage in physical activities. The curriculum is also designed to promote a moderate to vigorous intensity level of physical activity, health-related fitness, and movement skills. The curriculum package included yearly plans divided into several instructional units based on various sport activities, which is typically 3 to 4 weeks in length for each. The selection of activities in the SPARK program and the methods employed are to promote maximum student

participation during class time. The program precludes inactive sports and drills, elimination games, and activities that require specialized and expensive equipment (e.g., swimming class) or demand an inordinate amount of time to set up (Silverman & Ennis, 2003). A standard lesson of SPARK curriculum included two parts: activities that focus on health-related physical fitness and those that focus on motor/sport skills. The activities focused on health-related physical fitness were implemented with instructional units that included aerobic dance, aerobic games, and jump rope activities. The intensity, duration, and complexity of activities varied according to different environments. The activities not only focused on developing cardiovascular endurance, but also promoted muscular strength and body composition. In addition, there were another 12 units concentrated on developing motor skills and included age-based skills applied in sport activities such as basketball, soccer, and volleyball. Modifications were also applied to make those low-active games (e.g., softball, kickball) more active. In addition to the physical education curriculum, the SPARK package included "Lifelong Wellness," which is a self-management program. It aimed to help children and adolescents adopt healthy behaviors and skills, and maintain regular physical activity. In addition, practices of self-monitoring, goal setting, self-reinforcement, self-instruction, scheduling, and decision making/problem solving were also included in this package.

A number of publications have demonstrated positive outcomes of this program on school students' in-class physical activity levels, cardiovascular fitness levels, and psychological variables (Fu et al., 2013; Marshall, Biddle, Sallis, McKenzie, & Conway, 2002; McKenzie et al., 2004; McKenzie et al., 2009; Prosper, Moczulski, Quershi, Weiss, & Bryars, 2009; Sallis et al., 2002). Prosper and his colleagues (2009) investigated the

effect of SPARK on childhood overweight and obesity and its impact on lifestyle behaviors that promote lifelong fitness and healthy eating habits among 1469 students enrolled in 51 K-12 schools. The study found that body mass index had significant positive change for those overweight and obese students after the intervention was implemented for 1 school year. Significant improvements were also observed on students' self-esteem scores and indicators for lifestyle behaviors. The study demonstrated that SPARK could help improve the health of low-income families' youth whose neighborhoods are unsafe and often lack facilities for exercise. The study further concluded that SPARK provided a safe, accessible, no cost, and effective method to fight against childhood overweight and obesity.

The traditional physical education model has been the dominant instructional approach in the U.S. since the 1920s, especially at the secondary school level (Siedentop, 2007). The class in this model generally starts with sport skill instruction by a teacher, followed by games and sport activities for the rest of the class, which are delivered through the format of drills, practices, small-sided-games, and full-sided games (Curtner-Smith & Sofo, 2004; Siedentop & Tannehill, 2000). Although this dominant instructional physical education model has been serving the U.S. schools for decades, researchers indicated that traditional physical education teaching has not reached our expectations and increasing criticism has been directed toward this physical education model (Ennis, 1998, 1999; Ennis et al., 1997; Kulinna, 2008). For instance, the traditional physical education class has redundant but ineffective instruction from the teacher, and most of the contents focused too much on students' sport-related skills development. In addition, teachers in this instruction model often ignored students' performance or did not provide

feedback due to its teacher-centered nature. Moreover, because the traditional physical education model contains many small/full-sided invasive sport games, Ennis (1999) further indicated that gender issues emerged in the multi-activity model because girls found it difficult to fully participate in physical education classes. In contrast, boys, especially those who were good at sport activities, were able to dominate and control the classes in this form of the multi-activity model, which caused negative emotions and humiliation among the girls and those boys who were less physically active (Griffin, 1984, 1985).

Additionally, in this teacher-centered model, teachers are responsible for class management, task instruction, student responsibility, and assignments (Hastie, 1998). This results in the disconnection of skill learning and a lack of the students' class engagement due to the limited responsibility placed on them. Consequently, students soon become bored in traditional multi-activity PE classes, especially those who are less capable in sports activities (Siedentop & Tannehill, 2000). The majority of the lessons in the traditional physical education model are designed to promote students' athletic capabilities and skills, which are related to physical fitness skills.

There is no doubt that the quality of the traditional multi-activity physical education teaching model is not ideal, and should be replaced by innovative physical education curriculum models that could meet contemporary requirements (Kulinna, 2008).

Academic Learning Time in Physical Education (ALT-PE)

The amount of time a student is engaged in a subject at an appropriate level of difficulty is one of the basic elements that contribute to a successful teaching and learning activity (Lee, 1996). Thus, a student's engaged time has a significant influence on his/her

academic achievement (Gettinger & Seibert, 2002). The "Beginning Teacher Evaluation Study" that was conducted in the 1980s (Denham & Lieberman, 1980) was one of the earliest and most extensive research programs that aimed to examine the relationship of student's engagement time with subject matter, and also proposed the concept of ALT. They found that ALT was a strong determinant of academic achievement. Hence, among the many variables that contribute to student achievement, ALT has been advocated by educators because components of ALT are viewed as aspects of classrooms that teachers may be able to control and handle (Gettinger & Seibert, 2002).

ALT-PE is an application of academic learning time in school physical education settings, which has been extensively studied as a measure of teaching effectiveness. It is a meaningful tool to measure teachers' effectiveness in that the teacher who produces higher levels of ALT-PE are more effective in teaching (Rink, 1996; Siedentop, 1983). The ALT model for teacher effectiveness research in physical education was first developed and utilized by Darly Siedentop and his research group (Birdwell, 1980; Metzler, 1979; Siedentop, Birdwell, & Metzler, 1979; Whaley, 1980). They concluded that ALT-PE observation instrument is a valid tool for evaluating teachers' effectiveness in a physical education setting. Using the ALT-PE instrument for research in physical education is appropriate, because most of the content and student achievement taught in physical education classes cannot be measured through valid and reliable means (Placek & Randall, 1986). Although soccer scores, for example, provide immediate, measurable feedback on student's performance, skills such as shooting or dribbling are difficult to measure by quantitative means, because these skills are fleeting, flowing actions, temporary and nonreproducible, thus not easily recorded. Therefore, a process measure

such as ALT-PE seems to provide a powerful indirect measure to examine the learning effectiveness and students' achievement in PE class (Placek & Randall, 1986; Silverman, Dodds, Placek, Shute, & Rife, 1984). In addition, ALT-PE has provided valuable data for extending knowledge on teaching, learning, and teacher education. Moreover, it has made significant contributions to the quality of teaching and coaching through data-based literature (De Marco, Mancini, Wuest, & Schempp, 1996).

ALT-PE has also been extensively applied in students' achievement measurement in physical education classes. Metzler (1989) claimed that there is a positive relationship between ALT-PE accrual and student learning, despite students spending very little ALT in physical education classes (Dodds, Rife, & Metzler, 1982). In another study, Paese (1986) found that students' subject matter motor time has a high correlation with desired achievement. Several other research studies have shown that the more ALT-PE that students are engaged in with activities appropriate to their skill levels, the greater the learning they achieved (Beckett, 1989; Silverman, 1985; Silverman, Devillier, & Ramirez, 1991). Johnson investigated the effects of 3rd grade elementary school students' percentage of ALT-PE on their motor skills and social behaviors in the "Classwide Peer Tutoring in Physical Education," a cooperative teaching strategy (Johnson, 1999). He found that although there was no functional relationship at either the context or the student engagement level of the ALT-PE instrument (Siedentop et al., 1982), students significantly increased mean success rates from baseline to intervention, thus he concluded that the "Classwide Peer Tutoring in Physical Education" was an effective physical education strategy. In another study examining the effects of two cooperative learning strategies, "Performer and Coach Earn Rewards" and "Jigsaw II-

PE," on middle school students' ALT-PE (Barrett, 2000), it was reported that cooperative learning strategies do not consume more time compared to a traditional strategy, nor do they decrease students' learning time.

Beauchamp and his colleagues (1990) reported ALT-PE is an indication of quality in high school physical education after observing and comparing 75 high school students' context levels and involvement levels of the ALT-PE instrument (Siedentop et al., 1982) in various physical education classes over 4 months. In terms of the gender and grade difference on ALT-PE, one study that aimed to examine the difference of high school students' ALT-PE reported that males and females spent a similar amount of time in class involvement as measured by the ALT-PE instrument (Siedentop et al., 1982) and higher grade students reported higher ALT-PE rates than lower grade students (Beauchamp et al., 1990). In the Beauchamp et al. study (1990), they also concluded that high school boys (39%) had higher ALT-PE percentage on the motor engagement time than their female counterparts (36%), and grade 12 students (44%) demonstrated higher ALT-PE rates than grade 10 (36%) and grade 11 (38%) students.

Numerous studies have concluded the significance of ALT-PE in enhancing the quality of physical education and students' achievements (Gettinger & Seibert, 2002; Placek & Randall, 1986; Metzler, 1989; Silverman et al., 1984). However, it is still unknown if health-related physical fitness education programs could affect middle school students' ALT-PE. In addition, how students spend time in context levels in various curricular activities of health-related physical fitness programs is still unclear. In response, this study was designed to examine middle school students' ALT-PE levels in various sport activities (soccer, flag football, and ultimate Frisbee) in a health-related

physical fitness program, as compared to middle school students' ALT-PE levels in a traditional physical education program.

CHAPTER 3

EFFECTS OF A HEALTH-RELATED PHYSICAL FITNESS INTERVENTION ON MIDDLE SCHOOL STUDENTS' PHYSICAL ACTIVITY, CARDIOVASCULAR FITNESS AND MOTIVATION

Promoting physical activity and cardiovascular fitness is one of the primary goals of school physical education programs. It has been recommended that school-age children and adolescents accumulate at least 60 minutes of moderate to vigorous physical activity per day for health benefits (USDHHS, 2008). Some health-related school physical education programs have been reported to have a positive effect in promoting students' physical activity levels, as school children's physical activity levels were found to be higher when they participated in health-related physical education programs (McKenzie et al., 1997; McKenzie et al., 2004; Sallis et al., 1997; Sallis et al., 2002). In a study examining the "Go for Health" program, it was found that students in the intervention group displayed significantly higher physical activity levels over 2 years compared to students in the control group (Simons-Morton, Parcel, & O'Hara, 1988). In another experimental study, students in a health-related physical education program accumulated higher levels of moderate to vigorous physical activity compared to students in the control group (McKenzie, Sallis, Faucette, Roby, & Kolody, 1993). Additionally, students who participated in the SPARK program reported substantially more self-reported physical activity participation and higher physical activity intensity (McKenzie

et al., 2004; Sallis et al., 1997; Sallis et al., 2002). Although increasing students' in-class physical activity levels has been considered an important benchmark for evaluating the effectiveness of physical education programs (Gao, Newton, & Carson, 2008), it is still unknown if the SPARK program will increase students' in-class physical activity levels in terms of their step counts as assessed by using pedometers.

Along with physical activity, physical fitness is also an important indicator of good health, and therefore it has been an important objective of school physical education programs to increase fitness levels in school-aged children (McKenzie, 2003). Indeed, there has been a trend in physical education from an emphasis on motor skill development or athletic ability to an emphasis on what is commonly referred to as health-related physical fitness. One of the most important domains of health-related fitness is cardiovascular fitness, which has been linked to cardio-metabolic health in both adults and children (NASPE, 2005; Payne & Isaacs, 2007; Welk et al., 2011).

Although there are several influencing factors on in-class physical activity participation and cardiovascular fitness, psychometric measures such as motivation have recently been found to show significant associations through increasing class engagement (Gao, 2008, 2009; Lee, 1997). However, despite the positive mediating effects of motivation on physical activity, it has been shown that students' motivation for physical education participation actually declines throughout childhood, especially during the developmental years (Gao, Hannon, Newton, & Huang, 2011; Gao, Lee, Solmon, & Zhang, 2009). Therefore, research focusing on school children's motivation for physical education participation has become imperative.

Given the importance of optimal levels of physical activity and cardiovascular

fitness in school-aged children and given the significant mediating effect of motivation (perceived competence and enjoyment) on healthy physical activity behaviors, the purpose of this study was to examine the effect of the SPARK program on middle school students' in-class physical activity levels, cardiovascular fitness, and motivation compared to the traditional instructional model in a sample of middle school students. Additionally, a secondary aim was to examine age- and gender-related differences of the pre/posttest change scores on students' physical activity, cardiovascular fitness, perceived competence, and enjoyment between the SPARK and traditional models. It was hypothesized that the SPARK physical education model would yield greater increases in the change scores on step counts, compared to the traditional instructional model. Additionally, it was hypothesized that boys would achieve greater increases in change scores compared to girls in cardiovascular fitness, but no differences would be found between genders in the other variables. Finally, it was hypothesized that children in the younger grade levels would achieve greater increases in change scores compared to children in the older grade levels on perceived competence and enjoyment.

Methods

Participants and setting

Participants included 175 middle school students recruited from the 6th through 8th grades. Students were enrolled in two urban private schools located in the Mountain West Region of the U.S. After deleting drop-out participants via data screening procedures (see the data screening section), the final sample size of this study was 174 (82 boys, 92 girls) students. Age range of the final sample was from 10 to 14 years (M_{age} = 12.06, *SD* = .85).

The racial and ethnic distribution consisted of 82.3% Caucasian, 12.0% Hispanic, 2.3% Asian or Pacific Islander, 1.7% African American, and 1.7% Other (American Indian or Filipino). The sample was stratified into Control and Intervention groups by school. In the control school, there were 99 (49 boys, 50 girls) participants from five physical education classes, including 37 sixth graders, 31 seventh graders, and 32 eighth graders. In the intervention school, there were 75 (33 boys, 42 girls) participants from three physical education classes, including 25 sixth graders, 27 seventh graders, and 23 eighth graders.

In the intervention school, physical education class was delivered once a week. The physical education teacher in the control school was male, and had more than 10 years K-12 physical education teaching experience. Physical education class was also offered once a week in the control school, where the traditional physical education program was implemented. The teacher in the intervention school was male, and had more than 15 years of physical education teaching experience. Permission to conduct the study was obtained from the University Institutional Review Board, the school administrations, and the physical education teachers prior to the start of this study (see Appendix A and B). Students provided written informed assent and parents provided the written informed consent prior to participation in this study (see Appendix C and D).

Measures

The study outcome variables included were students' in-class physical activity levels, cardiovascular fitness levels, perceived competence, and enjoyment.

In-class physical activity level. The participants' in-class physical activity levels were measured by piezoelectric pedometers, New-Lifestyles SW-200 (New Lifestyles,

Lees Summit, MO), to determine whether the in-class step counts were different between the students in the intervention group (SPARK) and those in the control group (traditional physical education). It has been reported that the pedometer is an ideal instrument in physical education settings due to its characteristics of being inexpensive, easy to use, and relatively accurate (Sirard & Pate, 2001). Research evidence has also shown that the piezoelectric pedometer is a highly precise and reasonable pedometer for estimating physical activity level in young to middle-aged adults and suitable for individuals with various body mass index levels (Clemes, O'Connell, Rogan, & Griffiths, 2010; McClain, Hart, Getz, & Tudor-Locke, 2010). This type of pedometer combines several important features, including a record of steps, moderate-to-vigorous intensity levels of physical activity, time accumulation, and 7-day memory.

For the purpose of this study, only the step data were used. Before the initiation of data collection, pedometers were calibrated. Specifically, each pedometer was shaken vertically 100 times and then the error between shaken and recorded steps was examined for each pedometer. Deviation from the 100 shakes for all pedometers must be less than 5%. The calibration indicated that the pedometers could provide accurate step counts. In this study, students' in-class physical activity levels were quantified as steps per minute, which was calculated by dividing the overall pedometer steps in class by the class time, adjusted for dress and warm-up time (Scruggs et al., 2005). Students wore pedometers during the overall period of the data collection from week 1 to week 11. The purpose of collecting 11 separate pedometer measurement points was to track the changes in students' in-class physical activity levels throughout the experiment.

Cardiovascular fitness. In this study, participants' cardiovascular fitness was

assessed by the Progressive Aerobic Cardiovascular Endurance Run (PACER), which was conducted once at baseline in week 1, and once again at week 11. The PACER is the recommended cardiovascular endurance test used in the FITNESSGRAM assessment program. The PACER was administered indoors for all students on a marked gymnasium floor with background music and cadence given by an audio CD. Students were instructed to run from one floor marker to another marker set 20-meter apart while keeping pace with a prerecorded cadence. A single beep sounded at the end of the time allotted for each lap. A triple beep sounded when the students had completed a stage of the test and indicated that the pacing would get progressively faster. The test was terminated when a student twice failed to reach the opposite marker in the allotted time frame or when he/she voluntarily stopped. Final score was recorded in completed "Laps" (Meredith & Welk, 2010).

Perceived competence. The physical subscale of the Perceived Competence Scale for Children (Harter, 1982) was employed to assess students' perceived competence levels in physical education classes. The subscale consisted of six questions presented in a structured alternative format. This format allowed children the freedom to choose either side of the scale, as they did not have to admit incompetence or inability on either side, just some degree of difficulty. After reading each question, students decided which answer (positive or negative) in the pair was true for them and then they responded to bipolar statements (e.g., really true or sort of true). Each answer was scored from 1 to 4, with a score of 1 referring to *low perceived competence* and a score of 4 indicating *high perceived competence*. Scores for the six questions were averaged and then were used as students' perceived competence. This scale has demonstrated acceptable validity

and reliability in the sport setting (Fu et al., 2013; Weiss, 1987).

Enjoyment. Students' enjoyment levels in physical education classes were measured using the Sport Enjoyment Scale (Scanlan, Carpenter, Schmidt, Simons, & Keeler, 1993). The scale included four items, and was used to assess the aspects of enjoyment, pleasure, fun, and happiness rated on a five-point Likert scale that ranged from 1: *strongly disagree* to 5: *strongly agree*. The sample items are: (a) I like physical education lessons, (b) I have fun in physical education lessons, (c) physical education lessons make me happy, and (d) I enjoy physical education lessons. Scores for the four items were averaged and then used as students' enjoyment levels. The scale has been found to have satisfactory internal consistency in sport settings (Scanlan et al., 1993).

Research design and procedures

Prior to data collection, the principle researcher explained the information related to the study, which included the purpose, basic procedures, assent form, and parental form to the potential participants. Students were encouraged to raise any questions and concerns regarding the study. Only those students who were willing to participate in the study read and signed the assent form.

This study used a repeated measure design over a period of 11 weeks. Week 1 was the baseline time-point, during which all the participants from the two schools attended a traditional fitness physical education class. Their in-class physical activity levels, cardiovascular fitness levels, and motivational beliefs were pretested at baseline. Specifically, students' step counts during week 1 were recorded as their in-class physical activity level pretest data. The pedometers were distributed to the students at the beginning of class, and were assigned an identification number to match the number on

the pedometer. The principle researcher and teacher demonstrated to the students how to wear the pedometer properly (i.e., waistband-secured at their right hip, above the right knee). Students returned the pedometers at the end of the class, and the principle researcher recorded their in-class steps immediately after the class. The PACER test was conducted in the physical education class on week 1.

Additionally, students responded to self-reported perceived competence and enjoyment surveys at the end of the physical education class in week 1. The average time required to complete the surveys was approximately 5 minutes. The principle researcher administered the surveys at the end of the class period, and explained how to respond to the questions. Students were encouraged to answer truthfully and assured their responses would remain confidential in order to minimize personal bias. All data were recorded using anonymous confidential identification numbers, and students could not be identified by name after the data were collected. Data were kept confidential, and records were stored in a locked filing cabinet or on a password protected computer located in the researcher's workspace. Only the principal researcher had access to this information.

Over the course of the following 9 weeks (week 2 to week 10), the students in the intervention group participated in the SPARK middle school physical education program. Meanwhile, the students in the control group continued to engage in traditional physical education classes. Students from the SPARK and traditional physical education groups participated in the same sport activity at the same time during the 9-week intervention period in the order of soccer, flag football and ultimate Frisbee, with each activity lasting 3 weeks. On week 11, students' in-class step counts were measured again using identical procedures as the pretest time-point (week 1). Cardiovascular fitness levels and

motivational beliefs were measured as posttest at week 11 using the same protocol as in week 1.

Data analysis

All dependent variables were initially screened for normal distributions and outliers using k-density plots, box-plots, and the Shapiro-Wilk test for normality. Descriptive statistics (means and standard deviations) were calculated for each dependent variable within each grade, gender, and instructional physical education group. Cronbach's alpha was computed to examine the internal consistency of the Perceived Competence and Enjoyment questionnaires. A Cronbach's alpha value of ≥ 0.70 was used as a cut-point to determine an acceptable level of internal consistency (Cronbach, 1951).

In-class physical activity level (steps/minute) was computed for each time-point by dividing the total recorded pedometer steps by the instruction time. PACER scores were reported as the number of laps, and perceived competence and enjoyment scores were calculated based on averages at pretest and posttest time-points. Factorial ANOVA tests were conducted on the pretest scores on each of the dependent variables to determine if there were significant differences between the groups. The results indicated significant differences between the physical education groups on the pretest in-class physical activity and PACER scores. However, since this was a nonrandomized, quasi-experimental study where assignment to groups was not based on baseline scores, analysis of change scores was determined to be a less biased approach compared to the use of analysis of covariance (ANCOVA) (Van Breukelen, 2006). Additionally, the research question was unconditional, addressing the issue of differences in the average

change over time between groups as opposed to a conditional question addressing change over time if the groups have the same initial scores on the dependent variables. Therefore, in order to account for initial differences in in-class physical activity level, PACER, perceived competence, and enjoyment scores, change scores were computed for each dependent variable by subtracting pretest scores from posttest scores (Fitzmaurice, 2001).

The dependent variable pretest and posttest scores were then correlated with each other via zero-order Pearson Product-moment correlations using the total sample for analysis. This was employed to examine the strength of the linear relationship between raw scores of the dependent variables, and if the data were suitable for multivariate analyses. There were moderate linear relationships among raw data; therefore, a 2 (Group membership) × 3 (Grade) × 2 (Gender) multivariate Analysis of Variance (MANOVA) was then conducted to examine the differences in the dependent variables' change scores within a multivariate framework. The independent variables were group membership (SPARK, traditional), gender (girl, boy), and grade (6th, 7th, 8th). Wilk's lambda was used to determine the statistical significance of the multivariate model. Multivariate homoscedasticity was examined using Box's M test with alpha level set at $p \leq .01$. Any influential cases were identified using Cook's Distance with a conservative cut-point of 1.00 used for case removal.

Follow-up univariate ANOVA tests were then conducted based on the statistical significance of the omnibus MANOVA test. Statistically significant main effects were reported for each dependent variable in addition to statistically significant two-way and three-way interactions. Univariate homoscedasticity was examined using Levene's test. A Bonferroni post hoc test was employed if there were any statistically significant

differences for the grade variable. Alpha level was set at $p \leq .05$ and was adjusted appropriately using the Bonferroni method for post hoc analyses. All analyses were carried out using the SPSS v20.0 statistical software package.

Results

This section presents the current study's findings. Specifically, the results were addressed by the order of descriptive statistics, effects of intervention on in-class physical activity levels (steps/minute), effects of intervention on cardiovascular fitness levels (PACER), and effects of intervention on students' motivational beliefs (perceived competence and enjoyment).

Descriptive analysis

Tables 1, 2, and 3 present the raw means and standard deviations for each dependent variable within specific group-time, age-group-time, and gender-group time-points, respectively. The Cronbach's alpha for the perceived competence questionnaire was .81 at pretest and .79 at posttest, and the Cronbach's alpha for the enjoyment questionnaire were .92 at pretest and .94 at posttest. Based on these coefficient values, the two questionnaires used to measure the constructs of perceived competence and enjoyment were deemed as having acceptable internal consistency. Therefore, the self-reported measures were considered appropriate for the participants in this study.

The zero-order Pearson correlation coefficients for the pretest and posttest scores of the dependent variables are presented in Table 4 and 5. The scores of all dependent variables were statistically and moderately significant moderate correlated with each other in both pretest and posttest ($p < .01$).

Multivariate effects

Preliminary analysis revealed that there were no influential cases in the dataset as Cook's D values were < 1.0. Additionally, all dependent variables were normally distributed and the assumption of multivariate homoscedasticity was not violated, as Box's M test was nonsignificant. There were statistically significant interaction effects for Grade x Group (Wilk's $\Lambda = 0.794$, $F(8, 316) = 4.827$, $p < .001$), and Grade x Gender x Group (Wilk's $\Lambda = 0.886$, $F(8, 316) = 2.473$, $p < .05$). The results from the MANOVA also yielded a significant main effect for Gender (Wilk's $\Lambda = 0.933$, $F(4, 158) = 2.821$, $p < .05$) and Group (Wilk's $\Lambda = 0.878$, $F(4, 158) = 5.491$, $p < .001$).

Effects of interventions on in-class physical activity levels

The three-way Gender x Grade x Group interaction suggests that there were significant group differences in in-class physical activity change scores for boys in grade 6 and grade 7 ($p < .001$), but not in grade 8. For girls, there were significant group differences in in-class physical activity change scores in grade 6 and grade 8 ($p < .001$), but not in grade 7. The SPARK group achieved higher in-class physical activity scores compared to the traditional physical education group for the aforementioned pair-wise comparisons. The interaction is displayed in Figure 1 and Figure 2, respectively.

The data also revealed that there were statistically significant interactions for Grade x Group ($F(2, 161) = 5.589$, $p < .01$). The interaction of Grade x Group on in-class physical activity change scores is presented in Figure 3. The two-way Grade x Group effect suggests that, for the SPARK group, there were statistically significant change score differences between grade 6 and grade 7 (Mean Δ Difference = 8.11, 95% CI [1.69, 14.52], $p < .01$). However, for the traditional physical education group, there were

statistically significant change score differences between grade 6 and grade 8 (Mean Δ Difference = -6.96, 95% CI [-12.54, -1.37], $p < .01$).

Regarding the in-class physical activity level change scores between SPARK and traditional groups, the follow-up univariate test revealed a statistically significant main effect for group ($F (1, 161) = 21.819$, $p < .001$). Figure 4 illustrates that the students in the SPARK group achieved an overall higher physical activity level compared to the traditional physical education group over the 9-week intervention period. The in-class physical activity change scores between the groups are presented in Figure 5.

Effects of interventions on cardiovascular fitness levels

There was a statistically significant Gender x Grade x Group three-way interaction ($F (2, 161) = 5.701$, $p < .01$), which suggests that there were significant physical education group differences in PACER change scores for boys in grade 8 ($p < .01$), but not for boys in grade 6 or grade 7. Also, there were significant group differences in PACER change scores for girls in grade 8 ($p < .01$), but not for those in grade 6 or grade 7. The SPARK group yielded greater increased PACER change scores for the pair-wise comparisons in grade 8 girls, but in grade 8 boys the traditional group yielded greater increased change scores. There was a main effect for gender on PACER change scores ($F (1, 161) = 9.030$, $p < .01$), with boys having greater increased PACER change scores (Mean Δ = 11.983, SD = 1.114) compared to girls (Mean Δ = 7.421, SD = 1.032). The three-way interaction is displayed in Figure 6 and Figure 7, respectively.

Effects of interventions on motivational beliefs

There were no main effects for perceived competence change scores. However, there was a statistically significant Group x Grade interaction effect (F (2, 168) = 3.98, $p < .05$). The two-way Group x Grade suggests that, for the SPARK group, there were statistically significant increased perceived competence change score differences between grade 6 and grade 8 (Mean Δ Difference = .38, 95% CI [.07, .69], $p < .05$).

There were no main effects on enjoyment change scores, but there was a statistically significant Group x Grade interaction effect (F (2, 168) = 13.541, $p < .001$). The two-way Group x Grade interaction suggests that, for the SPARK group, there were statistically significant greater increased enjoyment change score difference between grade 6 and grade 7 (Mean Δ Difference = .67, 95% CI [.28, 1.07], $p < .001$) and grade 6 and grade 8 (Mean Δ Difference = .81, 95% CI [.39, 1.23], $p < .001$). Additionally, the two-way Group x Grade suggests that, for the traditional physical education group, there were statistically significant greater increased enjoyment change score differences between grade 6 and grade 8 (Mean Δ Difference = -.58, 95% CI [-.93, -.24], $p < .001$). The motivational belief interactions are displayed in Figure 8 and Figure 9, respectively.

Discussion

The primary purpose of this study was to examine the effects of a health-related physical education program (SPARK) on middle school students' in-class physical activity levels compared to a traditional physical education program. The results indicated that the SPARK program significantly increased students' in-class physical activity levels over the intervention period compared to the traditional physical education program in most students but did not display significant differences in 8th graders, thus

partially supporting the first research hypotheses. The secondary purpose was to investigate the effects of the SPARK program on middle school students' cardiovascular fitness levels compared to the traditional physical education program. The results yielded statistically significant differences between the SPARK and traditional physical education groups within specific grade and gender groups, but no group main effect was found on PACER change scores over the intervention period. Additionally, the present study examined whether SPARK could have a positive influence on middle school students' perceived competence and enjoyment. The results indicated that there were increases in perceived competence and enjoyment in the SPARK group for grade 6 compared to grade 8, supporting the original hypothesis that younger children would display greater change in motivation compared to older children.

Effects of SPARK on in-class physical activity

The results from this study indicate that there were increases in-class physical activity level for both the SPARK and traditional physical education groups from pre-test to posttest. However, the SPARK group had statistically greater increased in-class physical activity levels as compared to the traditional group in younger children. These results support that SPARK, as an established health-related physical education program, was significantly more effective in increasing middle school students' in-class physical activity levels than the traditional physical education program in younger children.

The results are consistent with most of the previous studies (Dowda, Sallis, McKenzie, Rosengard, & Kohl, 2005; McKenzie et al., 2004; McKenzie et al., 1997; McKenzie, Prochaska, Sallis, & LaMaster, 2004; Sallis et al., 1997, 2002), indicating that SPARK is an effective instructional model to increase healthy behaviors in youth.

However, Fu et al. (2013) conducted a study on health-related physical education intervention on 61 middle school students for 6 weeks compared to a traditional physical education program. It was reported that the intervention did not have a significant impact on increasing students' in-class physical activity levels compared to the traditional physical education program. There are several plausible reasons for this inconsistency with the current study. First, the intervention period of the current study was 9 weeks, whereas Fu et al. (2013) had a shorter intervention period (6 weeks). According to the previous research, combined physical activity interventions with behavioral modification approaches could be effective in increasing the short-term (Lubans & Sylva, 2006) and long-term (Dale & Corbin, 2000) physical activity behaviors in adolescents. The intervention of a 6-week time period may have not been long enough to foster a significant change in students' in-class physical activity levels. The results of the current study further support the evidence that a sufficient length of physical activity intervention exposure in order to significantly effect change in children's physical activity is between 8 to 15 weeks (Kang, Marshall, Barreira, & Lee, 2009).

Second, there were more sport activities (soccer, flag football, and ultimate frisbee) in the current study compared to the Fu et al. (2013) study. The students may have accumulated higher physical activity levels when they engaged in multiple sport activities compared to a single basketball only intervention as in the Fu et al. (2013) study. Multiple sport activities using SPARK typically involved less direct instruction from the physical educator and greater student engagement in ambulatory physical activity.

Third, less direct instruction and greater student involvement in class activities may have manifested increased enjoyment from the student, thus affecting increased

physical activity levels. Additionally, students in this study were more physically fit than those in Fu et al. (2013), as determined by the PACER scores, which correlates with increased physical activity behaviors.

The results also revealed that there were statistically significant interactions for Group x Grade, and Gender x Grade x Group on the in-class physical activity level change scores. Younger children in this sample seemed more responsive to SPARK due to its multiple-activity and enjoyable curriculum design (Dowda et al., 2005). Therefore, the overall trend for both genders was that the SPARK program had a greater effect on younger children (grade 6) yet seemingly had no greater effect in older children (grade 8) when compared to the traditional group. This is a unique finding, suggesting that health-related fitness programming may be more effective in younger age groups, possibly due to increased enjoyment of the program with its novel activities and less time spent in direct instruction and general content (see study 2). Older male children may not have been as responsive compared to younger children due to the lack of novelty in the activities (as a result of being familiar with the activities in the middle school years) implemented during the intervention period. A key consideration, however, is the results are interpreted in terms of change scores. Therefore, one cannot state that one instructional group produced higher overall physical activity levels compared to the other, but rather that there was a greater increase in physical activity at week 11 compared to week 1 in the SPARK group when compared to the traditional group. Despite this, younger grade levels displaying greater increases in physical activity behaviors needs further exploration in order to determine if SPARK indeed has a greater effect in younger children of both genders. If these results hold in future research, new

methods may need to be developed in order to make SPARK more effective in increasing physical activity in older children.

Effects of SPARK on cardiovascular fitness

The results of the study yielded a main effect for gender ($p < .01$), as boys tended to have statistically significant greater increased PACER change scores compared to girls. This was expected as research has shown that boys tend to increase their cardiovascular fitness over time compared to girls during the developmental years (Eisenmann et al., 2011). There was also a statistically significant Gender x Grade x Group three-way interaction, suggesting statistically significant physical education instructional group differences in PACER change scores among boys in grade 8, but not in grade 6 or grade 7. The SPARK group yielded greater change scores in boys. Additionally, there were statistically significant physical education instructional group differences in PACER change scores among girls in grade 8 ($p < .001$), but not for those in grade 6 or grade 7. In girls, the SPARK group displayed lower increased change scores compared to the traditional group.

This specific finding is interesting as there were group differences in PACER change scores in both grade 8 boys and girls, but the traditional group had a greater effect in girls while SPARK had a greater effect in boys. Therefore, one cannot state with confidence that one instructional model has a greater overall effect on cardiovascular fitness compared to the other model in this sample of youth. It has been documented that physical activity change was greater in the younger grade levels compared to the older grade levels in both genders, so valid reasons why the results yielded greater PACER change score differences between groups in 8th graders only are limited.

One has to consider that increasing cardiovascular fitness over a relatively short time frame may be difficult, especially when fitness was assessed via PACER, an indirect field measure used to estimate aerobic capacity, or $VO_{2\ Max}$ (Mahar et al., 2011). Eisenmann et al. (2011) showed that cardiovascular fitness, when assessed via $VO_{2\ Max}$, remains relatively stable across the developmental years, with boys displaying slight increases and girls displaying slight decreases between the ages of 12 to 18 years. Therefore, a 9-week exposure period to a novel health-related physical fitness program may not be long enough to elicit greater physiological changes needed to increase oxygen consumption capabilities when compared to the traditional instructional model. Despite this, the descriptive data clearly show that PACER scores did increase from week 1 to week 11 in both groups across all grades and genders. However, this specific effect cannot be directly examined using the change score approach employed in this study. The differences observed between groups in grade 8 may have been attributable to confounding factors such as greater familiarity with PACER, greater effort during the PACER, and greater motivation.

Despite the mixed findings manifested in this sample, the findings of this study add to the information provided by Sallis et al. (1997) regarding cardiorespiratory fitness change over time when implementing SPARK. Sallis et al. (2011) investigated the effectiveness of a health-related PE intervention in 955 middle school students. They found that students who participated in the SPARK program over 2 years reported statistically significant increased cardiovascular fitness levels as assessed via the one-mile run. The present study differs from the Sallis et al. study in a number of ways. First, this is the first study to compare the fitness change scores from pretest to posttest

between a health-related physical fitness program and a traditional physical education program. Most previous studies have adopted health-related physical fitness programs as the intervention approach, but did not compare its effect to the traditional physical education program, therefore it is unknown from previous work if SPARK is superior to the traditional model (control group). Second, the intervention period in the present study was 9-weeks, much shorter than 2-year intervention in Sallis et al. study. Third, the current study measured students' fitness levels by using the PACER test rather than the 1-mile run, which may result in different findings on school children's fitness levels. Despite the differences in the research design, both studies support the notion that the utilization of SPARK can have a positive effect on children's cardiovascular fitness. However, the results are not conclusive as to whether SPARK had a greater effect compared to the traditional physical education model given the moderating effect of gender and grade. Further research is needed to compare the effect of SPARK and traditional instructional models on cardiovascular fitness using a longer intervention exposure.

Effects of SPARK on motivational beliefs

Theoretically, younger children may be more responsive to health-related fitness programming compared to older children, and this phenomenon may be reflected in the greater increases in change scores observed between younger and older children in perceived competence in the SPARK group. Regarding enjoyment, increases in change scores were seen in the traditional group for grade 8 compared to grade 6, and in the SPARK group between grade 8 and grade 6, and between grade 7 and grade 6.

Based upon the evidence, it is not clear whether the SPARK group had any

meaningful greater effect on overall motivational beliefs when compared to the traditional physical education group in older children. Perceived competence did increase in grade 6 compared to grade 8 in the SPARK group, and grade 6 also had increased enjoyment compared to grade 8 in SPARK. Therefore the notion that SPARK is an effective program, not only to increase physical activity levels in younger children, but also to increase motivational beliefs is supported by the current research. Despite the positive findings observed in the SPARK group in the youngest grade level, there were also significant change score differences with the grade 8 traditional group having more positive motivational beliefs. Therefore, the traditional physical education group had a significant effect in older children compared to younger children at increasing motivational beliefs.

Although a large body of published studies has suggested that school physical education interventions were successful in changing motivational beliefs (Bagoien & Halvari, 2005; Carroll & Loumidis, 2001; Gao, 2008; Kalaja et al., 2010; Stein et al., 2007; Telama, 1998; Williams & Gill, 1995; Fu et al., 2013), this study revealed that this effect might be limited to younger students only. Fu et al. (2013) reported that school children in a health-related physical education intervention displayed statistically significant greater increased scores in enjoyment over a 6-week intervention period compared to those in a traditional physical education program. Fu et al. also suggested that the health-related physical fitness group had an increase in perceived competence and had greater increased perceived competence change scores compared to students in the traditional group. However, a limitation to the Fu et al. (2013) study is that motivational beliefs were not examined within specific grade levels. The current study

adds to the results found by Fu et al. (2013), displaying significant change scores in motivation beliefs within specific grade levels in both the SPARK and traditional groups. Therefore, the study adds important insights on which age groups are most affected by SPARK in terms of motivational beliefs.

In summary, this study supports that the SPARK program is an effective pedagogical strategy to increase middle school children's in-class physical activity and cardiovascular fitness in school physical education settings. The psychometric variables in this study did show change within specific younger grade levels, however, no differences were observed between groups in grade 8 in terms of increased perceived competence or enjoyment. Overall, it is well worth the efforts for researchers to continue to examine effective health-related physical fitness programs, such as SPARK, to increase the physical activity behaviors and motivational beliefs in school physical education settings.

Table 1. Descriptive statistics for groups over time (N=174)

	Traditional group			SPARK group		
Variable	Pretest (M±SD)	Posttest (M±SD)	CS (%)	Pretest (M±SD)	Posttest (M±SD)	CS (%)
Physical activity	46.15±12.56	47.45±14.16	1.30 (2.82%)	42.01±12.29	51.34±13.45	9.33 (22.21%)
PACER	34.83±17.71	43.45±22.68	8.62 (24.75%)	43.68±19.09	53.74±19.42	10.06 (23.03%)
Perceived competence	3.35±.80	3.37±.80	.02 (0.60%)	3.33±.83	3.31±.84	-.02 (-0.60%)
Enjoyment	4.30±.85	4.19±1.00	-.11 (-2.56%)	4.15±.92	4.00±1.06	-.15 (-3.75%)

Note. M = mean score; SD = standard deviation; CS = change score.

Table 2. Descriptive statistics within grade-group time-points (N=174)

		Grade 6			Grade 7			Grade 8		
Variable	Group	Pretest (M±SD)	Posttest (M±SD)	CS (C %)	Pretest (M±SD)	Posttest (M±SD)	CS (C %)	Pretest (M±SD)	Posttest (M±SD)	
Physical activity	Traditional	43.62±12.32	41.10±11.53	-2.53 (-5.80%)	47.53±11.56	50.18±13.91	2.65 (5.58%)	47.73±13.63	52.16±14.83	4.43 (9.28%)
	SPARK	46.44±15.76	60.23±13.39	13.79 (29.69%)	39.97±9.05	45.66±12.15	5.69 (14.24%)	39.49±10.18	48.20±9.78	8.71(22.06%)
PACER	Traditional	28.62±17.39	34.51±20.10	5.89 (20.58%)	38.71±15.51	50.00±20.18	11.29 (29.17%)	38.25±18.58	47.44±25.00	9.19 (24.03%)
	SPARK	45.16±18.80	55.44±19.13	10.28 (22.76%)	40.56±16.94	51.93±17.04	11.37 (28.03%)	45.82±22.08	54.05±22.92	8.23 (17.96%)
Perceived competence	Traditional	3.41±.78	3.33±.85	-.08 (-2.35%)	3.44±.79	3.48±.74	.04 (1.16%)	3.20±.80	3.32±.87	.12 (3.75%)
	SPARK	3.39±.80	3.56±.79	.17 (5.01%)	3.17±.77	3.33±.78	.06 (1.89%)	3.21±.81	3.00±.98	-.21 (-6.54%)
Enjoyment	Traditional	4.49±.72	4.11±1.05	-.38 (-8.46%)	4.56±.65	4.48±.88	-.08 (-1.75%)	3.82±.95	4.02±1.00	.2 (5.24%)
	SPARK	4.26±.92	4.60±.71	.34 (7.98%)	4.19±.98	3.85±.98	-.34 (-8.11%)	3.97±.84	3.50±1.17	-.47 (-11.84%)

Note. M = mean score; SD = standard deviation; CS = change score; S/M = steps per minute

Table 3. Descriptive statistics within gender-group time-points (N=174)

		Girl			Boy		
Variable	Group	Pretest (M±SD)	Posttest (M±SD)	CS (C %)	Pretest (M±SD)	Posttest (M±SD)	CS (C %)
Physical activity	Traditional	40.94±9.36	41.34±10.33	.40 (9.77%)	51.57±13.24	53.81±14.87	2.24 (4.34%)
	SPARK	39.97±9.90	47.84±11.04	7.87 (19.67%)	44.55±14.48	55.67±15.01	11.12 (24.96%)
PACER	Traditional	28.16±12.91	33.33±15.61	5.17 (18.38%)	41.78±19.42	53.98±24.19	12.20 (29.21%)
	SPARK	40.07±16.40	49.39±18.79	*9.32 (23.25%)	48.15±21.40	59.15±19.09	11.00 (22.85%)
Perceived competence	Traditional	3.19±.82	3.22±.82	.03 (1.02%)	3.52±.74	3.53±.80	.01 (.29%)
	SPARK	3.258±.86	3.260±.85	.002 (.06%)	3.42±.71	3.37±.81	-.05 (-1.33%)
Enjoyment	Traditional	4.00±.94	3.84±1.06	-.16 (-4.04%)	4.61±.60	4.57±.78	-.04 (-.89%)
	SPARK	3.95±1.01	3.81±1.11	-.14 (-3.55%)	4.39±.73	4.23±.96	-.15 (-3.45%)

Note. M = mean score; SD = standard deviation; CS = change score; S/M = steps per minute

Table 4. Correlation matrix displaying bivariate relationships among the dependent variable pretest scores

	Physical Activity	PACER	Perceived Competence	Enjoyment
Physical Activity	1			
PACER	0.672**	1		
Perceived Competence	0.333**	0.352**	1	
Enjoyment	0.218**	0.211**	0.621**	1

** *P<.01*

Table 5. Correlation matrix displaying bivariate relationships among the dependent variable posttest scores

	Physical Activity	PACER	Perceived Competence	Enjoyment
Physical Activity	1			
PACER	0.589**	1		
Perceived Competence	0.311**	0.366**	1	
Enjoyment	0.313**	0.291**	0.673**	1

** *P<.01*

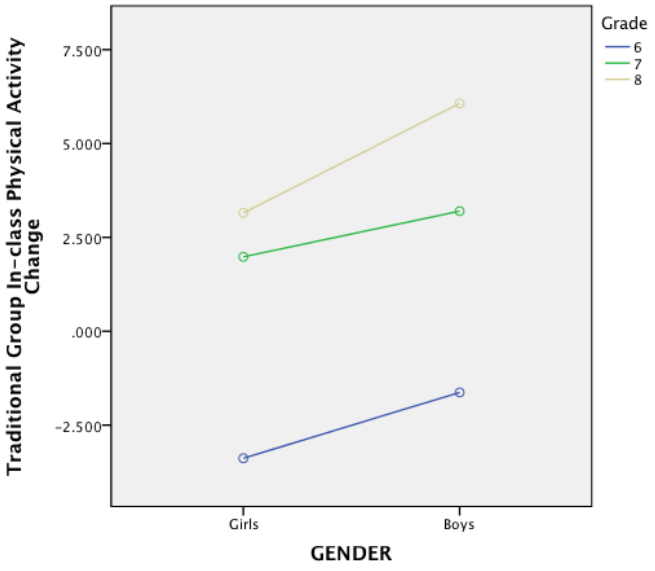

Figure 1. Interaction between gender and grade on in-class physical activity change scores in the traditional physical education group

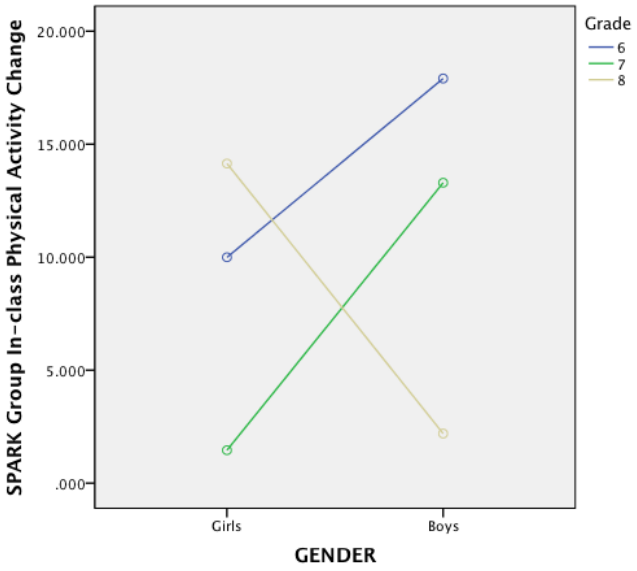

Figure 2. Interaction between gender and grade on in-class physical activity change scores in the SPARK group

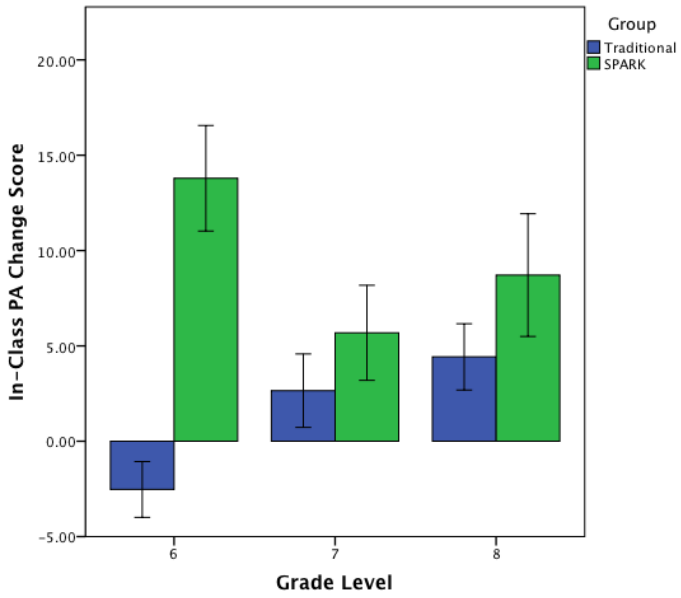

Figure 3. Interaction between group and grade on in-class physical activity changes

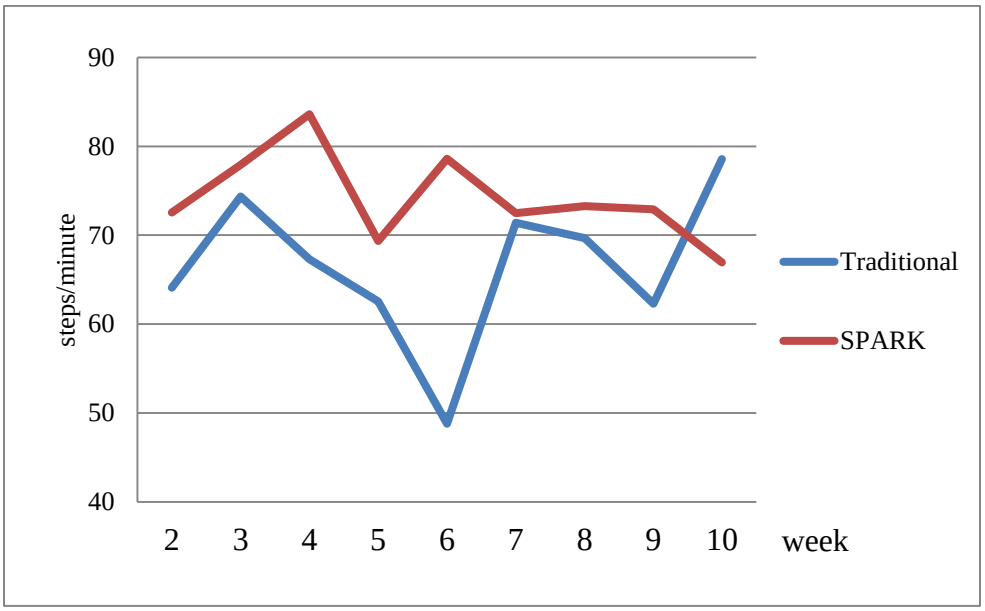

Figure 4. In-class physical activity levels during intervention period between physical education groups (N=174)

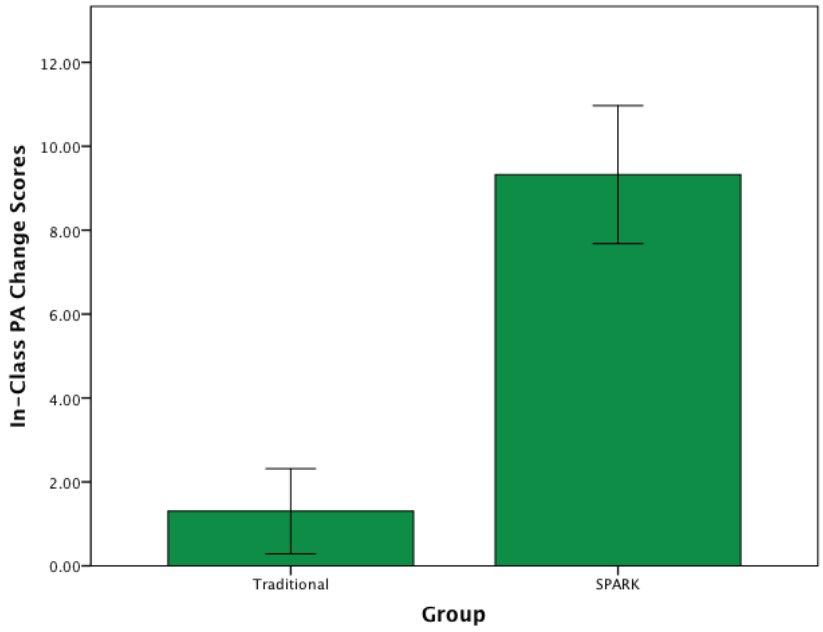

Figure 5. In-class physical activity changes between physical education groups.
† Statistically significant, *P* < *.001*

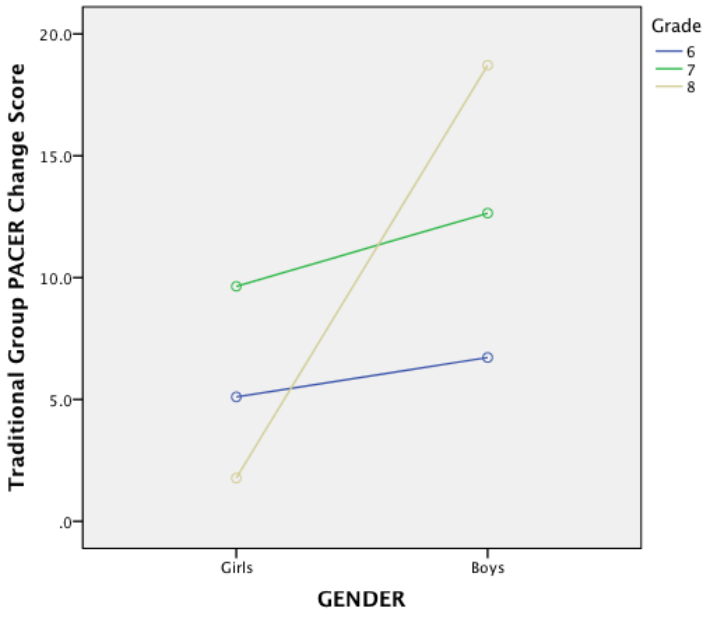

Figure 6. Interaction between gender and grade on cardiovascular fitness change scores in the traditional physical education group

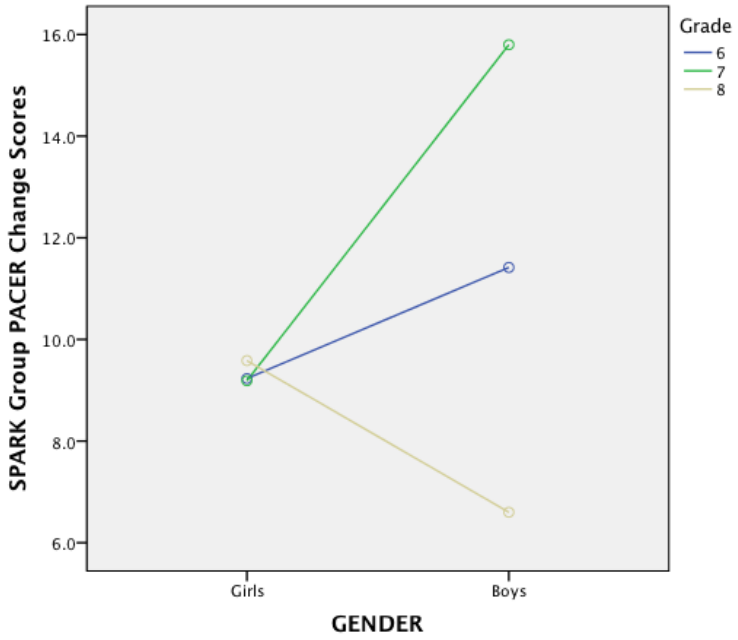

Figure 7. Interaction between gender and grade on cardiovascular fitness change scores in the SPARK group

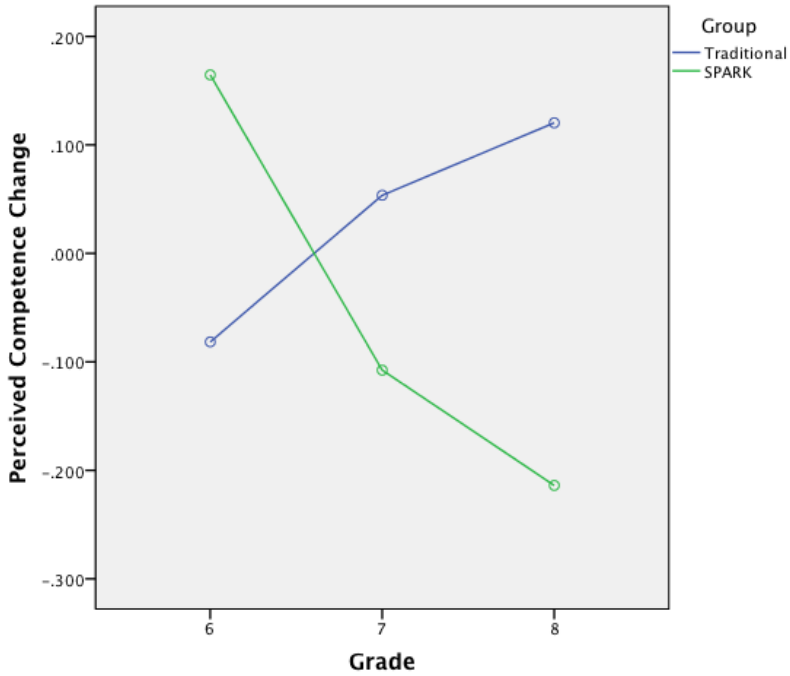

Figure 8. Interaction between group and grade on perceived competence changes

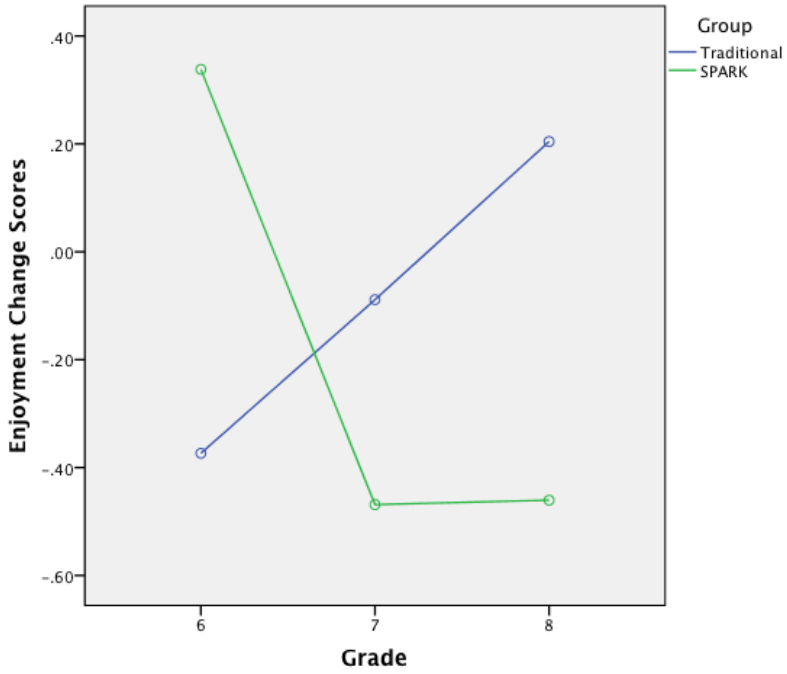

Figure 9. Interaction between group and grade on enjoyment changes

CHAPTER 4

EFFECTS OF A HEALTH-RELATED PHYSICAL FITNESS INTERVENTION ON MIDDLE SCHOOL STUDENTS'ACADEMIC LEARNING TIME IN PHYSICAL EDUCATION

Student's engaged time in academic learning has a significant influence on his/her achievement during the teaching and learning process (Gettinger & Seibert, 2002). The "Beginning Teacher Evaluation Study" (Denham & Lieberman, 1980) was one of the most extensive research programs aimed to examine the relationships of student's engagement time with subject matter, which proposed the concept of academic learning time. Among the many variables that contribute to student achievement, educators have advocated academic learning time because its components are viewed as aspects of the classroom that teachers are be able to control and handle (Gettinger & Seibert, 2002).

Academic Learning Time-Physical Education (ALT-PE) is an application of academic learning time in school physical education settings, which has been extensively studied as a measure of teaching effectiveness. It is a meaningful tool to measure teachers' effectiveness in that the teacher who produces higher levels of ALT-PE will be more effective in teaching (Rink, 1996; Siedentop, 1983). Previous studies have reported that the ALT-PE observation instrument is a valid tool for evaluating the quality of the physical education class via the examination of teacher's and students' engaged time (Birdwell, 1980; Metzler, 1979; Siedentop, Birdwell, & Metzler, 1979; Whaley, 1980).

Although numerous studies have emphasized the significance of ALT-PE in enhancing the quality of the physical education and students' achievements (Gettinger & Seibert, 2002; Metzler, 1989; Placek & Randall, 1986; Silverman et al., 1984), it is still unknown if a health-related physical fitness program (SPARK) could significantly affect middle school students' ALT-PE. In addition, how students spend their time in the various context levels (Siedentop et al., 1982) of curricular activities in the SPARK program is unclear. In response, this study was designed to examine middle school students' ALT-PE in various sport activities during the health-related physical fitness intervention compared to a traditional physical education model.

Methods

Participants and setting

The present study consisted of 175 sixth to eighth grade middle school students. They were enrolled in two urban religious schools in the Mountain West Region of the U.S. The ethnic distribution consisted of 82.3% Caucasian, 12.0% Hispanic, 2.3% Asian or Pacific Islander, 1.7% African American, and 1.7% Other (Indian or Native of America). Specifically, in the control school, there were 99 (49 boys, 50 girls) participants from five physical education classes, including 37 sixth graders, 31 seventh graders, and 32 eighth graders. In the experimental school, there were 75 (33 boys, 42 girls) participants from three physical education classes, with one class from each grade, including 25 sixth graders, 27 seventh graders, and 23 eighth graders, respectively. After deleting the drop-out participant via data screening, the final sample size of this study was 174 (82 boys, 92 girls). Their age ranged from 10 to 14 years old (M_{age} = 12.06, *SD* = .85).

In the intervention school, physical education class was conducted once a week and each class averaged 66 minutes during the period of data collection. The teacher was male, with more than 10 years K-12 physical education teaching experience. The physical education class was conducted once a week in the control school, where the average physical education class duration was 45 minutes. The physical education teacher was male, with more than 15 years physical education teaching experience. Permission to conduct the study was obtained from the University Institutional Review Board, the school administrations, and the physical education teachers prior to the start of this study (see Appendix A and B). Students were provided written informed assent forms and parents were provided the written informed consent form prior to participation in this study (see Appendix C and D).

A total of 12 target students (6 from SPARK group, 6 from traditional physical education group) were selected for the purpose of this study. The exclusion criteria were: (a) students who did not return an informed consent form, (b) students who had serious health conditions, injuries or illnesses that may limit physical activity participation, and (c) students with poor physical education class attendance. In the SPARK group, the physical education teacher provided two lists of students who met the inclusion criteria to the investigator. Specifically, the first list included all boys from 3 grades, and each boy's skill level was identified on the list. The second list was created for girls. Students' skill levels (i.e., low-skilled, average-skilled, or high-skilled) were classified by their physical education teachers based on teachers' previous understandings about the students. In each list, the investigator randomly arranged the students in teams of three based upon their grade and skill level, and made sure all grades and skill levels were represented in

each team. Then the investigator randomly picked one team from each list, and finalized the target students by combining the two teams. The target students in the traditional physical education group were selected using an identical protocol.

It has been reported that 3 or more students would be an acceptable subject sample to obtain a valid estimate through systematic observation (Barrett, 2000; Nye, 2010; Paese, 1985; Siedentop et al., 1982). In the SPARK group, 6 students were randomly selected from 3 grades (three girls: one low-skilled, one average-skilled, and one high-skilled; three boys: one low-skilled, one average-skilled, and one high-skilled). Another 6 target students from 3 grades in the traditional physical education group were also identified (three girls: one low-skilled, one average-skilled, and one high-skilled; three boys: one low-skilled, one average-skilled, and one high-skilled). Table 6 indicates each target student's characteristics.

ALT-PE measure

The outcome variable, how much time students spend in each category in the context level of their physical education classes, was measured using the context level of the ALT-PE systematic measurement observation instrument (Siedentop et al., 1982), which describes the context that the student is behaving in and refers to the class as a whole. There are 13 subcategories of context from three major categories: general content, subject matter knowledge, and subject matter motor (see Table 7). Specifically, it is predicted that the three categories of the context level in the ALT-PE instrument would demonstrate how students spend their time in their class (Siedentop et al., 1982). The ALT-PE systematic measurement observation instrument has been shown to have satisfactory internal consistency and validity in PE settings (Siedentop et al., 1982).

Siedentop et al. (1982) further defined each category and subcategory in the ALT-PE observational instrument as follows:

General content

Refers to class time when students are not intended to be involved in physical education activities.

Transition. Time devoted to managerial and organizational activities related to instructional activity, such as team selection, changing equipment, moving from one space to another, and changing stations.

Management. Time devoted to class business that is unrelated to instructional activity. For example, taking attendance, or lecturing about misbehaviors in the class.

Break. Time devoted to rest or discussion of nonsubject matter issues. For example, drinking water, or talking about an interesting television show.

Warm-up. Time devoted to routine execution of physical activities whose purpose is to prepare the individual for engaging in further activity. For example, stretching activities before a lesson, cooling down activities for finishing a lesson, or light exercise to begin a class.

Subject matter knowledge

Refers to class time when the primary focus is on knowledge related to physical education content.

Technique. Time devoted to delivering information concerning the physical form of a motor skill. For example, listening to a lecture, watching a demonstration, or watching a video.

Strategy. Time devoted to delivering information concerning the plans of action for performing either individually or as group. For example, explaining the man-to-man defense, or demonstration of an individual movement.

Rules. Time devoted to delivering information concerning the regulations that govern activity related to subject matter. For example, explaining the rules of a certain game, and demonstration of specific rule violation.

Social behavior. Time devoted to delivering information about appropriate and inappropriate ways of behaving within the context of the activity. For example, students demonstrate sportsmanship in soccer, or violations on a game.

Background. Time devoted to delivering information about a subject matter activity. For example, students learn about the history, traditions, or rituals of a sporting event.

Subject matter motor

Refers to class time when the primary focus is on motor involvement in physical education activities.

Skill practice. Time devoted to the practice of a skill or chains of skills outside the applied context with the primary goal of skill development. For example, circle drill in soccer.

Scrimmage/routine. Time devoted to refinement and extension of skills in an applied setting during which there is frequent instruction and feedback for the participants. For example, half court four-on-four basketball practice.

Game. Time devoted to the application of skills in a game or competitive setting when the participants perform without intervention from the instructor or coach. For

example, students participate in a soccer game.

Fitness. Time devoted to activities whose major purpose is to alter the physical state of the individual in terms of strength, flexibility, or cardiovascular endurance

Data collection and procedures

This section includes the equipment used for the observation, description of interrater agreement reliability, observation procedures, and data analysis.

Equipment

A digital videotape recorder was used to videotape and record each student's physical education class during the whole data collection period. The purpose was to keep a record of events for the study purpose. The digital videotape recorder was set up in one of the corners of the gymnasium or field during the physical education class in order to observe the whole class (see Figure 7).

Training of raters

Two raters were employed to observe and collect data for the purpose of this study. Both raters were graduate students enrolled at the University of Utah, working on graduate degrees in physical education and science studies, respectively. The raters were presented with the definitions of the ALT-PE categories and subcategories at the context level (Siedentop et al., 1982) and attended a written test (see Appendix G) regarding the observational instrument's categories and subcategories (see Appendix F). Raters were required to achieve a minimum score of 90 out of 100.

There were in total 12 target students from the SPARK and traditional physical education groups (6 in each group). Two students were observed per physical education

class, and each rater observed one student per class. Each target student was observed once a week for 9 weeks. Therefore, each rater completed a total of 54 observations (27 for SPARK, 27 for traditional) throughout this study.

Interrater agreement reliability

Interrater agreement is defined as the extent of agreement between human raters in recording and observing the occurrence and nonoccurrence of specific behaviors. This includes determining the reliability of the agreement between recorded data on specific target behaviors by two independent raters (Cooper et al., 1987). It is imperative in research experiments that rely on human observation as the method of the data collection. The higher the interrater agreement, the more confident one can be assured that the recorded data are reliable and trustable. For this study, interrater agreement was calculated by dividing the number of instant-by-instant agreement on the occurrences of sublevels of ALT-PE context categories by the number of agreements plus the number of disagreements. The proportion was then multiplied by 100 to obtain an agreement percentage (Barrett, 2000; Watkins & Pacheco, 2001). Previous research (Cicchetti, 1994; Fleiss, 1981) has provided interpretative guidelines of the interrater agreement: the values for interrater agreement less than .40 are poor; values between .40 to .60 indicate fair agreement; values between .60 to .75 suggest good agreement; and values greater than .75 suggest excellent agreement. Prior to this study, training sessions were held to ensure at least 75% reliability between the raters. Data for the interrater agreement calculation was collected by having the second rater observe 33% (n = 18) of the lessons observed by the first rater using videotaped lessons.

Observation procedures

Two raters used a 12-second-interval observation/record protocol. Specifically, a student was observed for the first 6-second period of the interval, and the next 6-second period was used to record the student's context level (general, subject matter knowledge, and subject matter motor). It has been reported that an interval between 10 to 12 seconds is an acceptable duration to obtain a valid estimate of systematic observation (Derri et al., 2007; Nye, 2010; Paese, 1985; Van Der Mars, 1992).

In the SPARK group, 6 students attended the SPARK classes for 9 weeks during the intervention period, including three curricular sport activities in the order of soccer, flag football, and ultimate Frisbee. Each of the 6 students was observed for one lesson weekly by the primary rater and the secondary rater. Therefore, there were nine observations as a whole for the SPARK group, and the raters observed three classes per sport activity. Each observation was completed for all 6 students in a single school day, and each student's time percentage in all categories and subcategories at the context level of the ALT-PE instrument were recorded and calculated. The 6 students' percentage of time spent on the three categories and thirteen subcategories for the first 3-week observation period were averaged as their ALT-PE in SPARK soccer class; the percentages of time spent on categories and subcategories for the second 3-week observation were averaged as the students' ALT-PE in SPARK flag football class; the time percentages of the categories and subcategories for the third 3-week observation were averaged as the students' ALT-PE in SPARK ultimate Frisbee class. Students' ALT-PE measurements in the traditional physical education group were calculated by the same protocol as used in the SPARK group.

Data analysis

The data were analyzed through the following three steps. First, interrater agreement reliability was calculated to examine the reliability of the observation among two independent raters, as it is necessary to conduct the interrater agreement in single-subject research design experiments that employs human observation as the data collection method (Cooper et al., 1987). Second, the percentages of lesson time that students spent in the three categories and 13 subcategories at the context level of the ALT-PE instrument (Siedentop et al., 1982) were calculated for the three sports (soccer, volleyball, and flag football) for the SPARK and the traditional physical education group as descriptive statistics. Third, a series of independent t-tests were conducted to determine if there were any differences in students' ALT-PE context levels in three sports (soccer, flag football, and ultimate Frisbee) between the SPARK and traditional physical education groups. The dependent variable was the percentage of lesson time that students spent in each of the three categories and subcategory of the context level of the ALT-PE instrument (Siedentop et al., 1982). Independent variables were the two physical education groups (SPARK and traditional), and the three sports (soccer, flag football, and ultimate Frisbee).

Results

Interrater agreement

Interrater agreement for ALT-PE was measured by having the second rater observe 33% (n = 18) of the lessons observed by the first rater using videotape. Mean interrater agreement for ALT-PE context level was 89.04 % (ranging from 73.67% - 99.53%), indicating excellent interrater reliability.

Descriptive data of ALT-PE context level

The data in Figure 11 and Figure 12 illustrate the percentages of lesson time that the SPARK group spent in each of the three context level categories of the ALT-PE instrument (Siedentop et al., 1982) across each sport activity and intervention weeks. Figure 13 and Figure 14 represent the percent of lesson time that traditional physical education group spent in each of the three categories of the context level of the ALT-PE instrument (Siedentop et al., 1982) across each sport activity and each intervention week. Table 8 presents the mean percentage of time spent in the ALT-PE context level categories and subcategories in each sport activity for SPARK and traditional physical education groups. Table 9 presents the mean percentages of time spent in the ALT-PE context level categories and subcategories over the intervention period for the two groups.

In general, during the 9-week intervention period, the percentages of time spent in three ALT-PE context level categories in the SPARK group were all lower compared to traditional physical education group, except for the subject matter motor category. Regarding group differences by sport activity, the SPARK group was found to have statistically significant lower values in percentage of time spent in general content time compared to the traditional group in all three sport types, while contrasting results were found on time percent spent in subject matter motor between the two groups. In terms of subject matter knowledge, no statistically significant differences were found on either of the three sport types between the two groups.

Discussion

The purpose of this study was to examine the effects of a health-related physical fitness program on middle school students' ALT-PE compared to a traditional physical education program. The results indicated that children's average time percentage spent in general content for the SPARK group was statistically lower compared to the traditional group over the 9-week intervention period within each sport activity. Additionally, children's time percent in subject matter motor for the SPARK group was statistically higher compared to the traditional physical education group across the entire intervention period within each sport type. Therefore, the hypotheses that the students in the SPARK group would have less time in general content, and significantly more time spent in subject matter motor compared to the traditional physical education group were partially supported.

SPARK is designed to encourage and promote health-related fitness levels by maximizing physical activity participation and enjoyment in physical education (Dowda et al., 2005). The goal of SPARK is achieved by decreasing the time of transition between different class contents, using less direct instruction time, creating more opportunities of physical activity engagement and skill practices, and implementing relatively short but effective warm-up activities. Based upon the researchers' observations, the traditional physical education classes spent more time in class management compared to SPARK. This may have been due to more activity stations in the SPARK classes, where each student at each station had their own practice contents and purpose, which could effectively decrease time spent in direct instructions. Compared to the traditional physical education group, the SPARK physical education

teacher did not have to manage the class as frequently, as most of the students practiced and engaged in the classes in a predetermined order. For example, the warm-up sections in the SPARK physical education classes were designed according to the class content. For example, the warm-up activities in the SPARK soccer classes mainly focused on students' lower body movements, and some warm-up activities encouraged students to interact with the soccer ball.

The traditional physical education warm-up activities were relatively longer and repeated. For instance, the warm-up activities were almost identical for every single class in that the students started the class with running five to ten laps along the gymnasium or field, followed by static stretching, which was more time-consuming compared to the SPARK warm-up sections. This may explain the statistically significant differences on the average warm-up time percent between two physical education groups. Additionally, most of the class breaks between skill practices and games in the SPARK classes were in the format of slow walking or jogging compared to the traditional group where children engaged in sedentary activities (standing and sitting). Taken together, it was not surprising that the SPARK group spent statistically significant less time in general content compared to the traditional group over the 9-week intervention period.

The data related to subject matter knowledge for both groups in this study were relatively lower compared to the other two ALT-PE context level categories. Compared with the findings in the previous studies (Barrett, 2005; Derri et al., 2007), the subject matter knowledge scores in the traditional physical education group in this study were relatively high. For example, Derri et al. (2007) found that the average time percent spent in subject matter knowledge among 110 elementary school students during 48 traditional

physical education lessons was 11.47%. Another study (Barrett, 2005) revealed that the average time percent spent in subject matter knowledge among 23 grade six students during 18 cooperative learning team-handball lessons was 8.33%. Placek and Randall (1986) examined and compared a sample of elementary students' ALT-PE from over 49 classes including rope jumping, track and field, soccer, and kickball and so on. The average time percent spent in subject matter knowledge for physical education specialists and nonspecialists were 8.8% and 5.2%, respectively. Thus far, most of the studies examining ALT-PE mainly focused on elementary students; few have investigated ALT-PE levels among middle school students. Therefore, the results of the current study augmented the literature in this field of inquiry.

Based upon the observations from the researchers, every SPARK class included two types of activities: a) activities aimed to develop health-related fitness levels such as cardiovascular capability, muscular strength, and locomotor and non-locomotor skills; and b) activities aimed to develop skill-related fitness levels such as speed, reaction and agility. Most of these activities were conducted in the format of skill practices, station fitness practices, and an amount time of game playing. In the SPARK classes, a relatively large amount of time (15 – 20 minutes) was spent in skill practices with the goal of promoting students' health-related and sport-related fitness. For example, the physical education teacher in the SPARK group usually observed students' performances and reactions during the classes, and provided immediate feedback. In this way, students in the SPARK group would regularly be allowed to repeat skill practice if they found the respective practice enjoyable. In addition, some of the small-side-games in the SPARK classes were developed in the format of skill practices. For example, students were

encouraged to throw the Frisbees into the hula-hoops set up by the physical education teacher in the field, with the purpose of developing students' capability of throwing the Frisbee precisely.

In each of the sport types, the traditional physical education classes included more game playing compared to the SPARK classes, because the nature of the traditional physical education program is to develop students' sport-related capabilities through implementing competitive scrimmages, small-sided-games, and full-sided games (Curtner-Smith & Sofo, 2004). In the meanwhile, the time of the skill practice sections in the traditional physical education classes were strongly deprived due to the high time percentage spent in games. Therefore, the children in the SPARK group spent significantly more time in skill practice, while less time in games as each of the sport types were explained.

A major purpose of the SPARK program is to promote students' fitness levels during physical education class (Sallis et al., 1997). By observing the classes in both physical education groups, the researchers found that every SPARK class included activities with the purpose of promoting students' fitness levels, such as the station fitness practice after the warm-up. Some other fitness activities between games were also regularly implemented during each class, an example being having a ¼ mile running competition. In addition, short and easy fitness drills and practices were regularly conducted during classes, such as performing three to five push-ups if their team lost a game, and students who wish to take a water break being required to complete three to five jumping-jacks or squat-jumps. These fitness activities significantly promoted students' time spent in the fitness category. The traditional physical education classes

lacked fitness promotion drills or practices due to its sport-oriented nature. The most common fitness activities observed by the researchers in the traditional physical education classes emerged after the warm-up session, including pushups, lateral planks, and jumping-jacks.

In summary, the results of this study provide empirical evidence for the importance of utilizing SPARK in promoting middle students' ALT-PE in school physical education settings. Compared to the traditional physical education program, SPARK was more effective in augmenting students' time percentage spent in subject matter motor, particularly in skill practice and fitness in each of the sport types employed in this study.

Table 6. Target student information

PE Group	Name	Grade	Gender	Skill level
SPARK	Sam	6	Male	High
	Sop	6	Female	Medium
	Djiv	7	Male	Medium
	Ara	7	Female	Low
	Hen	8	Male	Low
	Cic	8	Female	High
Traditional	Luk	6	Male	Low
	Hann	6	Female	High
	Mat	7	Male	High
	Nor	7	Female	Medium
	Dave	8	Male	Medium
	Emm	8	Female	Low

Table 7. Context level of the ALT-PE observational instrument

Context level		
General Content	Subject matter knowledge	Subject matter motor
Transition	Technique	Skill practice
Management	Strategy	Scrimmage/routine
Break	Rules	Game
Warm-up	Social behavior	Fitness
	Background	

Table 8. Descriptive statistics of time spent in the ALT-PE context level categories and subcategories across different sport activities in SPARK and traditional physical education groups

	Soccer (week 2 – week 4)		Flag Football (week 5 – week 7)		Ultimate Frisbee (week 8 – week 10)	
	Traditional	SPARK	Traditional	SPARK	Traditional	SPARK
General content	49.18 %* (30.32 % - 75.36 %)	30.84 % (18.26 % - 45.64 %)	46.44 %* (32.89 % - 60.50 %)	17.33 % (9.01 % - 30.00 %)	36.77 %* (13.82 % - 53.33 %)	21.30 % (4.97 % - 45.54 %)
Subject matter knowledge	18.06 % (8.87 % - 31.38 %)	13.61 % (6.22 % - 22.67 %)	13.29 % (7.11 % - 20.43 %)	11.12 % (2.22 % - 23.16 %)	10.03 % (2.22 % - 19.07 %)	5.67 % (0.00 % - 13.33 %)
Subject matter motor	32.76 % (0.00 % - 14.01 %)	55.56 %* (28.19 % - 68.99 %)	40.27 % (27.00 % - 56.89 %)	71.55 %** (60.00 % - 87.61 %)	53.20 % (32.59 % - 81.58 %)	73.03 %* (50.46 % - 89.23 %)

* $p < .05$; ** $p < .01$

Table 9. Mean and range percent of time spent in the ALT-PE context level categories and subcategories in the SPARK and traditional physical education group

	Traditional	SPARK
General content	44.13 %*	23.16 %
	(28.63 % - 61.55 %)	(15.44 % - 38.16 %)
Transition	12.11 %	9.50 %
	(8.09 % - 21.10 %)	(6.49 % - 15.22 %)
Management	8.19 %	4.75 %
	(3.22 % - 12.81 %)	(1.65 % - 7.92 %)
Break	6.10 %	4.23 %
	(2.48 % - 11.52 %)	(0.19 % - 8.63 %)
Warm-up	17.74 %*	4.67 %
	(1.41 % - 25.76 %)	(1.32 % - 8.26 %)
Subject matter knowledge	13.79 %	10.13 %
	(4.39 % - 27.37 %)	(3. 40% - 16.06 %)
Technique	3.45 %	4.23 %
	(0.15% - 6.38 %)	(0.82% - 12.79 %)
Rules	7.85 %	5.42 %
	(4.24 % - 10.82 %)	(2.13 % - 11.36 %)
Subject matter motor	42.08 %	66.71 %*
	(27.58 % - 66.98 %)	(47.90 % - 75.73 %)
Skill practice	5.08 %	30.64 %**
	(0.00 % - 17.90 %)	(17.25 % - 57.13 %)
Scrimmage/routine	3.16 %	2.48 %
	(0.00 % - 8.52 %)	(0.00 % - 9.45 %)
Game	31.42 %	24.94 %
	(5.78 % - 60.55 %)	(0.00 % - 44.31 %)
Fitness	2.43 %	8.65 %**
	(0.92 % - 3.88 %)	(2.97 % - 15.76 %)

* $p < .05$; ** $p < .01$

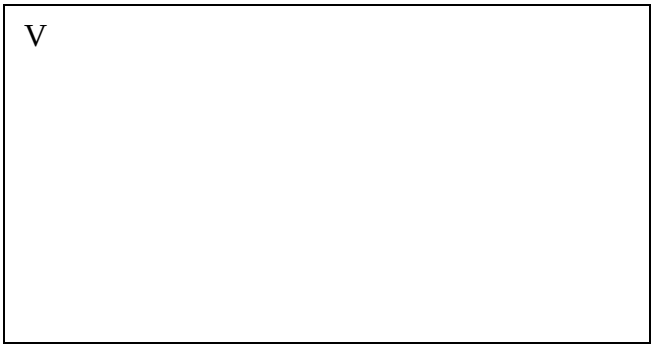

Figure 10. Location of the videotape recorder in the gymnasium or field. The "V" represents the videotape recorder

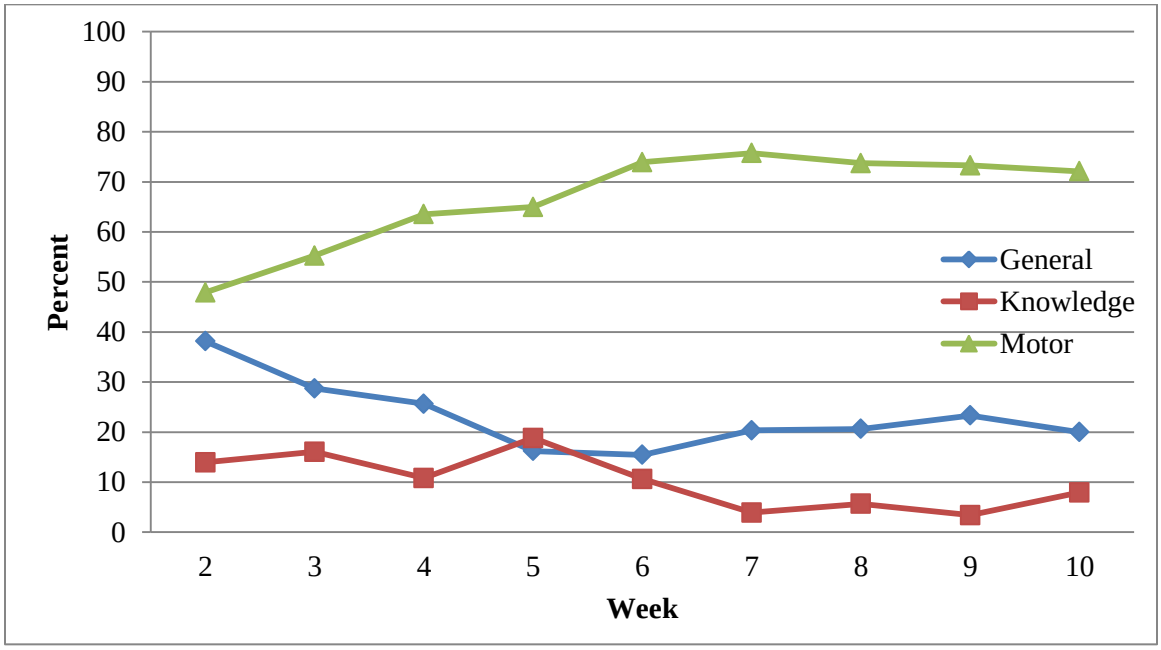

Figure 11. Percentage of lesson time in each ALT-PE context level category across weeks in the SPARK group

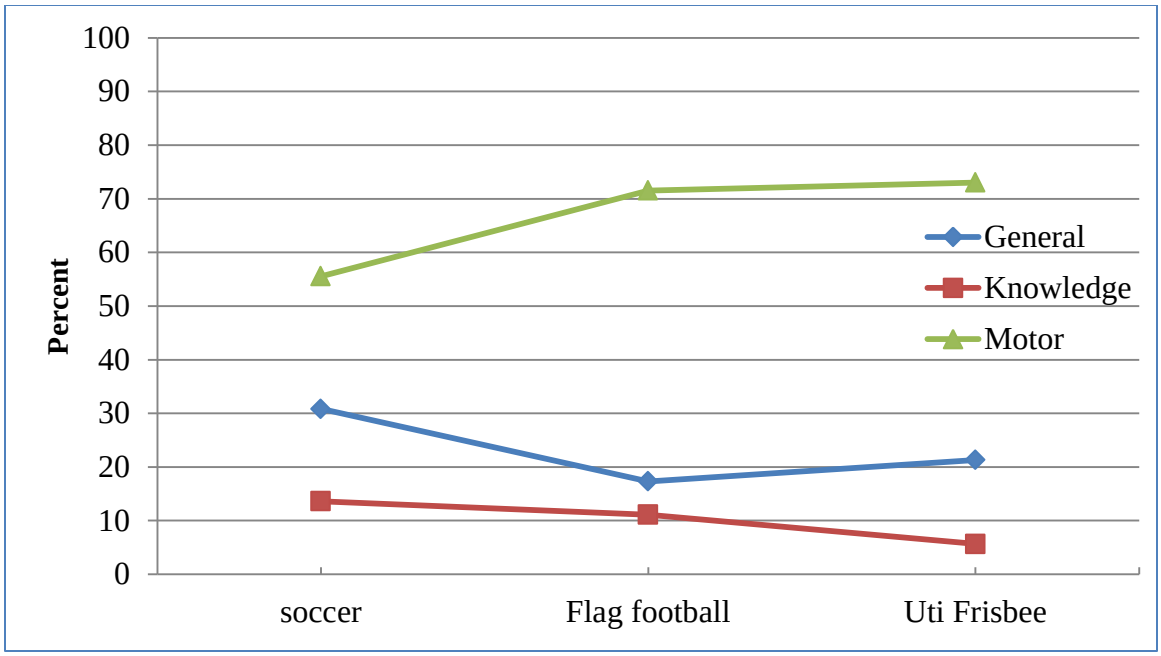

Figure 12. Percentage of lesson time in each ALT-PE context level category across sport activities in SPARK group

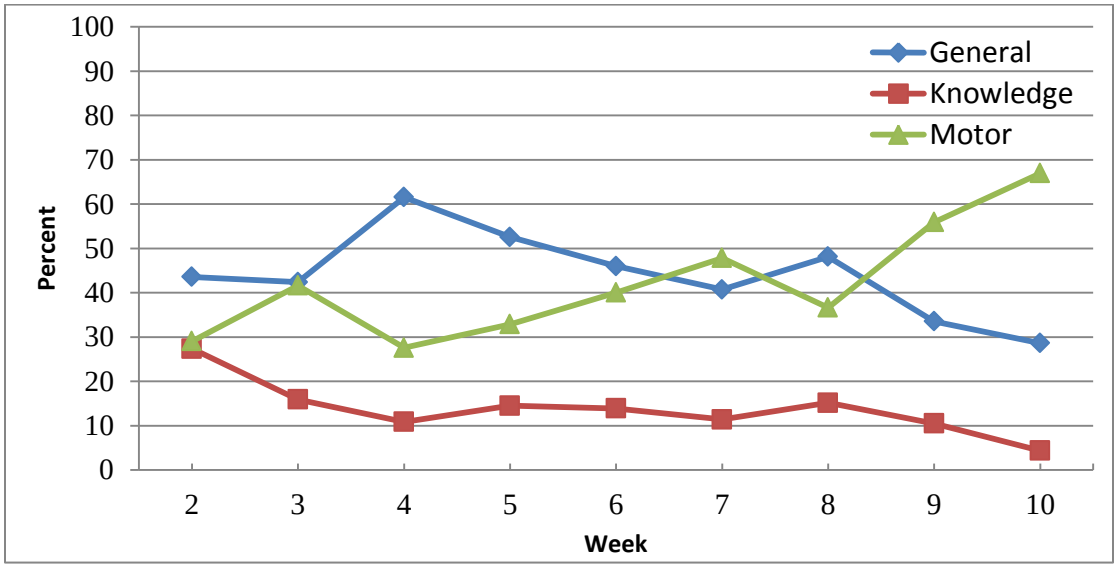

Figure 13. Percentage of lesson time in each ALT-PE context level category across weeks in traditional physical education group

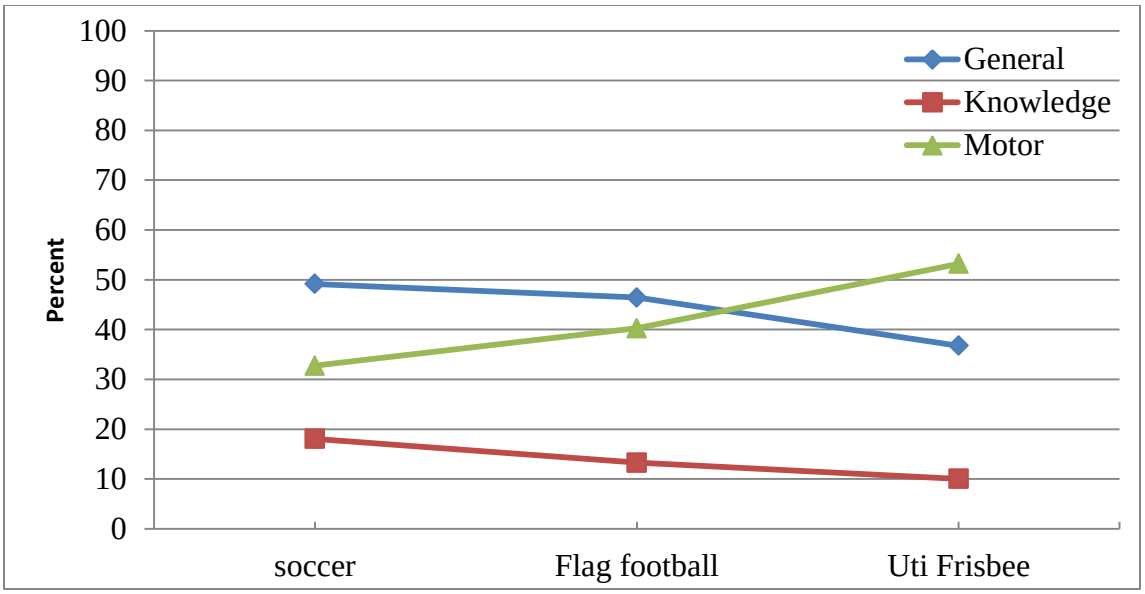

Figure 14. Percentage of lesson time in each ALT-PE context level category across sport activities in the traditional physical education group

CHAPTER 5

SUMMARY OF THE RESEARCH

This project provides unique insights on the effectiveness of a health-related physical education program on physical activity and motivational beliefs. Results from study 1 suggest that in-class physical activity levels increased in younger age groups compared to older age groups when implementing the SPARK model. This finding adds to the information that has already been provided in the current literature, specifically identifying the age groups where SPARK can be most effective compared to traditional models in the promotion of healthy physical activity behaviors. Similarly, it was found that, in study 1, motivational beliefs (perceived competence and enjoyment) were increased in younger age groups compared to older age groups when employing the SPARK intervention. This again adds to the current literature by providing specific age groups where SPARK can be most effective in promoting motivational beliefs associated with increased physical activity behaviors. Although cardiovascular fitness changes over time did not seem to be significantly different between SPARK and the traditional group, the PACER scores did increase from pretest to posttest time-points via examination of the descriptive data. Further research, however, is needed to compare SPARK to the traditional model in the capability to positively affect cardiovascular fitness using a longer intervention period.

In study 2, the traditional group had a higher percentage of time spent in general

content in physical education compared to the SPARK group, but the SPARK group had a greater percentage of time spent in subject matter motor with a significantly greater percentage of physical education time spent in the subcategories of skill practice and fitness. No study to date has investigated the effect of SPARK on students' ALT-PE compared to the traditional physical education model. Therefore, this project provides unique insights on how SPARK can shift the emphasis of physical education content to one of sport-related fitness (traditional) to one of health-related fitness (SPARK). This shift over time may provide students with more opportunity to increase physical activity behaviors in physical education, and also the potential to increase cardiovascular fitness over time.

There are some limitations to this study that must be considered before any generalizations can be made. Firstly, only middle school aged students were targeted in this study; therefore the results cannot be generalized to younger or older grade levels. Secondly, the sample consisted of students who were primarily from high social economic status and the majority were Caucasian, therefore the study was conducted on a homogeneous sample of youth that lacked ethnic diversity. Thirdly, the SPARK intervention was of relatively short duration compared to previous research, therefore the results may have differed if a longer intervention exposure period was implemented. Additionally, there might be some measurement issues. For instance, students' motivational beliefs levels were assessed via voluntary self-reported responses and the participants may have not answered truthfully. Children's in-class physical activity levels were measured via pedometers; therefore the intensity of activity was not assessed. Finally, the data were analyzed using change scores for the physical and psychometric

variables. Therefore, the overall time effects from pre- to postintervention could not be assessed using this statistical approach.

Despite its limitations, this research supports the notion that the SPARK program is an effective pedagogical strategy to increase middle school children's physical activity, motivation, and ALT-PE context levels in school physical education settings. Physical educators may consider SPARK as an alternative instructional program in order to sustain elevated levels of physical activity, cardiovascular fitness and ALT-PE in physical education so that children can have a greater probability of achieving recommended daily physical activity amounts and fitness levels as suggested by various health agencies. Even though significant differences in cardiovascular fitness were not seen between groups, there is some evidence that SPARK may have a greater effect on fitness in 8th grade boys.

Future research needs to implement the SPARK program over longer time frames in order to more accurately determine if SPARK can have a long-term effect on cardiovascular fitness as compared to traditional instructional approaches. Some psychometric variables in this study did show change within the younger grade levels as perceived competence and enjoyment had greater increases in grade 6 compared to grade 8 in the SPARK group. These increases in motivational beliefs may have contributed to the increased physical activity behaviors in this age group and may possibly yield greater cardiovascular fitness increases after exposure to a longer SPARK intervention period.

Future research needs to be conducted to further examine the effect of health-related fitness programs on physical activity, cardiovascular fitness, and motivational beliefs in school-aged children using longer intervention periods. Considering the

obvious health related benefits of elevated physical activity levels, cardiovascular fitness, motivation, and the context level of the ALT-PE, it is well worth the efforts for researchers to continue to examine effective instructional programs such as SPARK to increase these attributes and behaviors in physical education settings. Doing so will manifest more effective pedagogical techniques to sustain healthy behaviors (physical activity), physical traits (cardiovascular fitness), in addition to ALT-PE over time in school settings.

APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

INSTITUTIONAL REVIEW BOARD
THE UNIVERSITY OF UTAH
75 South 2000 East Salt Lake City, UT 84112 | 801.581.3655 | IRB@utah.edu

IRB: IRB_00061088

PI: You Fu

Title: Effects of Health-Related Physical Fitness Physical Education on Adolescents' Physical Activity Behavior, Motivation, and Academic Learning Time

This New Study Application qualifies for an expedited review by a designated University of Utah IRB member as described in 45 CFR 46.110 and 21 CFR 56.110. The research involves one or more activities in Categories 4, 6, and 7 (published in 63 FR 60364-60367). The designated IRB member has reviewed and approved your study as a Minimal risk study on 8/11/2013. The approval is effective as of 8/14/2013. Federal regulations and University of Utah IRB policy require this research protocol to be re-reviewed and re-approved prior to the expiration date, as determined by the designated IRB member.

Your study will expire on 8/10/2015.
Any changes to this study must be submitted to the IRB prior to initiation via an amendment form.

DETERMINATIONS

- **Inclusion of Children as Participants:** The IRB has determined that the inclusion of children is approved under 45 CFR 46.404 and 21 CFR 50.51. One parent/guardian may sign the parental permission document, unless the IRB has approved a waiver of consent for this population.

APPROVED DOCUMENTS

Parental Permission Forms
Parental permission documents 7/27/13--Clean copy

Assent Forms
Assent Documents 7/27/13--clean copy

Surveys, etc.
Surveys-8 8 13.docx

Literature Cited/References
References 6/20/13

Other Documents
Cosgriff school support letter
Madeleine choir school support letter
health-related physical fitness lesson plan sample

APPENDIX B

SCHOOL APPROVAL LETTER

THE MADELEINE CHOIR SCHOOL
ESTABLISHED 1996

July, 8, 2013

Dear You Fu,

As members of the Madeleine Choir School, we are delighted to support your research project: Effects of Health-Related Physical Fitness Physical Education on Adolescents' Physical Activity Behavior, Motivation, and Academic Learning Time.

This project is to help develop a greater understanding of issues associated with our middles school students' situational motivation, physical activity levels in physical education class settings. We understand the purpose of this project is to examine the effect of a health-related physical fitness-based physical education program on middle school students' perceived competence, enjoyment, and in-class physical activity levels, fitness levels and academic learning time as compared to the effect of a traditional approach physical education program on the study variables. This will facilitate physical education teachers design motivating curricula for our school students in the future.

We share a common purpose of wellness for all students in our school. As a partner in this work, we are committed to supporting the project objectives by disseminating information about the project, encouraging and supporting collaboration with other existing programs, providing meeting space when necessary, and serving on advisory boards as needed.

This research project will be a wonderful addition to the work of the the Madeleine Choir School, and we are very excited about the promise it holds for student wellness and interagency collaboration.

Sincerely,

Jill Baillie

Jill Baillie

Principal of the Madeleine Choir School

205 First Avenue · Salt Lake City, Utah 84103 · phone: 801.323.9850 · fax: 801.323.0581 · www.madeleinechoirschool.org

J.E. COSGRIFF MEMORIAL CATHOLIC SCHOOL
St. Ambrose Church

June, 27, 2013

Dear You Fu,

As members of the J.E. Cosgriff Memorial Catholic School, we are delighted to support your research project: Effects of Health-Related Physical Fitness Physical Education on Adolescents' Physical Activity Behavior, Motivation, and Academic Learning Time.

This project is to help develop a greater understanding of issues associated with our middles school students' situational motivation, physical activity levels in physical education class settings. We understand the purpose of this project is to examine the effect of a health-related physical fitness-based physical education program on middle school students' perceived competence, enjoyment, and in-class physical activity levels, fitness levels and academic learning time as compared to the effect of a traditional approach physical education program on the study variables. This will facilitate physical education teachers design motivating curricula for our school students in the future.

We share a common purpose of wellness for all students in our school. As a partner in this work, we are committed to supporting the project objectives by disseminating information about the project, encouraging and supporting collaboration with other existing programs, providing meeting space when necessary, and serving on advisory boards as needed.

This research project will be a wonderful addition to the work of the J.E. Cosgriff Memorial Catholic School, and we are very excited about the promise it holds for student wellness and interagency collaboration.

Sincerely,

Betsy Hunt

Betsy Hunt

Principal of J.E. Cosgriff Memorial Catholic School

2335 REDONDO AVE · SALT LAKE CITY, UT 84108 · PH: 801.486.3197 · FAX: 801.484.8270 · WWW.COSGRIFF.ORG

APPENDIX C

ASSENT TO PARTICIPATE IN A RESEARCH STUDY

Assent to Participate in a Research Study

Who are we and what are we doing?
We are from the Department of Exercise and Sport Science, University of Utah. We would like to ask if you would be in a research study. A research study is a way to find out new information about something. This is the way we try to find out how a health-related physical fitness-based basketball program influence middle school students' perceived competence, enjoyment, and in-class physical activity levels.

Why are we asking you to be in this research study?
We are asking you to be in this research study because we want to learn more about the effect of a health-related physical fitness-based basketball program on middle school students' perceived competence, enjoyment, and in-class physical activity levels. We want you to be in this study because empirical studies are recommended to examine the effects of the health-related physical fitness-based physical education curriculum on middle school students' perceived competence, enjoyment, and in-class physical activity levels.

What happens in the research study?
If you decide to be in this research study and your parent or guardian agrees, this is what will happen: It will take you approximately fifteen physical education sessions within five weeks to complete this study. As part of this study you will be asked to wear one pedometer on the waistband for 2 regularly scheduled physical education classes, meanwhile you will spend about five minutes completing two short questionnaires designed to assess your enjoyment and perceived competence toward physical education at the end of two regularly scheduled physical education classes.

Will any part of the research study hurt you?
The risks of this are minimal. There will the ordinary risks associated with the physical activities during physical education class.

Will the research study help you or anyone else?
There are no direct benefits for taking part in this study. However, we hope the information we get from this study may help develop a greater understanding of issues associated with students' situational motivation and physical activity levels in achievement settings. This study will also facilitate physical education teachers design motivating curricula for school students in the future.

Who will see the information about you?
We will keep all research records that identify you private to the extent allowed by law. Records about you will be kept confidential. Data and records will be stored in a locked filing cabinet or on a password protected computer located in the researcher's work space. Only the researcher and members of this study team will be allowed access to your information. Your name will be kept with your responses from enjoyment, perceived competence questionnaires. Results of the study may be published, but no names or identifying information will be included in the publication. Subject identity will remain confidential unless disclosure is required by law.

What if you have any questions about the research study?
It is okay to ask questions. If you don't understand something, you can ask us. We want you to ask questions now and anytime you think of them. If you have a question later that you didn't think of now, you can call You Fu at 385-628-9302 or ask us the next time we see you.

Do you have to be in the research study?
You do not have to be in this study if you don't want to. Being in this study is up to you. No one will be upset if you don't want to do it. Even if you say yes now, you can change your mind later and tell us you want to stop.
You can take your time to decide. You can talk to your parent or guardian before you decide. We will also ask your parent or guardian to give their permission for you to be in this study. But even if your parent or guardian say "yes" you can still decide not to be in the research study.

Agreeing to be in the study
I was able to ask questions about this study. Signing my name at the bottom means that I agree to be in this study. My parent or guardian and I will be given a copy of this form after I have signed it.

Printed Name

Sign your name on this line | Date

Printed Name of Person Obtaining Assent

Signature of Person Obtaining Assent | Date

The following should be completed by the study member conducting the assent process if the participant agrees to be in the study. Initial the appropriate selection:

_____ The participant is capable of reading the assent form and has signed above as documentation of assent to take part in this study.

_____ The participant is not capable of reading the assent form, but the information was verbally explained to him/her. The participant signed above as documentation of assent to take part in this study.

APPENDIX D

PARENTAL PERMISSION TO PARTICIPATE IN RESEARCH

Parental Permission Document

BACKGROUND

The principal investigator (PI) in this study is a doctoral student at the University of Utah. This study is a doctoral project that must be completed for the PI to proceed in the Exercise and Sport Science doctoral program. The PI's faculty sponsors and mentors are an assistant professor in the School of Kinesiology at the University of Minnesota and an associate professor in the College of health at the University of Utah.

Your child is being asked to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether you will allow your child to take part in this study.

Studies show that the health conditions of Americans are declining, and obesity is becoming more prevalent in society (Welk & Blair, 2000). It has been well-documented that school physical education programs play an important role in promoting health (Wright, Patterson, & Cardinal, 2000). But it has been reported that school physical education programs do not provide sufficient physical activity levels for youth (Biddle, Gorely, & Stensel, 2004), which causes a decline in youths' physical fitness (Malina, 2007).

Motivational beliefs such as perceived competence reflects the perception a person has of his or her ability to accomplish certain tasks resulting from cumulative interactions with the environment, while enjoyment refers to the enjoyment derived from the activity they are engaging in (Harter, 1985). Studies have indicated that there are positive relationships between perceived physical competence, physical activity participation and cardiorespiratory performance (Bagoien & Halvari, 2005; Gao, 2008). However, little research is available concerning the influence of a HRPF-based basketball program on middle school student's perceived competence, and enjoyment and in-class physical activity levels.

In response, the purpose of the study is to examine the effect of a HRPF-based basketball program on middle school students' perceived competence, enjoyment, and in-class physical activity levels as compared to the effect of a traditional skill based basketball unit on the study variables.

STUDY PROCEDURE
It will take your child approximately fifteen physical education sessions within five weeks to complete this study. As part of this study your child will be asked to wear one pedometer on the waistband for two regularly scheduled physical education classes, meanwhile your child will spend about five minutes completing two short questionnaires designed to assess his/her enjoyment and perceived competence toward physical education at the end of two regularly scheduled physical education classes.

RISKS
The risks of this are minimal. There will the ordinary risks associated with the physical activities during your child's physical education class.

BENEFITS
There are no direct benefits for taking part in this study. However, we hope the information we get from this study may help develop a greater understanding of issues associated with students' situational motivation and physical activity levels in achievement settings. This study will also facilitate physical education teachers design motivating curricula for school students in the future.

CONFIDENTIALITY
We will keep all research records that identify your child's private to the extent allowed by law. Records about you will be kept confidential. Data and records will be stored in a locked filing cabinet or on a password protected computer located in the researcher's work space. Only the researcher and members of this study team will be allowed access to your information. Your name will be kept with your responses from enjoyment, perceived competence questionnaires. Results of the study may be published, but no names or identifying information will be included in the publication. Subject identity will remain confidential unless disclosure is required by law.

PERSON TO CONTACT
If you have questions, complaints or concerns about this study, you can contact You Fu at 385-628-9302. If you feel you have been harmed as a result of participation, please call You Fu at 385-628-9302 who may be reached during 1:00am-5:00pm Tuesday and Thursday.
Institutional Review Board: Contact the Institutional Review Board (IRB) if you have questions regarding your rights as a research participant. Also, contact the IRB if you have questions, complaints or concerns which you do not feel you can discuss with the investigator. The University of Utah IRB may be reached by phone at (801) 581-3655 or by e-mail at irb@hsc.utah.edu.
Research Participant Advocate: You may also contact the Research Participant Advocate (RPA) by phone at (801) 581-3803 or by email at participant.advocate@hsc.utah.edu.

VOLUNTARY PARTICIPATION
It is up to you to decide whether to allow your child to take part in this study. Refusal to allow your child to participate or the decision to withdraw your child from this research will involve no penalty or loss of benefits to which your child is otherwise entitled. This

will not affect your or your child's relationship with the investigator.

COSTS AND COMPENSATION TO PARTICIPANTS
There is no cost to the subjects, nor is there any compensation for participating in the study.

CONSENT
By signing this consent form, I confirm I have read the information in this parental permission form and have had the opportunity to ask questions. I will be given a signed copy of this parental permission form. I voluntarily agree to allow my child to take part in this study.

_____
Child's Name

_____
Parent/Guardian's Name

_____ _____
Parent/Guardian's Signature Date

_____
Relationship to Child

_____
Name of Person Obtaining Consent

_____ _____
Signature of Person Obtaining Consent Date

APPENDIX E

MOTIVATIONAL QUESTIONNAIRE

Name: _____ Age: _____

Sex: □ Female □ Male Grade: _____

Ethnic origin (check **only one**):

□ White not Hispanic □ Asian or Pacific Islander □ Black not Hispanic

□ Hispanic □ Other: _____

Perceived Physical Competence Scale

Directions: The following scale is to determine how you feel about your ability in basketball class. The first thing you will do is to choose which person you are most like for each activity. Once you have chosen who you are most like, then you will decide whether the statement is really true for you or sort of true for you.

Remember that this is not a test. Please answer all questions as honestly as possible. Nobody will see your answers, or know how you responded.

1.

Really True for me	Sort of True for me	Some kids don't think they could be a lot better at basketball	**BUT**	Other kids feel they are much better at basketball.	Sort of True for me	Really True for me
☐	☐				☐	☐

2.

Really True for me	Sort of True for me			Other kids	Sort of True for me	Really True for me
☐	☐	Some kids are afraid they might not do well at basketball activities they haven't ever tried	**BUT**	think they could do well at new basketball activities they haven't tried before.	☐	☐

3.

Really True for me	Sort of True for me			Other kids	Sort of True for me	Really True for me
☐	☐	Some kids don't feel that they are good enough at basketball	**BUT**	feel they are good enough at basketball.	☐	☐

4.

Really True for me	Sort of True for me			Some kids	Sort of True for me	Really True for me
☐	☐	Some kids think basketball is not their first chosen game	**BUT**	think basketball is their first chosen game	☐	☐

5.

Really True for me	Sort of True for me			Other kids	Sort of True for me	Really True for me
☐	☐	In basketball games some kids usually watch instead of play	**BUT**	usually play rather than just watch.	☐	☐

6.

Really True for me	Sort of True for me			Other kids	Sort of True for me	Really True for me
☐	☐	Some kids don't do well at new basketball skills	**BUT**	are good at new basketball skills	☐	☐

Physical Activity Enjoyment Scale

Using the scale below, please circle the number that best describes the feeling you currently engaged in the basketball class. Answer each item according to the following scale:

	Strongly Disagree	Disagree	No Opinion	Agree	Agree Strongly
1. I like basketball classes	1	2	3	4	5
2. I have fun in basketball classes	1	2	3	4	5
3. Basketball classes make me happy	1	2	3	4	5
4. I enjoy basketball classes	1	2	3	4	5

APPENDIX F

ACADEMIC LEARNING TIME IN PHYSICAL EDUCATION

OBERSERVATIONAL FORM

Recorder _____ (Pri / Sec) Teacher _____ School_____ Grade _____
Date _____ Time Started _____ Time finished _____ Pre-activity/Post-activity

General	Transition (T)	Management (M)	Break (B)	Warm-up (W)	
Knowledge	Technique (TN)	Strategy (ST)	Rules (R)	Social Behavior (SB)	Background (BK)
Motor	Skill Practice (P)	Scrimmage (S)	Game (G)	Fitness (F)	

1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
4	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
5	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
6	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
7	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
8	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
9	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
10	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
12	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
13	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
14	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
15	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

APPENDIX G

WRITTEN TEST FOR ACADEMIC LEARNING TIME IN PHYSICAL EDUCATION (ALT-PE)

General	Knowledge	Motor
Transition (T)	Technique (TN)	Skill Practice (P)
Management (M)	Strategy (ST)	Scrimmage (S)
Break (b)	Rules (R)	Games (G)
Warm-up (W)	Social Behavior (SB)	Fitness (F)
	Background (BK)	

ALT-PE Written Test

Definition Discrimination

1. _____ Time devoted to the practice of skills or chains of skills outside the applied context with the primary goal of skill development, such as a circle drill in passing a volleyball, exploration of movement forms, practicing the Schottische step, or practicing a particular skill on a balance beam.

2. _____ Time devoted to refinement and extension of skills in an applied setting (in a setting which is like or simulates the setting in which the skill is actually used) and during which there is frequent instruction and feedback for the participants. For example, a half court five on five basketball activity, the practice of a complete free exercise routine, six against six volleyball (all with instruction, suggestions and feedback during the scrimmage).

3. _____ Time devoted to the application of skills in a game or competitive setting when the participants perform without intervention from the teacher. For example, a volleyball game, a complete balance beam routine, the performance of a folk dance, or running a half-mile race.

4. _____ Time devoted to rest and/or discussion of nonsubject matter related issues such as getting a drink of water, talking about last night's ball game, telling jokes, celebrating the birthday of a class member, or discussing the results of a student election.

5. _____ Time devoted to transmitting information concerning plans of action for performing either individually or as a group such as explanation of a zone defense, demonstration of an individual move, or discussion of how best to move the ball down a field.

6. _____ Time devoted to transmitting information about a subject matter activity such as its history, traditions, rituals, heroes, heroines, records, importance in later life, or relationship to fitness.

7. _____ Time devoted to managerial and organizational activities related to instruction such as team selection, changing equipment, moving from one space to another, changing stations, teacher explanation of an organizational arrangement, and changing activities within a lesson.

8. _____ Time devoted to class business that is unrelated to instructional activity such as taking attendance, discussing a field trip, lecturing about appropriate behavior in the gymnasium, and collecting money for the yearbook.

9. _____ Time devoted to transmitting information about regulations which govern activity related to the subject matter such as explanation of the rules of a game, demonstration of a specific rule violation, or viewing a film depicting the rules of volleyball (time devoted to transmitting information about rules governing general student behavior in physical education are coded "management").

10. _____Time devoted to transmitting information about appropriate and inappropriate ways of behaving within the context of the activity such as explanation of what constitutes sportsmanship in soccer, discussion of the ethics of reporting one's own violations in a game, or explanation of proper ways to respond to officials in a game.

11. _____Time devoted to routine execution of physical activities whose purpose is to prepare the individual for engaging in further activity, but not designed to alter the state of the individual on a long term basis, such as a period of light exercises to begin a class, stretching exercises prior to a lesson, or a cooling down activity to terminate a lesson.

12. _____ Time devoted to activities whose major purpose is to alter the physical state of the individual in terms of strength, cardiovascular endurance, or flexibility such as aerobic dance, distance running, weight training, or agility training (the activities should be of sufficient intensity, frequency, and duration so as to alter the state of the individual).

13. _____ Time devoted to transmitting information concerning the physical form (i.e., topography) of a motor skill such as listening to a lecture, watching a demonstration, or watching a film.

<u>Behavior Discrimination</u>

1. _____ Students are moving from one gymnastics station to another.

2. _____ Teacher is lecturing to the class about sportsmanship.

3. _____ The class is doing aerobic dancing (and has been for 10 minutes).

4. _____ The class is numbering off for teams.

5. _____ The class is playing a soccer game.

6. _____ The class is doing tumbling skills.

7. _____ The class is spread out around the gym at the start of class. The teacher is talking to a student who just entered.

8. _____ The class is in a movement lesson using balls.

9. _____ The class is involved in several basketball games.

10. _____ The class is working on a movement problem involving balancing on three body parts.

11. _____ The teacher is explaining net violations in volleyball.

12. _____ The teacher is discussing the upcoming tournament game with the class.

13. _____ The class is stretching prior to the beginning of a modern dance lesson.

14. _____The entire class is doing a folk dance, the Hora, to a record. The dance is done in its entirety.

15. _____ The class is in a gymnastics lesson working on skills.

16. _____ The class is doing a soccer dribbling drill inside the gym.

17. _____ After a strenuous activity, the class is told to "take five" for water.

18. _____ The class is involved in a folk dance lesson. The teacher is helping them to put together several steps to form the entire dance. The music is stopped frequently for comments from the teacher.

19. _____ The class is involved in serving drills in a volleyball unit.

20. _____ The class is in a basketball unit, and at the moment, is practicing free throws.

21. _____ The teacher is demonstrating the drive in a field hockey lesson.

22. _____ The class is watching a film on the history of cross country skiing prior to beginning a unit on that sport.

23. _____ The class is involved in a tumbling unit. The class is now spread out working on skills.

24. _____ The class is in a jump rope unit, working at the moment on double dutch.

25. _____ The class has just left the gymnasium to go to the playground to organize a soccer game.

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