2009

Direct observation in high school physical education

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DIRECT OBSERVATION IN HIGH SCHOOL

PHYSICAL EDUCATION

by

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Bachelor of Science
University of Nevada, Reno
1993

Master of Science
University of Nevada, Las Vegas
2005

A dissertation submitted in partial fulfillment
of the requirements for the

Doctor of Philosophy Degree in Sports Education Leadership
Department of Sports Education Leadership
College of Education

Graduate College
University of Nevada, Las Vegas
August 2009

ABSTRACT

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The purpose of this study was to analyze existing data collected using direct observation in a high school setting in order to understand more about the quality and contribution of physical education to public health goals. The System for Observing Fitness Instruction Time (SOFIT) was utilized to collect data related to student activity levels, lesson contexts, and teacher promotion of physical activity behavior. Two cross-sectional samples were observed in the spring 2005 and spring 2007 from seven high schools in a large urban school district in the eastern United States. In total, 164 lessons were observed yielding over 75 hours of observation. Descriptive statistics were calculated and logistic regression was utilized to determine the association between lesson contexts and student activity levels. The results showed the mean length of lessons was 29.1 minutes which translated to 32% shorter than scheduled. Students engaged in MVPA during 53% of the total intervals, however, only 13% were vigorous. Physical activity was not promoted 73% of the time, and, coincidently, a majority of the lessons did not meet public health guidelines (n = 93, 57%) and only engaged students in

MVPA for 35% of the lesson length. “Skill practice” was the best predictor of MVPA (Odds Ratio = 1.7) and best source of vigorous physical activity, however was only observed in 4% of the total intervals. The dominant lesson contexts were “game play” (49%) followed by “fitness activity” (21%). Little time was spent in “knowledge” (4%). In this study environmental factors related to instructional goals (i.e., lack of knowledge, skill practice, and promotion of physical activity) and decreased lesson length diminished the quality and contribution of physical education to public health goals. The quality and contribution of high school physical education can be improved by increasing student participation in vigorous physical activity, modifying instructional goals to include more knowledge and skill related content, and increasing the promotion of physical activity. More studies should be conducted to examine the relationship between key environmental and policy influences (e.g., lesson length, time spent in contexts, professional development) on the quality and contribution of high school physical education to public health goals.

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The data utilized in this study are a product of the Pittsburgh Obesity Prevention Initiative (POPI). Many thanks are owed to Highmark Blue Cross Blue Shield and the Grable Foundation for providing funds to conduct the POPI study, to SPARK for donating staff time and materials, and to the Pittsburgh Public Schools. Additional acknowledgment, appreciation, and thanks are due to Dr. Thomas McKenzie, Paul Rosengard and Julie Frank from the SPARK Programs, Inc., and to my committee including Dr. Monica Lounsbery (chair), Dr. Jerry Landwer, Dr. Timothy Bungum, and Dr. Martha Young who demonstrated unwavering patience and support throughout the experience and helped me to refine my ideas and improve the quality of my work.

Many people have inspired my endeavors over the years including family and colleagues. However, none has inspired or supported me more than my graduate school advisor, mentor, and friend Dr. Monica Lounsbery. Words cannot express the tremendous gratitude I feel for her investment in my potential. I would have never attempted to do this work if not for her optimism and persistence. I offer a lifetime of gratitude for her vision and belief in my potential, and her patience to deal with my many shortcomings.

CHAPTER ONE

INTRODUCTION

Background

Physical activity is an important health behavior for people of all ages and backgrounds (USDHHS, 1996, 2002, 2008b). Physical activity occurs when body movement is produced by the contraction of skeletal muscles requiring energy to be expended in order for the movement to be sustained (Casperson, Powell, & Christenson, 1985; USDHHS, 1996). Physical activities are commonly characterized according to type (e.g., aerobic, anaerobic, resistance), intensity (e.g., sedentary, light, moderate, vigorous), and volume (e.g., sets, repetitions).

Participation in regular moderate to vigorous physical activity (MVPA) is associated with numerous health benefits and is essential for young people. Regular participation is associated with healthy weight and reduced risk for chronic health conditions (USDHHS, 1996, 2002, 2004b). Unfortunately, decline in regular MVPA begins during childhood and by the time many young people reach high school they do not meet recommendations for daily participation (CDC, 2008; NCHS, 2008; USDHHS, 2004b, 2006). Decline in MVPA coincides with increases in sedentary activities (e.g., lying, sitting, standing) characterized by lack of movement and minimal energy expenditure.

The consequences of sedentary lifestyle in youth are severe (Gortmaker,

Must, Perrin, Sobol, & Dietz, 1993). Decreases in energy expenditure are associated with increased prevalence of overweight. Not only does being overweight in childhood have its own physical and psychological health problems, but overweight children are also likely to become overweight or obese adults of whom, are at increased risk for cardiovascular disease, diabetes, and cancer (Strong et al., 2005). Risk associations are similar for children and adults, so it is likely that risk for many future diseases can be reduced not only by children engaging regularly in physical activity but also by developing skills and habits that will permit them to have an active lifestyle as they grow older.

The impact of physical inactivity is evident in the increased prevalence in overweight among young people. From 1980 to 2000 the prevalence of overweight among adolescents tripled (CDC, 2004; Ogden, Flegal, Carroll, & Johnson, 2002) and as a result, obesity is now the most prevalent chronic disease risk for children and adolescents in the United States. Today, nearly 20% of children in the United States are overweight (Hedley, et al., 2004; Dietz, 1998) and the prevalence of overweight continues to increase each year (Ogden et al., 2006; USDHHS, 2006). Furthermore, the prevalence of chronic health conditions such as atherosclerosis, hypertension, obesity, and osteoporosis are increasing among people of all ages. Such conditions are increasingly viewed as preventable degenerative processes that may be prevented or delayed with regular participation in recommended amounts of physical activity during childhood (Rowland, 2007).

The majority of young people spend a significant amount of their childhood

and adolescent years in school. For this reason, schools are an important place where young people can participate in MVPA (CDC, 1997; Pate, et al., 2006). School physical education is strongly recommended for its potential to provide students with a significant opportunity to participate in daily MVPA, teach students generalizable movement skills (McKenzie, 2007), and contribute to public health goals (NASPE, 2005a; Sallis & McKenzie, 1991;Pate et al, 2006; USDHHS, 2000). In addition, public health leaders recognize physical activity as an important outcome of physical education and so establish a national objective to increase the number of students engaged in MVPA for at least half of every lesson (USDHHS, 2000, 2004b). However, in spite of the fact that high school physical education is mandated in most states and included among public health goals, very little is known about its effectiveness to provide students with a significant source of MVPA.

Most of what is known about physical activity during high school physical education is derived from self-report surveys (e.g., YRBSS). Self-report surveys do not detect contextual or behavioral influences which are known to influence physical activity behavior (McKenzie, 2002b). Direct observation provides rich descriptive data on the physical activity participation and is essential to understanding the physical activity behavior of young people in order to understand if intervention is necessary (Sallis, Zakarian, Hovell, Hofstetter, 1996). For this reason, direct observation is the criterion standard for assessing physical activity (Sirard & Pate, 2001) in physical education settings.

The System for Observing Fitness Instruction Time (SOFIT) is a valid and

reliable direct observation instrument that simultaneously assesses student activity levels, lesson contexts, and teacher interactions and is frequently cited in the study of physical activity outcomes in physical education (McKenzie, Sallis, & Nader, 1991). Although several studies of elementary and middle school physical education utilize direct observation to provide a rich description of these settings, few studies of high school physical education (Chow, McKenzie, & Louie, 2009) exist in the current literature. Therefore, the purpose of this study is to analyze existing data, collected using direct observation in a high school setting, in order to understand more about the quality and contribution of physical education to public health goals.

Research Problem

The prevalence of overweight and obesity are increasing and are associated with chronic health problems, increased medical expenditures, and decreased quality of life (Finkelstein, Fiebelkorn, & Wang, 2003; USDHHS 2004b, 2006). Participation in regular physical activity is important because it is associated with health-related variables including healthy weight, lower risk for chronic health conditions, health status, quality of life, and longevity (USDHHS, 1996, 2002). Unfortunately, the prevalence of physical inactivity worsens as young children matriculate through school and by high school many do not engage in sufficient amounts (USDHHS, 2004b, 2006). Quality school physical education is often recommended and endorsed as a significant opportunity for young people to engage in MVPA and realize public health goals. However, the quality of high

school physical education is often described using self-report data which may not be accurate. SOFIT is a valid and reliable direct observation instrument cited in many studies to describe the quality of elementary and middle school physical education. Importantly, few studies utilizing SOFIT to describe high school physical education lessons could be located.

Statement of Purpose

The purpose of this study is to analyze existing data collected using direct observation in a high school setting in order to understand more about the quality and contribution of physical education to public health goals.

Research Questions

The research questions that will be addressed specific to the sample of high school physical education lessons in this study are:

1. How active were high school students observed in the sample of high school lessons?
2. What proportion of time was spent in the lesson contexts of "management," "knowledge," "fitness activity," "skill practice," game play," and "other" in the sample of high school lessons?
3. How active were students in the sample of lessons, during respective lesson contexts (i.e., "management," "knowledge," "fitness activity," "skill practice," game play," and "other")?

4. What is the frequency and nature (i.e., in and out of PE) of teacher physical activity promotion in the sample of high school lessons?
5. What proportion of lessons met public health guidelines (engaging students in MVPA for ≥ 50% of lesson length)?
6. What was the association between lesson context and student physical activity levels (i.e., sedentary vs. MVPA) in the sample of high school lessons?

Significance

Physical education may be the only opportunity many high school students have to engage in regular sufficient physical activity and to learn generalizable movement skills necessary to lead a physically active lifestyle. High school physical education is mandated in most states; however, most of what is known about student physical activity levels is derived from self-report data which may prove unreliable. Student outcomes during physical education are influenced by many factors. For this reason, it is important to utilize direct observation to measure physical activity during physical education since it is the gold standard and considers contextual and behavioral influences on the physical activity behavior. Using direct observation will help researchers understand contribution of physical education to public health goals, describe how time during physical education lessons is spent, and learn more about the promotion of physical activity to young people. This information can be utilized to inform school policy, teacher preparation, and the development of interventions seeking to improve the

quality and quantity of physical education. The results can also be used to determine important variables such as energy expenditure which may resonate well with public health leaders.

Limiting Factors

Scope

The scope of this study is to evaluate a sample of high school physical education lessons collected during the Pittsburgh Obesity Prevention Initiative (POPI). In this manner only student physical activity levels, lesson contexts, and teacher interactions in terms of promotion of physical activity in or out of physical education are included as focal points of the research.

Assumptions

The assumptions of the study are as follows:

1. Student activity levels, lesson contexts, and teacher interactions were validly operationalized.
2. Data collectors interpreted and recorded the observed behaviors reliably.
3. Lying down, sitting, and standing are sedentary behaviors.
4. Walking and vigorous activities each contributed to moderate-vigorous physical activity.
5. Logistic regression can sufficiently measure the strength of association between lesson contexts and student activity levels in order to predict the likelihood of a specific activity level occurring.

Limitations

The use of existing data to describe student activity levels, lesson contexts, and the promotion of physical activity are limited as follows:

1. The results of this study are limited to SOFIT observations of 165 physical education lessons from 7 high schools in the Pittsburgh Public Schools. The System for Observing Fitness Instruction Time (SOFIT) a direct observation instrument measures student activity levels, lesson contexts, and teacher promotion of physical activity. No other measure of student physical activity levels, lesson contexts, or teacher interactions was used. The total number of SOFIT observations is limited by time and resources. SOFIT is a time intensive method of collecting data.
2. SOFIT data are limited to what can be seen or heard (McKenzie, 1991). In addition, direct observation utilizes momentary time sampling to record observations in 20 second intervals. Therefore, the SOFIT observations are limited to what is seen in heard during each momentary time sample and are not continuous type data
3. The results of SOFIT are further limited by instructional goals, class characteristics, and environmental conditions (McKenzie, 2002a). For example, the type of unit and the lesson placement in the unit limit the outcomes. In addition, the size and diversity of classes are known to influence the outcomes of SOFIT. Finally, the size and location of the space, the ratio of equipment for each student, and the weather also influence the outcomes of SOFIT.

4. The results of SOFIT observations may be influenced by subject reactivity to observers. Reactivity may have a positive or negative influence on all subjects. In this case, students and teachers may increase or decrease observed behaviors upon recognizing observers are coding behaviors and in spite of the fact they are unaware of the specific behaviors being observed.

Operational Definitions

1. Health- Health is characterized by the absence of disease or infirmity and is also characterized by as a state of complete physical, mental, and social well-being.
2. Physical activity- Physical activity occurs when body movement is produced by the contraction of skeletal muscles requiring energy to be expended in order for the movement to be sustained.
3. Sedentary physical activity- Sedentary physical activity includes activities that involve energy expenditure at the level of 1.0-1.5 metabolic equivalent units (METs). (One MET is the energy cost of resting quietly, often defined in terms of oxygen uptake as 3.5 $mL \cdot kg^{-1} \cdot min^{-1}$).
4. MVPA- Moderate to vigorous physical activity, includes physical activity that expends 3.0 to 5.9 METs (moderate) and > 5.9 (vigorous) activity. On the SOFIT scale MVPA is calculated by combining all walking (4) and very active (5) scores to make a new variable (MVPA).

5. MET- metabolic equivalent - 1 MET is the rate of energy expenditure while sitting at rest. It is taken by convention to be an oxygen uptake of 3.5 milliliters per kilogram of body weight per minute. Physical activities frequently are classified by their intensity using the MET as a reference.
6. Physical Activity Guidelines- Describe the types and amounts of physical activity that offer substantial health benefits for young people, adults, and seniors of all abilities and backgrounds.
7. Morbidity- Illness, disease; Can refer to the number of individuals in poor health during a given time period (the incidence rate) or the number who currently have that disease (the prevalence rate), scaled to the size of the population.
8. Mortality –Death; Mortality rate is typically expressed in units of deaths per 1000 individuals per year; thus, a mortality rate of 9.5 in a population of 100,000 would mean 950 deaths per year in that entire population.
9. Overweight among children- Overweight is defined as a BMI at or above the 85th percentile and lower than the 95th percentile among children.
10. Obesity among children- Obesity is defined as a BMI at or above the 95th percentile for children of the same age and sex.
11. Overweight among adults-An adult who has a BMI between 25 and 29.9 is considered overweight.
12. Obesity among adults- An adult who has a BMI of 30 or higher is considered obese.

CHAPTER TWO

REVIEW OF LITERATURE

Physical activity is an important health behavior and young people should engage in at least 60 minutes every day. Unfortunately, decline in physical activity begins during childhood and by the time many young people reach high school age they reportedly do not engage in sufficient amounts (NCHS, 2008). However, most of what is known about the physical activity behavior of high school-aged youth is generated from self-report data (e.g., YRBSS) and even though high school physical education is mandated in most states, very little is known about how much physical activity it provides. Therefore, the purpose of this study was to analyze existing data collected using direct observation in a high school setting in order to understand more about the quality and contribution of physical education to public health goals.

The purpose of this review is to provide literary support for the importance of studying student physical activity levels during high school physical education using direct observation. For organizational purposes this chapter is divided into the three sections: (a) the relevance of studying the physical activity behavior, (b) physical activity during physical education and (c) measurement of physical activity during physical education. Each section is organized into sub-sections. What follows next is the introduction to section one, the relevance of studying the

physical activity behavior of young people.

The Relevance of Studying Physical Activity Behavior

The study of physical activity behavior of young people is important for several reasons. Foremost, physical activity is related to health and therefore, in the first sub-section the relationship between physical activity and health is presented. Second, because physical activity is associated with good health it is often recommended as a preventive health behavior. In the second sub-section, an overview of the national guidelines and recommendations for regular and sufficient participation in physical activity are presented. Finally, physical activity behavior is influenced by many factors and in spite of the fact it is commonly recommended for good health, a large number of people do not engage in sufficient amounts. In sub-section three the prevalence of physical inactivity among young people today is described and the correlates and determinants of physical activity behavior are presented.

Physical Activity and Its Relationship to Health

According to the World Health Organization (WHO) good health is characterized by the absence of disease or infirmity and is described as a state of complete physical, mental, and social well-being (as cited in Bouchard, Blair, & Haskell, 2007). Unfortunately, the number of young people living in poor health is increasing annually (Aronne, Brown, & Isoldi, 2007; USDHHS, 2006) and coincides with increasing morbidities and mortality associated with chronic conditions in adulthood. The impact of morbidity, mortality, and medical

expenditures associated with physical inactivity are a detriment to society (Aronne, et al., 2007).

Physical inactivity is believed to be the leading behavioral cause of death in the United States (Mokdad, Marks, Stroup, & Gerberding, 2004) and today sedentary lifestyle is recognized as a world-wide public health problem (WHO, 2002). The relationship between physical inactivity, overweight, and obesity has been well-documented (e.g., USDHHS, 1996, 2002, 2004b; USDHHS & USDA, 2005). The conditions of overweight and/or obesity increase the risk of high blood pressure, high cholesterol, type 2 diabetes, heart disease, stroke, gall bladder disease, arthritis, sleep disturbances, breathing problems and certain types of cancers (CDC, 1997; Sinha et al., 2002; National Center for Health Statistics, 2008, USDHHS, 2000, 2004b, 2007)

The costs and consequences of physical inactivity are enormous and growing (Finkelstein et al., 2003; Finkelstein, Fiebelkorn, & Wang, 2004). Today, over 430 billion dollars is spent each year due the direct and indirect costs of cardiovascular disease and 92.6 billion dollars alone are spent on overweight and obesity annually (Arrone, et al., 2007). For this reason, many believe that increasing participation in physical activity among young people is important because it could help reduce the burden of chronic health problems on society (Luepker, 1999) by decreasing costs associated with morbidity and mortality (Hahn, Teutsch, Rothenberg, & Marks, 1990; USDHHS, 2002).

The importance of physical activity in the reduction of the nation's mortality and morbidity has been clearly established through decades of epidemiological

research (USDHHS, 1996). In particular, studies have shown that participation in physical activity is associated with lower prevalence of metabolic syndrome (Alexander, Landsman & Grundy, 2008; Chen, Roberts & Barnard, 2006; Chen, Srinivasan & Berenson, 2008; Ekeland, et al., 2005; Sui, et al., 2007; Irwin, et al., 2002; Jurca, et al., 2004), reduced occurrences of back pain and fractures (Malina, Bouchard, & Bar-Or, 2004) and improved psychological health and mood (Biddle, Fox, & Boutcher, 2000; Glassa et al., 2004).

More is known about the health benefits of physical activity in adults than in young people (USDHHS, 1996), however, childhood physical activity tracks into adulthood (Malina, 1996; Trudeau, Laurencelle, & Shephard, 2004) and there are some known immediate benefits (Gidding, et al., 2006; Strong, et al., 2005). For example, children's habitual physical activity is positively associated with most health-related fitness components and increases in physical activity and fitness are related to improved measures of health (Strong, et al., 2005). In addition, reviews of the scientific literature indicate that physical activity reduces risk of cardiovascular disease, overweight, and Type 2 diabetes, and vigorous activity helps increase the strength and density of bones (Sothern, Loftin, Suskind, Udall, & Blecker, 1999). Improvements in flexibility, muscular strength, and bone health not only advance movement and sport related performances, but are also are thought to be related to reduced back pain and fractures in adulthood (Malina, et al., 2004). Vigorous physical activity may also help improve psychological health and mood, and can assist in reducing blood pressure and increasing HDL-cholesterol among high-risk youths (Strong, et al., 2005).

The benefits of physical activity for young people include health-related, social, psychological, and cognitive benefits (USDHHS, 1996; Rowland, 2007). The health benefits for young people include better weight status, lower blood pressure, greater levels of good cholesterol (HDL), and lower risk for type II diabetes mellitus and some cancers (Rowland, 2007; Sothern, et al., 1999). In addition, many young people who participate in regular physical activity feel greater self-esteem and manage stress more efficiently (USDHHS, 1996). Further, participation in physical activity may have cognitive benefits (Sibley & Etnier, 2003) associated with executive functions such as planning, abstract thinking, rule acquisition, initiating or inhibiting appropriate actions, and selecting relevant sensory information (Tomporowski, Davis, Miller, & Naglieri, 2007; Hillman, Castelli, & Buck, 2005).

Recommendations and Guidelines for Physical Activity

Recommendations and guidelines for physical activity are mounting as society becomes more reliant on technology, participation in physical activity declines, and the prevalence and cost of chronic health problems continue to grow exponentially (NCHS, 2008). Recently, the United States Government released its first ever 2008 Guidelines for Physical Activity for Americans (USDHHS, 2008b). The 2008 Guidelines recommend that young people engage in at least 60 minutes of moderate or vigorous physical activity every day. The guidelines also suggest young people participate in a variety of developmentally appropriate activities including vigorous, muscle strengthening, and bone

strengthening activities at least 3 days of every week (USDHHS, 2008b). The guidelines verify and extend previous recommendations for children and adolescents to participate in at three sessions of at least 20 minutes of moderate intense physical activity per week and preferably daily (CDC, 1997). The guidelines support previous recommendations that children and youths should participate in a variety of physical activities that are developmentally appropriate and enjoyable (CDC, 1997; Strong, et al., 2005) and clarifies the types (e.g., vigorous, muscle and bone strengthening) of physical activities that are recommended.

Prior to the 2008 Guidelines, governmental recommendations for participation in regular physical activity are evident from a number of sources. The 1996 Surgeon General's Report on Physical Activity and Health is a landmark review of the relationship between physical activity and health (USDHHS, 1996). One of the major findings of the report is that physical activity is good for all people regardless of age. The report is a milestone because it represents the first time; the Surgeon General recognizes physical inactivity is a serious public health problem.

The Healthy People initiative establishes health objectives for the nation and includes physical activity as one of ten leading health indicators which reflect major health issues in the United States (USDHHS, 2000). For each leading health indicator, measurable objectives are identified that, if accomplished, would improve the health and well-being and reduce health disparities among all Americans. Several of the Healthy People objectives for physical activity target

improvement of the physical activity behavior of young people (USDHHS, 2000). The goals for physical activity include specific objectives for participation in vigorous physical activity (VPA) and MVPA, daily physical education, and also include a target goal for students to engage in MVPA during physical education classes.

The 60-minute per day goal for young people is also reflected in the 2005 Dietary Guidelines for Americans (USDHHS & USDA, 2005) which also recommended activity can be accumulated throughout the day and in various settings. The United States Dietary Guidelines for Americans provides important information on good dietary habits and include physical activity in the discussion since energy expenditure is related to energy consumption. Further, the guidelines purport that adequate physical activity provides protection against chronic diseases and helps to balance energy expenditure and intake.

The Prevalence of Physical Inactivity Among Young People

Unfortunately, many do not engage in sufficient physical activity due to a myriad of personal, social, and environmental barriers. Despite the many documented benefits of physical activity, numerous reports suggest that all segments of the population, including children and youths, do not engage in sufficient activity for health purposes (Ogden, et al., 2002; Pate, et al., 2006; Strong, et al., 2005; USDHHS, 2006). One study indicated that 61.5% of 9 to 13 year-old children did not participate in any organized physical activity during non-school hours and 22.6% did not engage in any leisure time physical activity (CDC, 2003).

A larger study utilized the National Health and Nutritional Examination Survey data 2003-04 to compare accelerometer data for 6329 participants who provided at least 1 day of data and from 4867 participants who provided 4 or more days of accelerometer data. Males were more active than females. Dramatic declines were seen with age starting in childhood. Only 8% of adolescents met recommendations for 60 min x day (-1) compared to 42% of children aged 6-11 (Troiano et al., 2008).

Correlates and Determinants of Physical Activity Behavior

Physical activity is a complex behavior which occurs in a setting (Sallis & Owen, 2002) and is subject to multiple levels of influence (McLeroy, Bibeau, Steckler, & Glanz, 1988) including physical, social, and environmental contexts (Chow, McKenzie, & Louie, 2008). Physical activity behavior can be influenced by intrapersonal, social, policy, and physical-environmental factors (Sallis & Owen, 2002). In a literature review examining 108 studies and more than 40 variables for children, and 48 variables for adolescents, Sallis, Prochaska, and Taylor (2000) identified variables that have been consistently found to be associated with children's physical activity. For children, these variables included gender (male), parental overweight status, physical activity preferences, intention to be active, perceived barriers (inverse), previous physical activity, healthy diet, program/facility access, and time spent outdoors. Variables that were consistently associated with adolescents' (ages 13-18) physical activity were sex (male), ethnicity (white), age (inverse), perceived activity competence, intentions, depression (inverse), previous physical activity, community sports, sensation

seeking, sedentary after school and on weekends (inverse), parent support, support from others, sibling physical activity, direct help from parents, and opportunities to exercise.

A longitudinal study conducted in South America and published in 2006 (Hallal, Wells, Reichert, Anselmi, & Victora, 2006) examined social, anthropometric and behavioral variables on physical activity from a sample of over 4000 children. Their study found that the risk factors for sedentary lifestyle in adolescence were female sex, high family income at birth, high maternal education at birth, and low birth order.

Other studies have examined barriers physical activity. Barriers are the obstacles that make it difficult to participate. Sallis and colleagues (2000) identified five categories of these factors of which included demographic and biological, psychological, cognitive, and emotional, behavioral attributes and skills, social cultural and physical environment. In yet another study (Allison, et al., 2005), researchers cited several intrinsic and extrinsic barriers (individual characteristics, low priority, other involvement in technology/computer type activities; influence of peers and family, lack of time, and inaccessibility and cost).

Examining differences between genders has been an aim of recent research seeking to clarify variables related to physical activity. Decline in physical activity is more prevalent in girls than boys however, physical activity among all major racial groups decreases over time (Luepker, 1999). A review by Stone, McKenzie, Welk, & Booth (1998) found that a considerable number of children

are not active enough, boys are significantly more active than girls, and participation in physical activity declines with age although the trend may or may not be a linear one. There also appears to be disparity among ethnicities (Pate et al., 2005). One study demonstrated that by the age of 16 or 17 56% of black and 31% of white girls reported no habitual leisure time PA. Low levels of PA were associated with high BMI in both groups. Lack of parent education was associated with greater decline among white girls as well as smoking cigarettes. Pregnancy and low level of parent education was associated with greater decline among all black girls and older black girls respectively (Kimm, et al., 2002).

Given that a large proportion of the population, including children, do not meet physical activity guidelines, research has begun to focus on utilitarian physical activity such as active transport. For school-age children active transport to and from school has been examined. Long distances from home is the most often cited barrier to walking to school (CDC, 2003) and second most cited is danger from traffic (Brownson, Boehmer, & Luke, 2005).

What follows next is the second major section that provides evidence that physical education is an important opportunity for young people to engage in MVPA.

Physical Activity and Physical Education

The study of physical activity behavior during physical education is important for many reasons. Quality physical education is characterized according to the National Association for Sport and Physical Education (NASPE) and is endorsed

by a variety of disciplines. Many who endorse quality physical education do so in part because they believe it provides students with a significant opportunity to engage in physical activity. In sub-section one quality physical education is defined and recommendations for quality physical education are presented. In addition, recommendations for physical education that provides students with a significant opportunity to accrue recommended amounts of MVPA are reviewed from a variety of sources. Finally, many factors are known to influence the quantity and quality of physical activity during physical education. In the second sub-section, the profile of physical education is described which includes a review of variables which influence physical activity levels during physical education.

Recommendations for Quality Physical Education

The National Association for Sport and Physical Education (NASPE) sets the standard for quality physical education which provides students with an opportunity to learn, teaches meaningful content, and utilizes appropriate instruction (NASPE, 2005a). NASPE recommends that elementary schools offer *150* minutes of physical education per week and that secondary schools offer *225* minutes per week—ideally with some instruction being offered every day. Meaningful content in quality physical education is provided when instructors teach a variety of activities to promote regular participation in MVPA, develop motor skills, and enhance physical fitness. Appropriate instruction is inclusive, maximizes student opportunities to respond in well-designed lessons, and regularly assesses student learning (NASPE, 2005a).

Daily physical education is frequently recommended for all K-12 students

(CDC, 1997;Pate et al., 2006; Strong et al., 2005; USDHHS, 1996, 2000). The recommendations for daily physical education stem from a variety of organizations representing education (NASBE, 2000), government (USDHHS, 1996, 2000), public health (AHA, 2008; AAP, 2000, 2006; USDHHS 2000; NASPE & AHA, 2006), task forces (ACSM, 1988; Pate, et al., 2006), parents and teachers (NASPE, 2003) who recognize physical education's role in providing opportunity for young people to engage in physical activity and achieve national health goals.

In addition to recommendations, physical education is mandated in most states (Lee, Fulton, Burgeson, & Spain, 2007). However, there is no federal law that requires it. Hence, many states fall far short of these recommendations and do not mandate or even provide recommended enrollment in physical education (NASPE & AHA, 2006). Studies have identified that stated policies regarding school physical education and other sources of physical activity such as recess, are not always followed. For example, it is common place for regularly scheduled physical education to be cancelled due to weather conditions or in order to accommodate other school functions that may require use of the physical education facilities. Additionally, it is ordinary practice to withhold physical education and/or recess attendance from students on an individual basis as a form of punishment or to address academic inadequacies. While physical education national standards for kindergarten through twelfth grade exist (see NASPE, 2005a) they are both general and broad which accommodates a spectrum of educational philosophies and practices. To date there is no standard

required curriculum or educational practice in physical education. Therefore, even within a single school site the variability of students' physical education experience may differ greatly, making controlled study of its direct health related outcomes nearly impossible.

Recommendations that physical activity should be an important outcome of a quality physical education program are not new. Healthy People 2010 establishes objectives the number of schools which require daily physical education, increasing the number of students who participate in daily physical education, and increasing the number of students who engage in MVPA for ≥50% of lesson length (USDHHS, 2000). However, there is much evidence that the quality of physical activity provided to students is highly variable and in some cases may be lacking all together (USDHHS, 2004a). One recent publication by McKenzie and Lounsbery (2009) summarized this phenomenon through the analogy "If exercise is medicine, physical education is the pill not taken."

In spite of the evidence that student experiences in physical education are highly variable, it is clear that physical activity is a major outcome for all quality physical education programs. Physical activity is specifically mentioned as a meaningful outcome according to NASPE and should be regularly promoted and assessed. Furthermore, NASPE purports "physical activity is critical to the development and maintenance of good health; the goal of physical education is to develop individuals who have the knowledge, skills, and confidence to enjoy a lifetime of healthful physical activity." In addition, Healthy People 2010 recognizes physical activity as a leading health indicator and establish a goal for

the provision of physical activity during physical education classes. According to Healthy People 2010 physical education classes should engage ≥50% of students in MVPA for ≥50% of every lesson (USDHHS, 2000). Others agree that schools are obligated to provide quality physical activity opportunities for children (Pate et al., 2006; NASPE, 2008) and have the potential to positively influence public health (Allensworth, Lawson, Nicholson, & Wyche, 1997; McKenzie, 2007). Public health entities (AHA, 2008; AAP, 2000, 2006; USDHHS 2000) back quality physical education because of its relationship to physical activity. In fact, many national organizations and leaders in the profession believe quality physical education can help young children and adolescents achieve national health goals (ACSM, 1988; NASBE, 2000; NASPE & AHA, 2006; Pate, et al., 2006; USDHHS, 2000).

In consideration of current health-related trends schools are in a unique position to significantly influence young people through offering quality physical education. Unfortunately, in spite of the many recommendations and the expectations for quality physical education, the outcomes are often less than acceptable. What follows next is a profile of school physical education and physical activity.

Profile of School Physical Education and Physical Activity

The profile of physical education in the United States has been clarified by the Center for Disease Control and Prevention's School Health Program Policy Study (SHPPS). SHPPS is a survey that assesses school health policies and trends at the state, district, school, and classroom levels nationwide. Since 1994, SHPPS

has been conducted every 6 years with the last SHPPS study completed in 2006 and the next planned for 2012.

During the time between the most current (2006) and the last (2000) SHPPS, the landscape of American public education shifted dramatically with the reauthorization of Elementary and Secondary Education Act, No child Left Behind (NCLB) of which, was signed into law in 2002. In the public health context of the problem of obesity rising to epidemic status, NCLB raised school requirements for reporting the academic achievement of students in core subject matter area, placing increased emphasis and priority for student assessment and achievement in core academic subjects. Consequently and similar to other subject matter areas deemed non-core, physical education and other school physical activity opportunities have struggled to remain a priority in the K-12 school settings.

When compared to previous years of SHHPS results, results from the 2006 report show improvement gains in some program and policy areas and yet, other results continue to highlight health program and policy gaps. What follows is an abbreviated review of some of the enrollment, content, and staffing gains and gaps in school physical education and physical activity as delineated by the 2006 SHHPS report. The results of the full report are available in the 2007 (volume 77 issue 8) of the *Journal of School Health* (Lee, et al., 2007).

Enrollment Requirements in Physical Education

Participation in physical education declines as students matriculate through school and decline is greater among girls than boys. The number of students

enrolled in PE fell between 1984 and 1990 (Brownson, et al., 2005; CDC, 1990). From 1991 to 2001, the percentage of students who attended PE daily decreased from 41.6% to 32.2%, suggesting PA during school is declining (Brownson, et al., 2005).

Results from the 2006 SHPPS showed that of the nearly 1000 schools reporting nationwide, 78.3% required students to take at least some physical education of which, was a more than 10% increase from the 2000 SHHPS. Data, as analyzed by school level, showed that 69.3% of elementary schools, 83.9% of middle schools, and 95.2 of high schools required at least some physical education. While these results showed there were gains in terms of the percentages of schools requiring at least some physical education, the data also reveal the glaring gap that few students receive daily physical education with only 3.8% of elementary schools, 7.9% of middle schools, and 2.1% of high schools reporting that daily physical education or its per week minute equivalent were provided (150 minutes for elementary; 225 for middle and high schools). Furthermore, results showed that by grade level requirements for enrollment in physical education varied widely with 6th grade having the highest number of schools reporting required enrollment (68.1% of schools) and the 10th, 11th, and 12th grades having the fewest number of schools reporting required enrollment (33.2%, 20.2%, and 20.4%).

In addition to the low number of students who enroll in daily physical education, only 36% of all schools had a maximum allowable student to teacher ratio for required physical education. This means that compared to other subject

matter areas, schools can enroll excessive numbers of students in physical education and in many cases more than twice the number allowed in other subject matter areas. According to NASPE the teacher to student ratio in physical education should be 1:25 for elementary schools, 1:30 for middle schools and 1:35 for high schools for safe and effective instruction (NASPE & AHA, 2006).

Content

The content of physical education as delineated by SHPPS is limited to descriptions of the nature of the activities taught by schools reporting required physical education. These results showed that among the 78.3% of schools, 98.5% taught group or team activities, 95.1% taught individual or paired activities, 63.2% taught dance activities, and 8.5% taught aquatic activities. Physical Best is a health-related fitness education program from the National Association for Sport and Physical Education and the American Alliance for Health, Physical Education, Recreation and Dance (NASPE, 2005b). The focus of Physical Best is to provide developmentally appropriate activities for students of all ages and abilities by focusing on the individual student and his or her own fitness improvement and the promotion of a physically active lifestyle. Physical Best also recommends the use of Fitnessgram which is a health-related physical fitness assessment developed by the Cooper Institute. The 2006 SHHPS data suggest a rising trend toward the use of individualized physical activity plans in middle school and high school settings with 25.6% of schools reporting teachers in at least one physical education class required to do so. Furthermore, more middle schools (9.5% in 2000 compared to 24.1% in 2006)

and more high schools (8.3% in 2000 and 21.2% in 2006) recommended the use of Fitnessgram.

Staffing

Policies concerning the credentials and professional development of physical education staff are important facets of the profile of physical education. Research has shown that certified physical teachers are more likely to use recommended best practices known to engage children in moderate to vigorous physical activity (Davis, Burgeson, Brener, McManus & Wechsler, 2005). Additionally, studies have also shown that professional development can also lead to increased student MVPA during physical education (Sallis, et al., 1997). In 80.1% of elementary schools, 73.3% of middle schools, and 66.3% of high schools, physical education was taught only by a physical education teacher or specialist. It is concerning that as children grow into adolescence and increased risk for physical inactivity, their chances of having their physical education classes taught by a certified teacher diminishes greatly.

Nationwide, only 14.0% of the 51 state education agencies reported they had adopted a policy requiring districts to have a coordinator of physical education. This finding is problematic from a policy standpoint because when physical education does not have its own coordinator at the school district level, there is likely no one advocating for student, curricular, and staff needs.

Other School Sources of Physical Activity

Results from the 2006 SHPPS show that for most students, the typical provisions for enrollment in physical education are not conducive to bringing students into

compliance with physical activity guidelines. For this reason, other school sources of physical activity play a critical public health role. Such sources of physical activity include recess (in elementary schools) and before, during and after school programs. Compared to the 2000 report, the percentage of states requiring elementary schools to provide regularly scheduled recess for students increased from 4.1% in 2000 to 11.8% in 2006. Additionally, 67.8% of elementary schools provided daily recess for students in all grades in the school. For all schools 48.4% reported offering intramural activities or physical activity clubs. However, compared to the 2000 report, the percentage of schools that required students to pay a fee to participate in these activities increased from 23% to 35% in 2006.

So, while physical education is frequently recommended and endorsed for its potential to provide students with significant opportunities to engage in MVPA it is important to consider how we know what we know. In consideration that PE can impact public health goals the evaluation of PE should be held in high esteem. What follows next is the final section related to the measurement of physical activity during physical education.

Measurement of Physical Activity in Physical Education

It is important to measure physical activity levels of students in physical education and this can be accomplished according to a variety of methods. This section describes the major methods for measuring physical activity levels of

students in physical education. First, surveillance self-report methods are reviewed. Second, indirect methods are presented. Third, direct observation is described and a review of physical education studies using the System for Observing Fitness Instruction Time (SOFIT) is summarized.

Surveillance

Large scale surveillance of the physical activity behavior of young people is conducted by the Centers for Disease Control and Prevention (CDC). Two of the primary surveillance systems utilized by the Centers for Disease Control and Prevention are cross-sectional in design and utilize self-report survey methodology (i.e., NHANES & YRBSS). The Youth Risk Behavior Surveillance System (YRBSS) is administered biennially to a sample of high school students from public and private high schools nationwide (USDHHS, 2006, 2000b). The YRBSS includes six items related to participation in recommended amounts of physical activity, physical education, involvement in extra-curricular sports, and time spent watching television and using computers during the previous week (USDHHS, 2008c). The National Health and Nutrition Examination Survey surveys participants on the type, intensity, duration, and frequency of activities during the last thirty days (USDHHS, 2008a). However, cross-sectional data only provide a snapshot of the behavior and are therefore limited. Additionally, participants commonly over-report their physical activity behavior when surveyed. Further, the longer the recall period the greater error in the measure – people forget.

Some studies have examined the reliability YRBS questions and have found

a general underestimation of the proportion of students attaining recommended levels of moderate physical activity and an overestimation of the proportion meeting vigorous recommendations (Troped, et al., 2007). In addition, very few longitudinal studies exist and for this reason the long-term benefits of physical activity behavior among children are not clear. For purposes of this review only YRBSS and NHANES will be presented in addition to a few studies which utilized proxy measures (motion sensors). In addition one longitudinal study was located.

According the YRBSS participation in physical activity among young people is not significantly increasing or decreasing. In 2007, 34.7% of those reporting met the recommended levels of physical activity. In other words, they reported they were physically active doing physical activity that increased their heart rate and made them breathe hard some of the time for a total of at least 60 minutes per day on 5 or more days during the 7 days prior to the survey (USDHHS, 2008c). Other variables related to physical activity included measures of physical education, computer use time, and television viewing time per day.

Accelerometry

Accelerometers are motion detectors used to track movement in three planes. Accelerometers are often used in large epidemiological studies of children's activity (Trost, McIver, & Pate, 2005), although they may be more costly than other tools (e.g., pedometers). In studies using accelerometers boys tend to be more active than girls and physical activity levels decrease with age. Further, younger children are more likely to participate in recommended amounts of physical activity than older children (Riddoch, et al., 2004).

Pedometry

Pedometers are motion detectors which track physical activity in two planes. Pedometers are commonly used in the study of young children and in physical education settings. Pedometers typically assess physical activity levels by counting steps and the accumulation of MVPA is assessed by factoring the number of steps taken per unit of time (Scruggs, 2003). For studies of physical education, pedometers may be viewed as more feasible since they cost less than other tools (e.g., accelerometers and heart rate monitors) and are simple to use and understand.

In studies utilizing pedometers, boys and girls who did not meet recommendations for physical activity are about two times more likely to be overweight/obese. Others cite there is a dose–response relationship between pedometer steps per day and adiposity" (Eisenmann, Laurson, Wickel, Gentile, & Walsh, 2007). While 10,000 steps-per day are recommended for adults, this number may be too low for children (Tudor-Locke & Bassett, 2004).

Direct Observation

Physical activity behavior is influenced by contextual and behavioral factors (McKenzie, et al., 1991). Direct observation is considered the criterion standard for measuring physical activity behavior because it allows the observer to simultaneously assess contextual and behavioral influences on physical activity (Sirard & Pate, 2001). Direct observation is often utilized to study student physical activity levels in physical education environments (McKenzie, et al., 1991). Lesson contexts and teacher behaviors are known to influence student

physical activity levels during physical education.

The System for Observing Fitness Instruction Time (SOFIT) is a valid and reliable direct observation instrument commonly used in the study of physical education. SOFIT has been validated in elementary school (Rowe, Schuldheisz, & van der Mars, 1997) and high schools (van der Mars, Rowe, Schuldheisz, & Fox, 2004) using heart rate monitors. The 5 level instrument was validated by comparing the results of observations with coinciding heart rates of 19 4-9 yr olds who wore HRM while they were actively engaged in activities. The average heart rates ranged from 99 lying down to 153 very active. In addition, energy expenditures have been calculated for children between each activity level (i.e., lying, sitting, standing, walking, vigorous). So, the categories can discriminate between heart rate and energy expenditure (e.g., a student lying down has a low heart rate and energy expenditure compared to a student who is walking).

SOFIT is widely known among researchers in physical education for its use in several large scale intervention studies conducted in the United States including SPARK (Sallis, et al., 1997), CATCH (McKenzie, et al., 1996), MSPAN (McKenzie, Sallis, Prochaska, Conway, & Rosengard, 2004), and TAAG (McKenzie, et al., 2004; Webber, et al., 2008) among others.However, very studies of HS PE exist (Chow, et al., 2009). Several studies found that student physical activity levels during physical education were far below the public health goal for increasing the number of students engaged in MVPA for ≥50% lesson length. SOFIT studies also found girls are significantly less active than boys during physical education lessons.

Studies utilizing SOFIT confirm there is a relationship between lesson contexts and student physical activity levels. The activity levels of students are typically higher in lessons with a fitness focus (McKenzie, et al., 1991). When the context is fitness the length of classes are shorter but the allocation of time to fitness is up to 4 times greater. Meanwhile, non-fitness classes allocate little time for fitness and spend more time in management, game-play, and skill practice (McKenzie, et al., 1991).

CHAPTER THREE

METHODS

Participation in physical activity declines as young people matriculate through school and coincides with dramatic increases in weight gain and the onset of chronic health conditions. As a result, K-12 school physical education is strongly recommended and is recognized as a public health tool. In fact, according to public health objectives physical education students should engage in moderate to vigorous physical activity for at least 50% of every lesson (USDHHS, 2000). Student physical activity levels are influenced by contextual and behavioral factors during physical education. Unfortunately, and as highlighted in Chapter 2, most of what is known about physical activity levels of high school students during physical education is derived from self-report surveys and indirect methods which are not sensitive to contextual and behavioral influences. Therefore, the focus of this study is on learning more about high school physical education (e.g., student activity levels, percentage of time devoted to various lesson contexts and teacher interactions).

This chapter provides an overview of the methodology that will be used to answer to following research questions:

1. How active were high school students observed in the sample of high school lessons?

2. What proportion of time was spent in the lesson contexts of "Management," "Knowledge," "Fitness activity," "Skill practice," "Game play" and "Other" in the sample of high school lessons?
3. How active were students in the sample of high school lessons, during respective lesson contexts (i.e., "management," "knowledge," "fitness activity," "skill practice," "game play" and "other")?
4. What is the frequency and nature (i.e., in and out of PE) of teacher physical activity promotion in the sample of high school lessons?
5. What proportion of lessons met public health guidelines (engaging students in MVPA for ≥ 50% of lesson length)?
6. What was the association between lesson context and student physical activity levels (i.e., sedentary vs. MVPA) in the sample of high school lessons?

In order to answer the research questions of this study existing SOFIT data from the Pittsburgh Obesity Prevention Initiative (POPI) will be analyzed. This chapter describes the setting, participation, and the data collection methods utilized in POPI to obtain the current study's data set. In addition, a description of the analyses for each of the current study's research questions is provided.

Setting and Schools

SOFIT data were collected in 7 Pittsburgh Public School high schools in spring 2005 and spring 2007 as part of POPI. The purpose of POPI was to create, implement, and evaluate the effects of a new high school physical education professional development and consultation intervention in an effort to

improve the overall quality of physical education programming offered. In POPI, three schools were randomly assigned to receive a SPARK professional development intervention. The four remaining schools served as control schools. POPI was a collaboration between Pittsburgh Public School District high school physical educators, district administrators and staff, SPARK program staff from San Diego State University (SDSU), the University of Pittsburgh School of Public Health, Slippery Rock University Physical Education Department, Highmark Blue Cross Blue Shield, the Grable Foundation, and Sportime.

Pittsburgh Public Schools is the largest of 43 school districts in Allegheny County and second largest in Pennsylvania. The District serves approximately 28,000 students in K-12 levels in 65 schools. The 7 participating high schools currently serve 4,308 students (49.5% male vs. 50.5% female) and the majority of students describe themselves as African American (58.3%) or White (36.2%) (http://www.pps.k12.pa.us/pps/site/default.asp, Accessed June 30, 2009).

The Pennsylvania State Department of Education establishes state standards for physical education and mandates that all districts provide planned instruction that provides every student with the opportunity to achieve the academic goals therein. However, local districts and schools determine how this is accomplished. According to Shirley Black, Health/Physical Education Advisor with the Pennsylvania Department of Education there is great variability between districts and schools in how this is accomplished. For example, some schools mandate students enroll in 4 years of physical education and others do not.

Data Collection

SOFIT

SOFIT is a direct observation instrument used to simultaneously assess objective data on student physical activity levels, lesson context, and teacher interactions (McKenzie, et al., 1991). SOFIT is widely recognized and is cited in numerous studies of elementary and middle school physical education (McKenzie et al., 1995, 1996, 2004, 2006; McKenzie, Marshall, Sallis, & Conway, 2000; NICHD, 2003; Sit, McManus, McKenzie, & Lian, 2007). SOFIT physical activity codes have been validated using heart rate monitoring (McKenzie, et al., 1991) and Caltrac accelerometers (McKenzie, Sallis, & Armstrong, 1994). Recently, SOFIT was validated for use with high school students (van der Mars, et al., 2004). SOFIT results may be influenced by many factors including instructional goals, instructional content, class characteristics, and environmental conditions (McKenzie, 2002a).

For POPI, SOFIT provided a direct measure of student activity levels (i.e., lying down, sitting, standing, walking, vigorous), lesson context (i.e., management, knowledge, fitness activity, skill practice, game play, other), and teacher interactions during physical education classes (i.e., teacher promotion of physical activity in and out of class)*:* Additionally, observers recorded the date, school, grade, teacher, teacher gender, lesson start and stop time, lesson duration, class size, number of girls and boys in the class, and lesson location.

Observer Training

SOFIT data were collected by trained data collectors, graduate students from

the University of Pittsburgh who were paid $10.00 per hour as an incentive to participate. Observers were trained prior to baseline in spring 2005 and again at follow-up in spring 2007. The training for POPI observers was conducted similarly other studies (e.g., SPARK, CATCH, and MSPAN). The training was held over a two day period and included classroom activities and field-based observations. On day one of the workshop trainees participated in classroom activities in order to become familiar with the operational definitions, discriminatory processes, instrument notation, and coding conventions of SOFIT. Trainees practiced by observing videotape samples and then were assessed according to pre-coded samples which were established as criterion observations. In this manner, the trainees were trained how to reliably discriminate and code observed physical activity levels, lesson contexts, and teacher interactions. On the second day of training observers actually practiced coding in the field in "real-time." The training continued for individual observers until they reached the standard 85% criterion for observer agreement.

Observation Schedule

Observations were conducted at baseline prior to the implementation of the staff development program (spring 2005) and at follow-up after all staff development sessions were delivered (spring 2007). The original arrangement called for a minimum of 5 full-day visits per school.

Reliability Measures

Interobserver Agreement. Two observers independently observed the same students while paced by a single tape recorder with a y-adapter for two

earphones to assess inter-observer reliability. After the data were collected the percentage of interval by interval agreements was calculated for each category (i.e., student activity level, lesson context, and teacher interaction) by dividing the number of agreements by the total number of intervals observed.

The interval by interval agreement between two observers was reported as 95.4% for student activity levels, 100% for lesson context, and 98.1% for teacher interactions. This is consistent with other SOFIT studies which reported reported inter-observer agreements averaging greater than .90 for each category (e.g., student activity levels, lesson contexts, and teacher interactions; McKenzie, et al., 1995, 1996, 2004; 2006; Sallis, et al., 1997).

Data Analysis

The statistical package SPSS version 16.0 was utilized to analyze the data. The significance level for all statistical procedures was set at $p < .05$. The data were screened according to the procedures outlined in the SPSS Survival Manual (2^{nd} edition; Pallant, 2005) for outliers, errors, and missing values. Inconsistencies and errors in the data file were corrected. The data were screened for normality on variables including lesson length, class size, student activity levels, lesson contexts, and teacher interactions.

Upon completion of screening the file, analyses were conducted to answer each of the major questions as follows:

RQ #1-4

Descriptive statistics were used to describe the overall results of the SOFIT

observations according to the schools, dates, teachers, lessons, student activity levels, lesson contexts, and teacher interactions at the interval level and lesson levels. First, the total number of intervals for respective student physical activity levels (i.e., lying, sitting, standing, walking, and vigorous), lesson contexts (i.e., management, knowledge, fitness activity, skill practice, game play, and other), and for teacher promotion of physical activity (i.e., during physical education, out of physical education, or no promotion of physical activity at all) were summed. Next, the total number of intervals for each student physical activity level, lesson context, and teacher interaction were translated to the proportion of time observed for each category. Next, profiles for each lesson context were created to show the corresponding student activity level summaries (i.e., lying, sitting, standing, walking, vigorous). In this manner the relationship between each lesson context and student physical activity levels was clear.

RQ #5

Next, the profile of student engagement in MVPA was created by coding a new dichotomous variable for MVPA for each interval. All intervals for student physical activity levels coded as 4 and 5 were re-coded as 1 for MVPA and all student physical activity levels coded as 1, 2, or 3 were coded 0 for sedentary. The total number of MVPA intervals was summed for each lesson and the proportion of each lesson observed in MVPA was calculated. Finally, a new dichotomous variable was coded for each lesson to identify the proportion of overall lessons which met or did not meet public health guidelines (>50% of lesson length in MVPA).

RQ#6

Logistic regression was used to answer RQ#6 (“What is the association between lesson contexts [Management; Knowledge; Fitness Activity; Skill Practice; Game Play; Other] and student physical activity levels [sedentary vs. MVPA]”?). In this manner lesson contexts which were most predictive of MVPA were identified. Student activity levels were re-coded into a single outcome variable (1 = for sedentary, 2 = MVPA) and lesson contexts were used as predictors. In this manner the degree to which each lesson context predicts student activity levels became apparent.

Human Subjects

Permission to examine existing data was sought from the University Institutional Review Board in order to conduct the study. Since the study utilized existing data there was no interaction with the schools or students who were involved. Therefore, the risks for participation in this study were minimal. All names were assigned a code which was utilized throughout the study. Any identifying information was stored separately in a secure file. Data was stored in a secure laboratory space in a locked file cabinet.

CHAPTER FOUR

RESULTS

The purpose of this study was to analyze existing data collected using direct observation in a high school setting in order to understand more about the quality and contribution of physical education to public health goals. Six research questions were examined in this study:

1. How active were high school students observed in the sample of high school lessons?
2. What proportion of time was spent in the lesson contexts of "management," "knowledge," "fitness activity," "skill practice," "game play" and "other" in the sample of high school lessons?
3. How active were students in the sample of high school lessons, during respective lesson contexts (i.e., "management," "knowledge," "fitness activity," "skill practice," "game play" and "other")?
4. What was the frequency and nature (i.e., in and out of PE) of teacher physical activity promotion in the sample of high school lessons?
5. What proportion of lessons met public health guidelines (engaging students in MVPA for ≥ 50% of lesson length)?
6. What was the association between lesson context and student physical

activity levels (i.e., sedentary vs. MVPA) in the sample of high school lessons?

The purpose of this chapter is to present the results of the study. The chapter is organized in four sections. In section one the number of days, lessons, teachers, class size, lesson length, and average intervals observed per school are described. In section two the proportion of student activity levels, lesson contexts, and teacher promotion of physical activity in the total intervals is explained. In section three the number of lessons which met public health guidelines is clarified (e.g., ≥ 50% of lesson engaged in MVPA). In section four the association between lesson context and student activity levels is presented. Appendix A includes frequency tables for major variables.

Descriptives

Descriptive statistics were calculated to better understand the distribution of intervals and environmental conditions (e.g., class size, lesson length). As outlined in Chapter 3, data were collected using the System for Observing Fitness Instruction Time (SOFIT). Four students were randomly selected prior to the start of the lesson. The student activity level, lesson context, and teacher promotion of physical activity behavior were simultaneously recorded every 20 seconds. For each SOFIT observation the date, school, teacher, lesson start time, lesson end time, number of boys and girls, and lesson location were also identified. The variables described in this section included the number of days, lessons, and teachers per school (see Table 1) and the average number of

students and minutes observed per lesson (see Table 2). The data yielded 13,632 intervals totaling 4,544 minutes or 76 hours of observation. On average 84 intervals were observed per lesson (SD = 9.4).

Table 1 summarizes the number of days, lessons, and teachers observed during spring 2005 and spring 2007. As Table 1 shows, on average, there were 6 days, 23 lessons, and 4 teachers observed per school. In total, 164 lessons and 39 teachers from 7 high schools were observed. Further, 53% of the observations were of male students (n=7,230). A majority of the lessons were taught by male teachers (63.4%) and were conducted indoors (95.2%).

Table 1.

Days, Lessons, and Teachers Observed per School

School	Days	Lessons	Teachers
1	5	20	6
2	2	12	5
3	7	30	5
4	9	31	6
5	6	30	6
6	9	27	8
7	5	14	3
Total	43	164	39
Mean	6.1	23.4	4.0[a]
SD	2.5	8.0	2.0

[a]*Excludes substitutes and combined classes*

Table 2 shows the average class size and lesson length observed per school including standard deviations and confidence intervals. As shown in Table 2, on average, 24 students (SD = 10.9) and 29 minutes (SD = 2.4) were observed per lesson. The average class size per school ranged from 13 (School 2) to 31 (School 5) and the overall standard deviation was greater than 10 students (SD = 10.9). Table 2 also shows the range of the mean lesson length observed was 16-40 minutes. On average the dosage of physical education received by students was 32% shorter than the scheduled lesson length (43 vs. 29 min.) and likely reported (e.g., SHPSS). Figure 1 highlights this finding was consistent in all seven school sites.

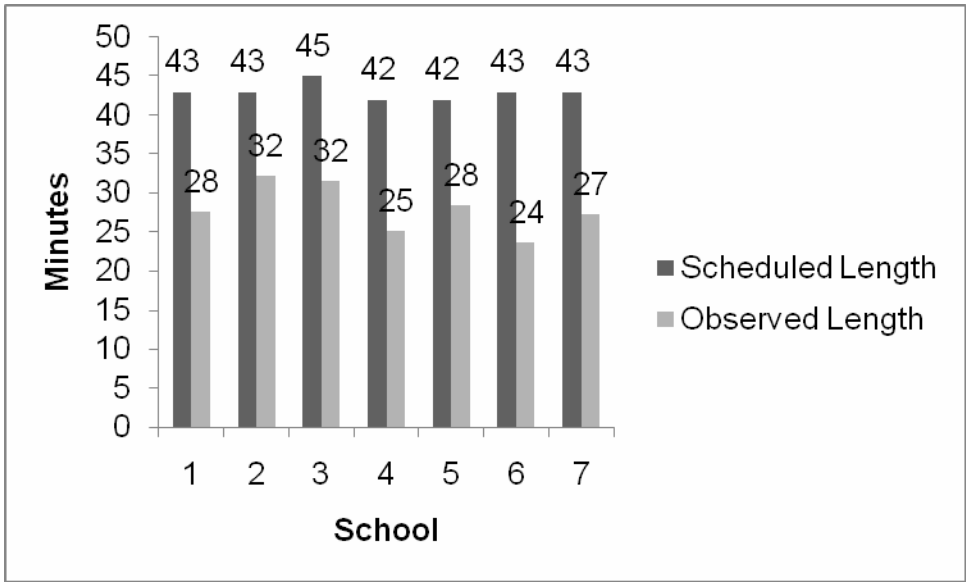
Table 2.

Class Size, Lesson Length, and Intervals Observed per School

School	Class Size		95% CI		Lesson Length		95% CI	
	Mean	SD	Lower	Upper	Mean	SD	Lower	Upper
1	24.6	7.8	20.9	28.3	31.0	3.6	29.3	32.7
2	12.8	4.4	10.0	15.5	31.9	3.6	29.6	34.2
3	25.0	10.6	21.0	28.9	30.8	5.2	28.9	32.7
4	20.5	6.6	18.1	22.9	26.9	3.6	25.6	28.2
5	31.0	13.8	25.9	36.2	29.5	4.8	27.7	31.3
6	23.1	10.4	19.6	32.9	25.5	3.8	23.3	27.7
7	20.9	10.3	15.0	26.9	28.0	5.1	25.0	31.0
Overall	23.6	10.9	22.2	25.7	29.1	4.7	28.3	29.9

The number of lessons and teachers observed in the seven schools was evidence of the balance and depth of the data set. However, more importantly, the description of class size and lesson length made apparent that student experiences in physical education were highly variable. Some classes were small but others were large. None of the physical education lessons observed lasted for the entire scheduled period. The results were important examples of environmental factors that negatively influenced the quality of physical education.

F*igure 1*. Average scheduled vs. average actual lesson length

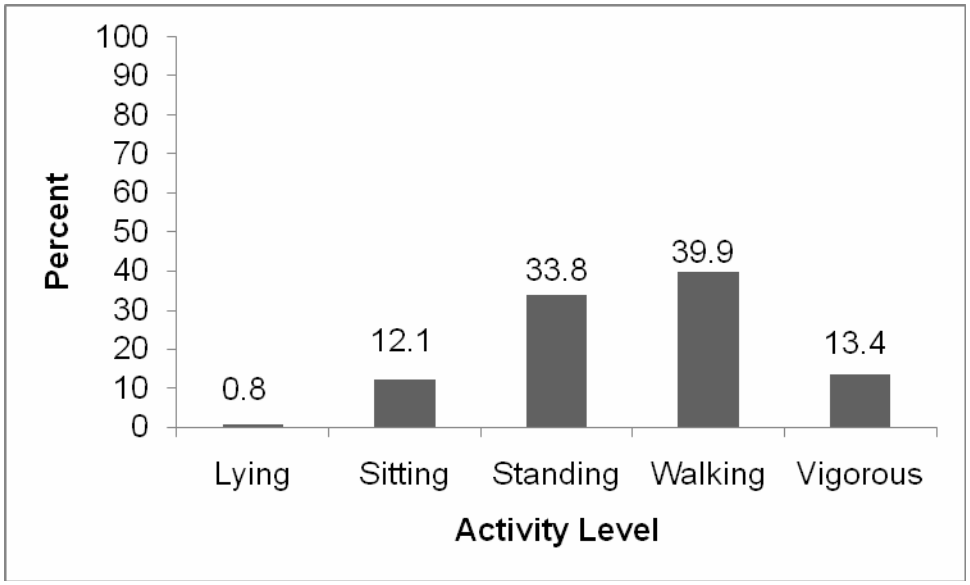


Student Activity Levels

Descriptive statistics were used to answer the question “How active were high school students in the sample of high school lessons?” Given that quality physical education is associated with the percentage of lesson time students are engaged in MVPA, the proportion of intervals students were sedentary,

moderate, and vigorous were calculated. Figure 2 summarizes the proportion of intervals for each category of physical activity behavior (i.e., lying, sitting, standing, walking, and vigorous) observed in the 13,632 intervals. Students spent the greatest proportion of time walking (40%) and standing (34%) and the smallest proportion of time vigorous (13%). Student engagement in MVPA (sum of walking and vigorous codes) was 53.3% of the time which translated to 2,422 minutes or 40.37 hours of walking or vigorous behavior.

Figure 2. Proportion of student activity levels observed



Lesson Contexts

Lesson contexts are the medium in which content are delivered and are associated with student physical activity levels. The description of lesson contexts was utilized to evaluate the quality of physical education. Descriptive statistics were used to determine “What was the proportion of time spent in each

lesson context (i.e., “management,” “knowledge,” “fitness activity,” “skill practice,” and “other”)” and “How active students were during each lesson context?”

Figure 3 shows the proportion of lesson contexts (i.e., “management,” “knowledge,” “fitness activity,” “skill practice,” “game play” and “other”) observed in 13,632 intervals. “Game play” was the dominant lesson context (49%) followed by “fitness activity” (20.8%).

Figure 3. Proportion of lesson contexts observed

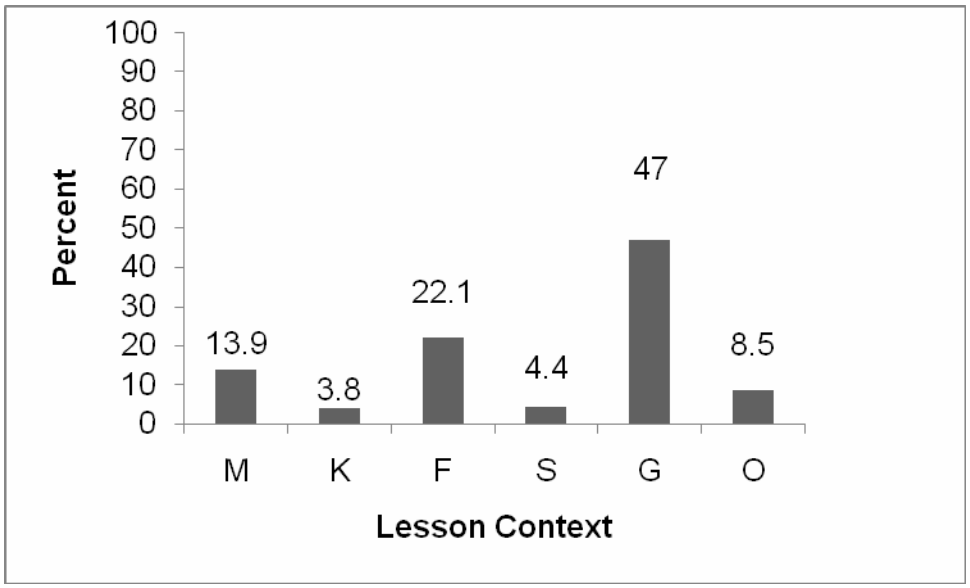


Figure 4 shows the proportion of sedentary and MVPA during each lesson context. “Game play,” fitness activity,” and “other” appeared to provide students with significant opportunities to engage in MVPA. During “game play” and “fitness activities” students engaged in MVPA 60.5% and 57.2% of the time respectively and during “other” students were engaged in MVPA almost half of the time (48.8%). Meanwhile, Figure 3 shows “management” and “knowledge” were

observed 13.7% and 3.6% of the intervals respectively; however, Figure 4 shows students were mostly sedentary (71% vs. 72.6%) during each.

Figure 4. Sedentary vs. MVPA behavior by lesson context

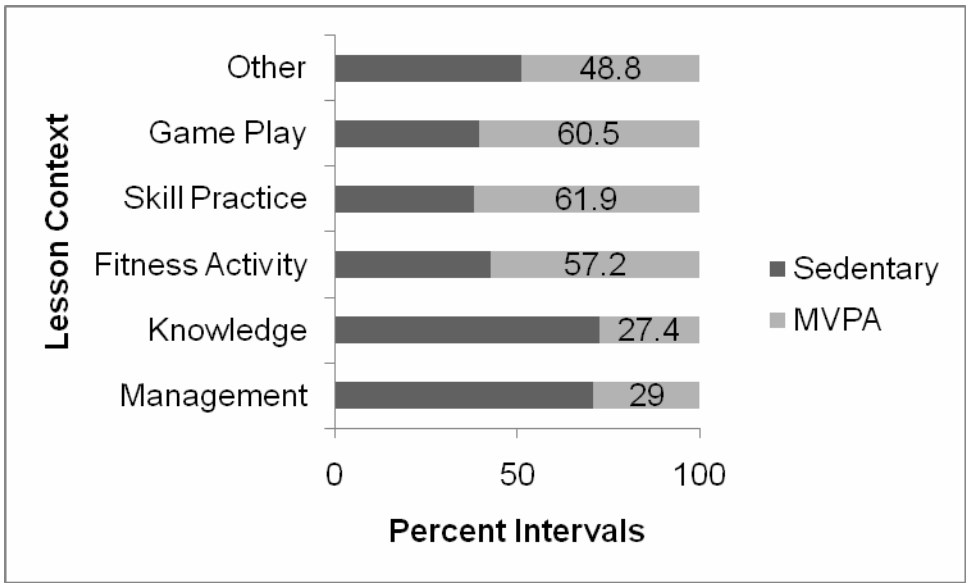
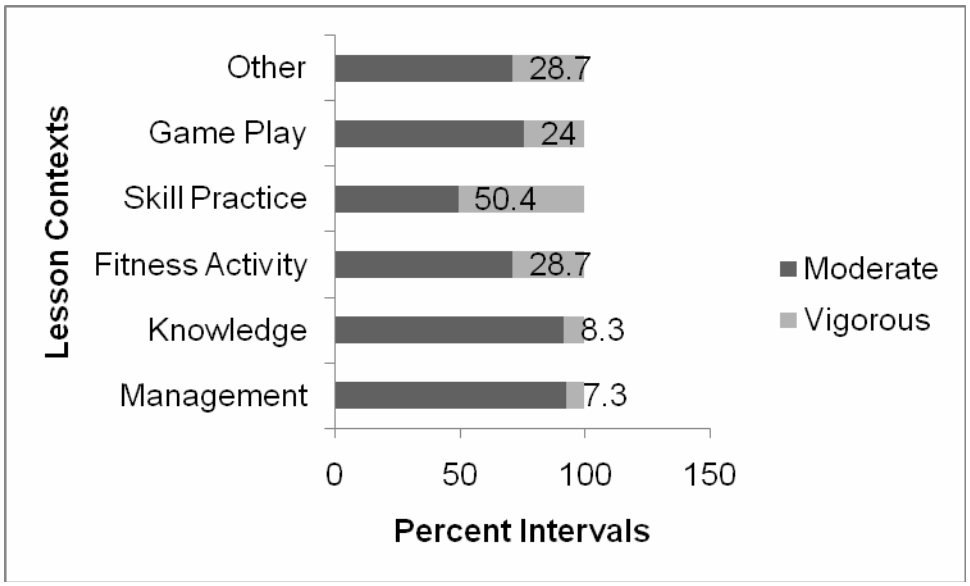


Figure 5 shows the proportion of moderate and vigorous physical activity during each lesson context. Interestingly, very little time was devoted to “skill practice” which was observed in only 4% of the total intervals (refer to Figure 3). However, as Figure 4 shows, when students were engaged in “skill practice” they were coded in MVPA 61.9% of the time. Figure 5 shows “skill practice” was the most significant source of vigorous physical activity. When students were engaged in MVPA during “skill practice” they were vigorous 50.4% of the time. Conversely, students were mostly walking around during “game play” and “fitness activity.”

Figure 5. Moderate vs. vigorous behavior by lesson context



Teacher Promotion of Physical Activity (RQ3)

Descriptive statistics were used to answer the question, “What is the frequency and nature (i.e., in and out of PE) of teacher physical activity promotion in the sample of high school lessons?” It is important to understand how often teachers promoted physical activity in order to understand the quality of physical education students experienced.

No promotion of physical activity was observed 73.3% of the time. This translated to 3,331 minutes or 55.5 hours students were exposed to physical education without experiencing reinforcement of physical activity in any way. Promotion of physical activity “during” physical education was observed in 26.4% of the intervals; however, teachers promoted physical activity behavior outside of class in only 3 intervals which translates to 1 minute or 1% of the time. In consideration of the entire study, there was very little promotion of physical

activity in or out of physical education.

Public Health Guidelines

To understand the contribution of physical education to public health goals, descriptive statistics were run to answer the question, “What proportion of lessons met public health guidelines (engaging students in MVPA for ≥ 50% of lesson length)?” Mean scores were calculated to determine the percent of MVPA provided in lessons that “Meet” and “Do not meet” public health guidelines to better understand the amount of MVPA students experienced in each group.

Figure 2 shows students were engaged in MVPA during 53% of the total intervals (n=13,632). However, only 71 of the 164 lessons (43%) met public health guidelines by engaging students in MVPA for greater than 50% of the observed lesson length. Students were engaged in MVPA 63% of the time when lessons met public health guidelines (SD = 9.2), well above the 50% goal. Greater than half the lessons did not meet public health guidelines (56%; n=93). Table 3 shows when lessons did not meet public health guidelines students were only engaged in MVPA for 35% of the lesson length (SD= 10.6). This finding is consistent with MVPA observed in other studies (Chow, et al, 2009) which found, on average, students were engaged in MVPA 36% of the time.

Lesson Context and Student Physical Activity Levels

Given the contextual relevance of what is taught in physical education and how students and teacher spend their time in relation to student PA levels,

logistic regression was conducted to answer the question, “What was the association between lesson context and student physical activity levels (i.e., sedentary vs. MVPA) in the sample of high school lessons?” In this manner odds of observing MVPA during each lesson context were calculated.

In total 13,601 intervals were entered into the analysis and 31 cases were excluded due to missing values. Initially, 53.4% of all cases were correctly classified as either “sedentary” or “MVPA” without the inclusion of the 6 predictors (i.e., “knowledge,” “management,” “fitness activity,” “skill practice,” “game play,” and “other”). Next, the model including the 6 predictors was tested and was significant X^2 = (5, n=13,601) = 768.870, p < .0005. The model correctly distinguished between student activity levels (e.g., sedentary vs. MVPA) in 60.9% of cases explaining between 5.5% and 7.3% of the variance in student activity levels. As shown in Table 4, five of the predictors made a unique statistically significant contribution to the model (i.e., “knowledge,” “management,” “fitness activity,” “skill practice,” “game play” and “other”). Controlling for all other factors in the model, the strongest predictor of MVPA was “skill practice” with an odds ratio of 1.7. This indicated that when students were engaged in “skill practice” they were 1.7 times as likely to be engaged in MVPA. The odds of MVPA occur ring were also increased during “game play” (1.6 times) and during “fitness activity” (1.4 times). Further, Table 4 also shows “knowledge” and “management” were negatively associated with student physical activity. The odds of being engaged in MVPA during “knowledge” and “management” were 1.07 and 1.18 times less respectively. The negative predictive power of the

model was greater than the positive predictive power. In other words, 65% of the time the model observed sedentary intervals when it predicted a sedentary interval would occur, while 60% of the time it observed MVPA when it predicted MVPA would occur.

Table 3.

Percent MVPA in lessons that "Met" and "Did not meet" public health guidelines

Group	n	MVPA %	SD	95% CI	
				Lower	Upper
"Met"	71	63.2	9.2	61.0	65.5
"Did not meet"	93	34.6	10.6	32.3	36.8

Table 4.

Association between Lesson Context and MVPA

Predictor	B	S.E.	Wald	df	Odds Ratio	CI (OR) 95%	
					(OR)	Lower	Upper
Management	-.845	.077	120.087	1	.430	.369	.500
Knowledge	-.931	.117	63.329	1	.394	.314	.496
Fitness Activity	.339	.069	24.146	1	1.404	1.226	1.608
Skill Practice	.535	.106	25.578	1	1.707	1.387	2.100
Game Play	.476	.063	57.263	1	1.610	1.423	1.821

CHAPTER FIVE

DISCUSSION

The purpose of this study was to analyze existing data collected using direct observation in a high school setting in order to understand more about the quality and contribution of physical education to public health goals. The purpose of this chapter is to discuss the results (refer back to Chapter 4) of the study. For organizational purposes, the chapter is organized by first discussing results which address the quality of physical education including, student physical activity levels, lesson context, and teacher promotion of PA. Next, a discussion of the study results relative to physical education's contribution to public health goals is provided. The chapter concludes with a summary of major conclusions.

Quality of Physical Education

Student Physical Activity Levels

One major finding from this study was related to the dosage of physical education and intensity of student physical activity. In terms of dosage, physical education classes were 35% shorter than the scheduled lesson time with the mean lesson time of 29.1 minutes (refer to Table 2). This finding lends further credence to recent claims that physical education is "the pill not taken" (McKenzie & Lounsbery, 2009) in that policy and environmental challenges

hinder physical education's potential to contribute to public health goals.

One plausible reason for the difference between the scheduled and actual length of lessons was the transition time spent in the locker room area before and after each lesson. Typically students spend the first and last segment of every class period in the locker room changing clothes and waiting to transition to the educational space where instruction occurs. The amount of time spent in the locker room is influenced by many factors including teacher expectations, fundraising, and unpredictable interruptions (e.g., medical excuses, non-dresses, locker issues). Transition time has been cited as a detriment to physical activity opportunity in previous studies of physical education. For example, one study of middle school physical education found transition time to change clothes and transport to and from instructional areas may have reduced student opportunities for participation in physical activities (McKenzie, Marshall, Sallis, & Conway, 2000).

Another important finding was related to the intensity of student physical activity. Physical education provided students with an excellent opportunity to participate in MVPA. Students were engaged in MVPA during 53% of the total intervals. However, due to shortened lesson lengths, students, on average only accumulated 15.7 minutes of MVPA per lesson.

Of the time students were engaged in MVPA (53%), student activity levels were not vigorous (i.e., more active than walking). Only 25.7% of the total MVPA intervals were coded vigorous. It is important for students to engage in vigorous physical activity during physical education because the length of lessons is far

below the daily recommendation for participation in physical activity. Vigorous physical activity is positively associated with energy expenditure and negatively associated with time. When physical activity is vigorous, less time is needed to experience health benefits. If students engage vigorously during physical education, their opportunities to meet physical activity guidelines and to receive the benefits of participation during class are more likely to be realized.

Lesson Contexts

Perhaps the most interesting finding related to lesson context was how little time was spent in “skill practice” and “knowledge” (see Figure 3). This finding was surprising as “skill practice” and “knowledge” comprised only 4% and 3.6% of the total intervals respectively. Clearly, this finding also suggests that not much time is devoted to delivering content-related instruction. Additionally, the fact that “skill practice” was not more prevalent is unfortunate because, in this study, it was most highly associated with participation in MVPA (refer to Table 4; Odds Ratio = 1.7) and vigorous physical activity (see Figure 5). The lack of time devoted to “skill practice” and “knowledge” is concerning considering quality physical education is characterized by opportunity to learn meaningful content that includes motor skills. Undoubtedly, both contexts are essential to the quality of physical education delivered. However, the results are not surprising and similar results have been cited before. At least one study cited lack of time spent in “skill practice” and “knowledge” contexts (McKenzie, Marshall, Sallis, & Conway, 2000).

“Game play” and “fitness activity” were the dominant lesson contexts.”

Students engaged in “game play” and “fitness activity” in 49% and 20.8% of all intervals respectively. The abundance of intervals coded as “game play” (almost 50%) with few coded as “skill practice” or “knowledge,” suggests that much of physical education comprises students being organized in game play with little to no content being provided.

On a positive note, “game play” was positively associated with MVPA (refer to Table 4; Odds Ratio = 1.6); however, when students were observed in MVPA during “game play” they were observed walking most of the time (see Figure 5). Only 24% of intervals during game play were vigorous. McKenzie (2002a) cited numerous factors that influence student activity levels during physical education (see Appendix B). It is plausible that the nature of the games, the size of the class, the ratio of equipment to students, and the expectations of the teacher influenced student activity levels during “game play.”

Similarly the odds of MVPA increased during “fitness activity” (refer to Table 4; Odds Ratio = 1.4); however, only 28.7% of the MVPA intervals were coded vigorous. It is interesting that students were not more active during “fitness activity.” One study reported “fitness activity” demanded the greatest energy expenditure (McKenzie, Marshall, Sallis, & Conway, 2000). The lack of vigorous behavior observed during “fitness activities” is concerning because it potentially indicates that students are not making a connection between participation in “fitness activity” during physical education and participation in physical activity at a health-enhancing intensity. Achieving a health-enhancing level of fitness is one of the NASPE standards (NASPE, 2005a). Ultimately, the results may be a

reflection of the task and/or the teacher. Perhaps students were allowed or encouraged to walk or were not accountable for participating vigorously at all (i.e.., effort was not assessed).

"Management" and "knowledge" contexts were negatively associated with physical activity levels (refer to Table 3; Odds Ratio .430; .394). During "management" and "knowledge" the odds of student engagement in MVPA decreased. It is likely that sedentary behavior was reinforced by the teacher during "knowledge" and "management." For example, it is possible that students were asked to sit down and listen to directions or watch a demonstration. The results indicate that high school physical education teachers may benefit from participation in professional development to learn strategies and skills to prompt and reinforce physical activity during all lesson contexts. Teachers who are trained to increase student physical activity levels during instruction might ask all students to stand up and shadow demonstrate. In this manner all students are more active during "knowledge" instead of sitting and watching.

Overall, it is highly likely the association between student activity levels and lesson contexts is related to teacher behaviors, attitudes, expectations, and methods. Perhaps the expectations for participation in MVPA were different during "skill practice" than in "fitness activity" and "game play." Teachers may have expressed greater expectations for students to engage in the activity during "skill practice" providing students with opportunities to work in smaller groups thereby increasing student opportunities to respond. When students were engaged in "game play" and "fitness activity" students may not have been

directed to engage vigorously in the activity, may have been placed in large groups with a high ratio of students to equipment, and fewer opportunities for students to respond, thereby increasing the odds for moderate and/or sedentary activity.

Teacher Promotion of Physical Activity

Overall, there was a total lack of promotion of physical activity in and out of physical education. In fact, during 73.3% of the intervals no promotion of physical activity occurred at all. Students were promoted to engage in class in 24.4% of the total intervals. Meanwhile, promotion of physical activity outside of class occurred in less than 1% of the total intervals. The finding is magnified by considering the lack of time devoted to “knowledge” or “skill practice” and the notion that students spent most of the time walking during “game play” and “fitness activities” (see Figure 3). The lack of teacher effort to insert “knowledge,” “skill practice,” or to promote physical activity in any way is astonishing and raises questions about what teachers were doing during lesson time if anything at all.

The lack of promotion of physical activity observed in high school physical education is an important finding. Participation in physical activity in and out of physical education is a primary objective for quality physical education programs and the profession according to NASPE. However, findings from this study suggest that either teacher training or teacher subject warrant to promote physical activity is lacking.

The lack of promotion of physical activity and apparent lack of time spent

teaching related content (e.g., health, fitness, skill) in physical education has also been documented (McKenzie, et al., 2006). There are several potential reasons for the lack of promotion of physical activity. First, as previously alluded to, teachers may have a different subjective warrant as it relates to instructional content and student outcomes. For example, they may not share the same values for the importance of promoting physical activity. This is often complicated by the fact that many high school physical education teachers suffer from role confusion since they coach and teach physical education. The perception among coaches may be that their coaching performance is on public display and teaching is not. They may not value their role as a physical education teacher enough to embrace the profession's important health-related mission. Further, it may not be required of them by their department chair or principal.

Second, teachers may lack the knowledge, skills, and disposition to understand the importance of promoting physical activity in and out of class. The teacher's knowledge and skills are a reflection of the teacher preparation program they completed. Like physical education curriculum, teacher preparation programs in physical education can be described as having a "muddled mission" (Pate & Hohn, 1994). There are many viewpoints about what the outcomes physical education should be and the types of curricula and activities that matter (e.g., sport model, teaching games for understanding, teaching personal and social responsibility, health-related fitness). Pre-service teachers are trained to possess knowledge, skills, and dispositions according to the values and mission of the program they attend. Unfortunately, not all programs have embraced the

public health mission of physical education. This is evidenced by the types of courses they offer and the knowledge, skills, and disposition of the teachers they produce.

Contribution to Public Health Goals

Overall, 56.7% of lessons did not meet public health guidelines. In addition, there was great variability in the volume of student physical activity in lessons that met and did not meet public health guidelines. On average, when lessons met public health guidelines, students were engaged in MVPA for 17.7 minutes but when lessons did not meet guidelines they only accrued 9.4 minutes of MVPA. In either case, the amount of MVPA accumulated was far short of the 60 minute per day recommendation (USDHHS, 2008b).

This finding is important because it appears that physical education is not reaching its potential as a public health tool. A majority of lessons did not meet public health guidelines and even when they did, the volume of physical activity was far below daily guidelines for young people (e.g., 60 minutes per day). The discrepancy in the dosage and the lack of accumulation of the recommended amounts of MVPA in physical education demonstrate the need for additional physical activity opportunities throughout the day. In addition, the findings are cause for major concern about how time is spent during physical education lessons and the important role teachers play in promoting physical activity (e.g., contextual and behavioral factors).

Conclusion

The results of this study were limited by factors related to the instructional goals, class characteristics, and environmental conditions (refer to Appendix B). One limitation related to instructional goals was apparent in the results. The lesson context finding that showed skill practice and its association with MVPA (see Figure 4) is interesting; however, this finding is tempered by the few skill practice intervals observed (n = 541; refer to Appendix A, Table A2). As a follow-up, it would be interesting to examine the relationship between student activity levels and the lesson context of skill practice in a more controlled study.

The results of this study add to the evidence that lesson length is an important variable of which should be a target of interest in future studies. The discrepancy between the scheduled and actual length of physical education lessons is consistent with findings from other studies of elementary (Chow, et al., 2008), middle (McKenzie, Marshall, Sallis, & Conway, 2000) and high school (Chow, et al., 2009) physical education. It is plausible that key stakeholders report the scheduled length of lessons when they complete questionnaires to describe the profile of physical education. The results of this study demonstrate that direct observation should be utilized more frequently in the description of physical education.

In conclusion, the quality and contribution of high school physical education to public health goals was lacking in this study and therefore, high school physical education did not realize its potential as a public health tool. This was apparent in the volume of student physical activity, the minimal amount of vigorous physical

activity during the most prevalent lesson contexts, lack of time devoted to “knowledge” and “skill practice” contexts, lack of promotion of physical activity, and the number of lessons that met public health guidelines. More research is needed in order for policy makers and key stakeholders to understand the impact of environmental and policy variables on the quality and contribution of physical education to public health goals. Future studies should target variables including class size, lesson length, instructional goals, and professional development.

APPENDICES

Appendix A

Table A1

Frequency and Time Engaged in each Physical Activity Level

Student Activity Level	Frequency	Percent	Minutes	Hours
Lying	106	8	19	.3
Sitting	1645	12.1	274.2	4.6
Standing	4599	33.8	766.5	12.8
Walking	5438	39.9	906.3	15.1
Vigorous	1828	13.4	304.7	5.1

Table A2

Frequency and Time Engaged in each Lesson Context

Lesson Context	Frequency	Proportion(%)	Minutes	Hours
Management	1861	13.7	310.2	5.2
Knowledge	488	3.6	81.3	1.4
Fitness Activity	2837	20.80	472.8	7.9
Skill Practice	541	4.0	90.2	1.5
Game Play	6678	49.0	1113	18.6
Other	1201	8.8	200.2	3.3
Missing	26	.01	4.3	.72

Table A3

Frequency and Time Spent Promoting Physical Activity

Teacher Interaction	Frequency	Proportion	Minutes	Hours
Promotion of PA in PE	3594	26.4	599	10.0
Promotion of PA out of PE	3	0	1	
NO Promotion of PA	9992	73.3	1665.3	28.5

Table A4

Profile of Physical Activity during Lesson Contexts

Context	Lying	Sitting	Standing	Walking	Vigorous
Management	53	658	608	501	39
Knowledge	3	174	177	122	11
Fitness Activity	35	504	674	1157	466
Skill Practice	1	62	143	166	169
Game Play	4	88	2543	3072	970
Other	10	152	453	418	168

Table A5

Proportion of Physical Activity Levels during Lesson Contexts (%)

Context	Lying	Sitting	Standing	Walking	Vigorous
Management	2.9	35.4	32.7	26.9	2.1
Knowledge	.6	35.7	36.3	25.1	2.3
Fitness Activity	1.2	17.8	23.8	40.8	16.4
Skill Practice	.2	11.5	26.4	30.7	31.2
Game Play	.1	1.3	38.1	46.0	14.5
Other	.8	12.7	37.7	34.8	14.0

Appendix B

Factors Influencing SOFIT Data

Adopted with permission from SOFIT Overview and Training Manual

(McKenzie, 2002)

Instructional goals[a]
-fitness, skill, knowledge, social/emotional development

Instructional content
-type of unit[b]
-lesson placement in unit[c]

Class characteristics
-size[d]
-diversity[e]

Environmental conditions
-size and location of instructional space[f]
-equipment and supplies[g]
-weather[h]

[a] PE has many different goals; a single lesson might target a specific outcome and exclude others; outcomes change as teachers move through instructional units.
[b] Activities (e.g., sports) promote different activity levels (e.g., soccer=high MVPA; softball, track and field which are often held in the spring=low MVPA).
[c] Initial weeks of a unit typically have higher instruction and management time; the last weeks have more game play.
[d] Larger classes are associated with less MVPA and more management time.
[e] Having more objectives in a lesson are associated with increased instruction and management (transitions) time and reduced MVPA.
[f] MVPA is reduced in smaller spaces, including indoor classes. Because of inclement weather, outdoor lessons may be cancelled OR taken indoors impacting the MVPA of students already in indoor spaces.
[g] More equipment and supplies are associated with increased student opportunities to respond and MVPA.
[h] Very hot, humid, and cold weather inhibits MVPA.

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