VALIDATION OF THE SIMPLE ACTIVITY MEASURE (SAM)

IN A COLLEGE PHYSICAL ACTIVITY CLASS

DISSERTATION

Presented to the Graduate Council of
Texas State University-San Marcos
in Partial Fulfillment
of the Requirements

for the Degree

Doctor of PHILOSOPHY

by

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San Marcos, Texas
May 2013

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ACKNOWLEDGEMENTS

I would never have been able to complete my dissertation without the guidance and support of my committee members and the encouragement from my family and friends.

I would like to express my deepest appreciation to my committee chair, Dr. Steven R. Furney, for his guidance, patience and support. Dr. Furney never lost faith in my ability to succeed. Additionally, Dr. Furney never seemed to tire of the providing me with the encouragement I needed. Thank you for the feedback provided to me during the research process.

I would also like to thank my committee members Dr. Tinker D. Murray, Dr. Robert F. Reardon, and Dr. James Eldridge for their encouragement and guidance. Dr. Murray provided me with constructive feedback throughout the writing process. Dr. Reardon and Dr. Eldridge provided me with invaluable statistical feedback.

To my colleagues Edgar Gonzalez, Vivian Lara, Jennifer Prye, and Andrina Moreno: The time and expertise that each of you shared with me will never be forgotten.

I would also like to thank my family and friends whose support and encouragement never faltered.

This manuscript was submitted on February 25, 2013.

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ABSTRACT

VALIDATION OF THE SIMPLE ACTIVITY MEASURE (SAM)

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Background: Community Colleges in Texas have experienced budget cuts. Additionally, the Texas Higher Education Coordinating Board recently voted to eliminate physical activity classes as part of the core curriculum in Texas effective the Fall semester of 2014. Further, many counties in South Texas are classified among the fattest in the nation. Affordable and accurate accountability measures of moderate to vigorous physical activity (MVPA) in physical education (PE) at all levels can assist the physical educator in positively impacting the health, well-being and disease risk among community college students in Texas. Particularly, these measures at the Community College level are important to have if the Texas Higher Education Coordinating Board actions are reversed in the future.

Subjects and methods: The participants (n=246) in this study included students enrolled in physical activity classes in south Texas community colleges. The SAM activity levels were compared with heart rates (HR) and an additional tSAM Stat

Worksheets (Form 2010 EZ) were modified and edited by the researcher based upon a previous investigation and engineered for observers.

Results: The results suggest that SAM is a cost effective alternative for the measurement of MVPA in the physical education classroom. The results also suggest that the instructional intervention tool increases accuracy in the assessment of MVPA.The findings support SAM as a valid and cost effective method to assess MVPA in PE. Specifically, the SAM intensity average was 3.89 ± .976 and average heart rate was (HR) 116.43±17.81 with a significant correlation at 0.01 level (r=.236).

CHAPTER 1

INTRODUCTION TO THE STUDY

A sedentary lifestyle among individuals and within communities has been linked to risk factors associated with chronic disease; specifically obesity, overweight, and high body mass index (BMI). Obesity is an important health indicator because of its positive relationship to many other diseases such as diabetes, hypertension, high blood cholesterol, and cancer (Largo-Wright, Todorovich, & O'Hara, 2008, p. 31). Despite the importance of physical activity (PA) for health and obesity prevention, less than one-third of approximately 32 million adults in the United States engage in regular physical activity (Largo-Wright et al., 2008, p. 33). Although there is vast evidence indicating that regular physical activity will provide health gains high levels of physical inactivity and obesity are prevalent at the national, state, and local levels.

Higher education in Texas has historically included and supported physical activity classes as a part of the core curriculum (Texas Higher Education Coordinating Board, 2011). The inclusion of these activity classes as a part of the core curriculum has provided an opportunity for students to gain college credit as well as contribute to significant minutes engaged in regular physical activity. It has been reported that young adults engage in less physical activity with age (U.S. Department of Health and Human Services [HHS], 2010); therefore, increased opportunities for physical activity in higher education could play an important preventative role in disease risk management and prevention.

Recently, community colleges across Texas have experienced extensive budget cuts. Additionally, the Texas Higher Education Coordinating Board recently voted to eliminate physical activity classes as part of the core curriculum effective the fall semester of 2014 (Texas Higher Education Coordinating Board, 2011). A valid and cost effective method to accurately assess moderate to vigorous physical activity (MVPA) in physical education (PE) could assist the physical educator in positively impacting the health, well-being, and disease risk among students. Affordable and accurate accountability measures of MVPA in PE at all levels and especially at the Community College level are important to have if the Texas Higher Education Coordinating Board actions are reversed in the future.

An accurate measurement of MVPA in the PE classroom has typically required the purchase and use of equipment like accelerometers, pedometers, and/or heart rate monitors. A previous study reported that the use of the Simple Activity Measurement (SAM) may provide an economical and effective accountability tool to measure MVPA in school based PE classes (Surapiboonchai, Furney, Reardon, Eldridge, & Murray, 2012). Preliminary findings supported the use of SAM as a cost effective alternative to other measurement technologies (Surapiboonchai, 2010).

The Importance of the Study

This study will assess the validity and reliability of the SAM, a tool designed to provide a simple and cost saving method to assess student MVPA in college physical education. The potential benefits of observing the MVPA levels of college students in PE classes include improved health, well-being and reduced risk of disease including obesity. The physical educator who is able to accurately assess activity levels within the classroom may have a clearer depiction of actual activity levels versus perceived activity levels. Additionally, the SAM could act as an accountability measure for external evaluators or administrators. Such information within the classroom could also assist the physical educator in both classroom management and modification to ensure the students within the class meet the minimal American College of Sports Medicine (ACSM) recommended guidelines for MVPA (HHS, 2010, p. 8-9). Consequently, the physical educator could have a greater impact on the health, well-being, disease risk, and overall quality of life of the students.

Current activity guidelines for Americans recommend that “adults participate in at least 150 minutes (2 hours and 30 minutes) a week of moderate-intensity, or 75 minutes (1 hour and 15 minutes) a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity” (HHS, 2010, p. 6). The accurate assessment of activity levels in the physical education classroom, followed by improved classroom management which focuses on maximizing time for MVPA may positively contribute to students accumulating more minutes of weekly MVPA while improving their odds of meeting current activity guidelines.

Research Problem

An accurate measurement of MVPA in the classroom typically requires the purchase and use of equipment. While there are effective, valid, and reliable observation tools for assessing MVPA levels; this equipment is labor intensive and require at least a half day of teacher in-service training (McKenzie, 2010, p. 114). There is a lack of valid and low cost observational methods available that assists the physical educator in the assessment of MVPA. The SAM is a cost effective observational tool to assist the physical educator in the assessment of MVPA. Preliminary studies indicate that the SAM is a valid and reliable instrument to measure MVPA (Surapiboonchai, 2010). Additionally, these findings have supported the use of SAM as a cost effective alternative to other measurement technologies. Further studies are required to determine further the validity and reliability of SAM as compared to other more costly methods of assessing MVPA, particularly in the college PE setting.

Definition of Terms

Absolute Intensity – absolute intensity of an activity is determined by the rate of work being performed and does not take into account the physiologic capacity of the individual (U.S. Department of Health & Human Services [HHS], 2008, p. 52).

Accelerometer – pager sized device to measure total ambulatory activity levels including activity intensity (Crouter, Churilla, & Bassett, 2006, p. 1).

Baseline Activity – light-intensity activities of daily life such as walking, standing, and lifting groceries (U.S. Department of Health & Human Services [HHS], 2008, p. 2).

Body Mass Index (BMI) – indicator of body composition by assessing weight relative to height and calculated as body weight in kilograms (kg) divided by height in meters squared (m^2) ($kg \cdot m^{-2}$). A BMI of 25 to 29.9 is considered overweight and a BMI of ≥30 for obesity. BMI does not distinguish between body fat, muscle mass, or bone (ACSM, 2010, p. 63).

Chronic Diseases – illnesses that persist over time, are generally not cured by medication, nor resolve spontaneously, and are rarely cured completely; leading causes of death and disability in the United States; encompass a wide range of situations including arthritis, diabetes, and cancer (Bushman, 2011, p. 15, 183).

Exercise – a type of physical activity that is planned, structured, repetitive in nature and includes a goal for the improvement of one or more components of physical fitness (ACSM, 2010, p. 2).

Health **–** the absence of any disease or impairment; a state that allows the individual to adequately cope with all demands of daily life; a state of balance, an equilibrium that an individual has established within himself and his social and physical environment (Sartorius, 2006, p. 662).

Health-Enhancing Physical Activity – activity, when added to baseline activity, produces health benefits (HHS, 2008, p. 2).

Heart Rate Monitor (HRM) – a device that helps determine how hard someone is working by measuring the number of heart beats per minute (BPM) (Bushman, 2011, p. 25).

Intensity – refers to how much work is being performed or the magnitude of the effort required to perform an activity or exercise. Intensity can be expressed in absolute or relative terms (HHS, 2008, p. 52).

Light Physical Activity (LPA) – light-intensity physical activity, or low-intensity physical activity, is between 1.1. MET to 2.9 METs (HHS, 2008, p. 55).

Metabolic Equivalents (METs) **–** an assessment method of exercise or physical activity intensity. One MET is the amount of energy expended sitting quietly at rest adjusted to body weight (OneMET = 3.5 ml oxygen consumed/kg of body weight/minute). Also equal to onekcal/kg/hour. Physical activity intensity is often expressed in MET units. For example, walking at a 14 minute pace per mile is expressed at an intensity of six METs or six times the energy sitting quietly at rest (ACSM, 2010, p. 2-3).

Moderate Physical Activity (MPA) – moderately-intense physical activity is between 3.0 and 5.9 METS (HHS, 2008, p. 55) or 40 to 60 percent of maximal capacity. Moderate activity can be comfortably sustained up to 60 minutes if there is a gradual progression and the activity is generally noncompetitive. Subjectively, moderate-intense exercise causes little or no discomfort, little increase in breathing, and should be well within a person's capability (ACSM, 2010, p. 4, 156).

Moderate to Vigorous Physical Activity (MVPA) **–** activity above 3 METs; exercise physiologists consider accelerometer counts of >3000 per minute and heart rate responses of ≥ 130 beats per minute (ACSM, 2010, p. 4).

Morbidity – any departure, subjective or objective, from a state of physical or psychological well-being, short of death (National Institutes of Health [NIH], 2000, p. viii)

Obesity – characterized by excess body weight that comes from adipose (fat) tissue with a BMI of 30 or higher (ACSM, 2010).

Overweight – characterized by excess body weight that may come from muscles, bone, adipose tissue, and water with a BMI of 25 to 29.9 (ACSM, 2010).

Pedometer – a battery-powered, pager-sized device worn on your belt that records and displays the number of steps you take based on your body's movement (Choi, Pakk, Choi, & Choi, 2007, p. E108).

Physical Activity (PA) – bodily movement that enhances health and which is produced by skeletal muscle contraction resulting in a substantial increase in energy expenditure (ACSM, 2010, p. 2). Physical activity has both an occupational and leisure basis that can include activepursuits like golf, tennis, and swimming. It can also include other activities like gardening, cutting wood, and carpentry. Physical activity can provide progressive health benefits and be a catalyst for improving health attitudes, health habits, and lifestyle (U.S. Department of Health & Human Services [HHS], 2008).

Physical Education Activities – include both instruction and participation in physical and recreational activity as opposed to theory or classroom courses (Texas Higher Education Coordinating Board, Spring 2012, p. 132).

Physical Fitness – attributes relating to the performance of physical activity (ACSM, 2010, p. 2); the ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with enough energy to enjoy leisure activities and meet unforeseen emergencies (Bushman, 2011).

Rating of Perceived Exertion (RPE) – numerical value used by exercise and clinical practitioners to describe the range of indicators that make up an individual's perception of physical exertion during aerobic or resistance exercise (Robertson, 2004, p. 4).

Relative Intensity – relative intensity activity takes into account or adjusts for a person's exercise capacity (HHS, 2008, p. 52).

Simple Activity Measure (SAM) – an observational tool for assessing moderate to vigorous physical activity, which modifies the System for Observing Fitness Instruction Time (SOFIT) (Surapiboonchai, 2010).

Vigorous Physical Activity (VPA) **–** activity that requires an energy output in excess of 6 MET units (HHS, 2008, p. 55). The ACSM classifies vigorous exercise at intensity greater than 60 percent of aerobic capacity. Exercise at this level can feel somewhat heavy to very heavy and often result in increased breathing and sweating. Vigorous nonstop exercise resulting in fatigue within 20 minutes requires a considerable challenge to the cardiorespiratory system (ACSM, 2010, p. 5).

Purpose of the Study

The purpose of this study is to validate and measure the reliability of the SAM instrument for the assessment of MVPA in college physical activity classes. Specifically, this study will seek to affirm previous validity and reliability results from study populations from grades 3-12 in public school when applied to community college students performing physical activity in PE classes.

Research Question

The primary research question for this study: Is SAM a valid and reliable instrument when used in college physical activity classes?

The secondary research question for this study: Is there a correlation between the SAM observational tool and the Suunto HRM system?

Theoretical Framework

This study was designed as a replication study (Surapiboonchai, 2010) to test the validity and reliability of the SAM instrument to measure MVPA in college physical activity classes.

Delimitations

A number of research studies have shown a link between PA and health. There were a number of interesting research questions that could have been asked in this study but were not pursued, for example, "Can college physical activity classes provide the recommended physical activity requirements?" This and other questions were not pursued in this particular study because the focus of the inquiry was testing the validity and reliability of the SAM to measure MVPA. The inclusion of other questions, while interesting, would have been beyond the scope of this research.

Assumption

This study was based on the assumption that the SAM tool is a valuable assessment instrument for assessing MVPA because of its effectiveness and low cost for schools.

CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

Research supports the idea that increased knowledge of fitness concepts will result in increased activity (Casebolt, 2009). Physical activity classes in higher education can provide a venue for students to increase activity and meet the recommended physical activity guidelines. Essentially, health benefits could be gained by increasing opportunities for physical activity in physical education settings. However, there is insufficient evidence thus far that university course interventions will result in increased MVPA for students (Sallis et al., 1999).

Physical Activity

Physical activityis bodily movement produced by skeletal muscle contraction resulting in a substantial increase in energy expenditure (ACSM, 2010, p. 2). Physical activity has both an occupational and leisure basis that includes active recreational pursuits including golf, tennis, and swimming. Physical activity can provide progressive health benefits and be a catalyst for improving health attitudes, health habits, and lifestyle. Bodily movement can be divided into either baseline activity or health enhancing physical activity (HHS, 2008, p. 2).

Light physical activity includes light-intensity activities between 1.1 MET and 2.9 METs.

Moderate physical activity (MPA) ismoderately-intense physical activity between 40 to 59 percent of maximum capacity or 64 to 76 percent of maximal heart rate (ACSM, 2010, p. 2, 5). The ACSM also defines moderate intensity activity as activities that are three to six METs or walking at three to four miles per hour. Subjectively, moderate-intense exercise causes minimal or no discomfort, with minor increases in breathing, and should be well within a person's capability. Moderate physical activity can also be defined as being performed for 30 minutes on most days of the week (Magoc, Tomaka, & Thompson, 2010, p. 428) and can be performed in a variety of ways with the necessary amount depending on the time, frequency, and intensity with which the activity is performed.

Vigorous physical activity (VPA) requires an energy output in excess of 6 MET units. The ACSM classifies vigorous exercise at intensity levels of 60 to 84 percent of heart rate reserve or 77 to 93 percent of maximal heart rate. Subjectively, exercise at this level can feel somewhat heavy to very heavy and often result in increased breathing and sweating.

Individuals who engage in only baseline activity are considered to be inactive; essentially, the very short episodes of moderate or vigorous intensity activity they engage in are not considered long enough to count toward meeting the guidelines (HHS, 2008, p. 2). Health enhancing physical activity is activity that, when added to baseline activity, produces health benefits (HHS, 2008) and can include activities such as brisk walking, lifting weights, and yoga.

Benefits of Physical Activity

In many studies covering a number of diverse issues, researchers focused on exercise and physical activity; more specifically, the studies focused on the role that physical activity played on many health outcomes including mortality, morbidity, and disease, risk factors for disease, functional capacity, mental health, and injuries (HHS, 2008, p. 7-8).Increased levels of physical activity often lead to improved physical fitness which is generally associated with improvement of good health, disease prevention, and longevity of life (Casebolt, 2009, p. 28).

A sedentary lifestyle, or physical inactivity has been linked to risk factors associated with chronic disease; specifically obesity, overweight, and high body mass index (BMI). Physical inactivity is considered a health concern and long-term insufficient PA is a prevalent and preventable risk factor for chronic disease and death (Zanovec, Lakkakula, Johnson, &Turri, 2009, p. 181). Alack of PA has been identified by the Centers for Disease Control and Prevention as a modifiable health risk behavior known to cause chronic disease. Chronic diseases are those diseases which have been identified as the leading causes of death and disability in the U.S. with seven out of ten deaths among Americans each year resulting from chronic diseases including heart disease, cancer and stroke (HHS, 2010).

Physical inactivity is an established risk factor for the development and maintenance of obesity (Stamatakis, Hirani, &Rennie, 2009, p. 765). Obesity is a major health problem in the United States with approximately 30.4% of adults (≥ 20 years) classified as obese and 16% of children (6-19 years) as overweight (Baskin, Franklin, & Allison, 2005, p. 5). Adult obesity is associated with excess mortality and a number of health problems and overweight children are at an increased risk of becoming overweight adults (Baskin et al., 2005, p. 5).The risk and years of life lost associated with obesity have been shown to be greater in younger adults than older adults (Eisenmann, Bartee, &Damori, 2004, p. 210).

Obesity is an important health indicator because of its relationship to many other diseases such as diabetes, hypertension, high blood cholesterol, and cancer (Largo-Wright, Todorovich, & O'Hara, 2008, p. 31). More specifically, the problems of overweight or obesity substantially increase the risk of morbidity from hypertension, high blood cholesterol, type two diabetes, coronary artery disease, stroke, gallbladder disease, osteoarthritis, sleep apnea and respiratory problems, as well as cancers of the endometrium, breast, prostate, and colon (HHS, 2010). In essence, overweight and obesity has been shown to be associated with decreased health and well-being.

Physical activities along with diet are just some behavior modifications directly affecting health and treatment for overweight and obese populations (HHS, 2010). Studies demonstrate that participation in regular physical activity results in many health benefits but despite the established importance of physical activity for health and disease prevention, less than one-third of approximately 32 million adults in the United States engage in regular physical activity (Largo-Wright et al., 2008, p. 33). Greater amounts of physical activity can result in additional health benefits and those individuals maintaining a regular physical activity program could derive greater benefits.

Physical Activity for Americans

Engaging in physical activity is one of the most important steps that Americans can take to improve their health (HHS, 2008, p. 1). Furthermore, the improvement of health can be an achievable goal for American youth, adults, seniors, and individuals with special conditions. A clear understanding of the link between physical activity and health could serve as a catalyst for individuals, groups and communities to commit to and regularly engage in healthy physical activity.

By the 1970s enough scientific evidence supported the link between vigorous activity and cardiorespiratory fitness (HHS, 2010, p. 10). Despite this evidence the prevalence of obesity in America increased sharply after the 1970s – from 13.4% in 1980 to 34.3% in 2008 among adults (HHS, 2010, p. 2). As understanding of the link between physical activity and fitness grew, recommendations for Americans and physical activity followed. However, levels of physical inactivity have continued to increase steadily.

A broad range of evidence has shown that many adults in the United States fall short of meeting the minimal recommendations for physical activity. Data from 2005 indicated that less than half (49.1%) of US adults meet the CDC/ACSM recommendations for physical activity. The Centers for Disease Control and Prevention reported in 2007 that approximately 50% of all individuals aged between 12 and 21 do not engage in vigorous exercise regularly, and that daily attendance in school physical education programs declined from 42% in 1991 to less than 33% in 2005. Less than 25% of these individuals were not active at all. Additionally, the United States Department of Health and Human Services has reported that in 2009, less than 20% of adolescents participated in physical activity for at least 60 minutes daily. Moreover, the prevalence of obesity has tripled in adolescents in the last three decades. This increased prevalence of obesity coincides with the steepest decline of physical activity in individuals between the ages of 13 and 18 (Zanovec, Lakkakula, Johnson, &Turri, 2009, p. 176-177).

The *Healthy People* 2000 goals for the nation's health recognized the importance of physical activity and included physical activity goals. *Healthy People* 2010 reported that in the U.S. in 2000 approximately 400,000 or 17% of annual deaths were related to poor diet and physical inactivity. Additionally, the report stated that three of the top preventable causes of death relate to a lack of physical activity. The same report cites that 11% of children and adolescents ages 6-19 years were overweight and obese. *Healthy People* 2020 includes in its mission the engagement of multiple sectors to take action and strengthen policies and improve practices driven by evidence and knowledge. Further, the overarching goals include the attainment of high-quality, longer lives and the improvement of health of all groups (United States Department of Health and Human Services [HHS], 2011).

Importance of Physical Activity in Higher Education

The college years are influential in shaping adult behaviors, particularly in regard to diet, physical activity, and other lifestyle habits (Desai, Miller, Staples, &Bravender, 2008, p. 109) and the college population is at risk for developing obesity linked to physical inactivity. Public health officials have identified college-age individuals as a neglected but important population for initiatives addressing lifestyle changes to decrease health risks (Zanovec, Lakkakula, Johnson, &Turri, 2009, p. 181).It is important to help university students adopt a healthy lifestyle consisting of adequate PA and a healthy diet due to the following three reasons: 1) university students may play a critical role in developing social and cultural norms, 2) many university students decrease their PA levels, and 3) young adulthood PA and diet habits have valuable carry over effects (Deng, Castelli, & Castro-Pinero, 2011, p. 20).

The number of obese and overweight college students has risen in recent years making them at risk of developing a range of diseases and adverse health conditions. In addition, because obesity is not easily reversible, those who are obese or develop obesity as young adults are at an increased risk of obesity through adulthood (Desai et al., 2008, p. 109).

Many young adults on college campuses are not meeting the current physical activity recommendations (Casebolt, 2009, p. 28). A substantial number of these young adults leading sedentary livesare at an increased risk for factors which negatively impact health. Research has supported the notion that an increase in knowledge related to health related fitness concepts such as fitness assessment, goal setting, and application of FITT (frequency, intensity, time and type) principle will result in increased activity. Students enrolled in physical activity credit on community college campuses are more likely to meet the minimal recommendations for physical activity.

A university study at a Southern State University investigated student PA and BMI in relation to the *Healthy Campus* 2010 objectives set by the American College Health Association in 2002. The percentages of students (N=1125) who were physically active and whose BMI were categorized as overweight and obese were compared with the goals of *Healthy Campus* 2010. The study revealed that 33.9% of students participated in MPA and 28.9% participated in VPA (Deng, Castelli, & Castro-Pinero, 2011, p. 20) and that 28.8% of female and 39.4 % of male students were classified as overweight and obese.

A study conducted by Dinger and Behrens (2006) revealed that 62% of the study participants ranging in age from 18-24 did not participate in regular leisure time physical activity and that 42% of undergraduates do not engage in enough physical activity to receive health benefits. Increasing the prevalence of physical activity credit in higher education will enable students to more successfully meet recommended activity guidelines. Consequently, studies of physical activity levels in college students indicate that the minimum goal of 30 minutes of PA on most days is not achieved by most college students.

Project GRAD evaluated a university course to promote physical activity. The course was designed as an intervention to promote adopting and maintaining physical activity among adults in transition from university to adult roles. Students were encouraged to plan for structured, moderate activity; to increase and maintain their lifestyle activity; and to incorporate muscle strengthening and flexibility exercises in their routine. The study revealed a lack of evidence which suggests that more study is needed (Sallis et al., 1999).

Another study conducted at Cornell University revealed that persons are becoming more overweight and the higher an individual’s BMI the lower the activity level; consequently, a higher likelihood of both weight gain and increased BMI (Kasparek et al., 2008, p. 443).

Body fat mass and visceral fat area was highly associated with BMI in college students, suggesting that BMI serves as a good surrogate marker for obesity in college students ages 18-24 (Hung, 2011).

In summary, many college students are overweight and obese and fail to meet the minimum dietary and PA guidelines which place them at significant risk for a number of lifestyle related chronic diseases (Huang et al., 2003, p. 84).The school setting can provide a structured atmosphere to incorporate physical activity while promoting healthy lifestyle choices. Physical activity classes in higher education can also provide a venue for students to increase activity and meet the recommended physical activity guidelines. Essentially, health benefits could be gained by increasing opportunities for physical activity in physical education settings. Further, college administrators who are proactive about educating students on healthy behaviors could play a vital role in the physical activity levels and health of the student population.

Physical Activity Guidelines

Physical activity guidelines provide science-based guiding principles to aid individuals in the improvement of health through safe and appropriate physical activity. Physical activity guidelines can alsoprovide information and guidance which could promote good health and reduce disease. Further, these guidelines provide parameters that, when followed, can ensure that individuals engage in activity that result in maximal health benefits and the least amount of risk for accident or injury.

Physical fitness levels and total amount of physical activity affect risk of musculoskeletal injuries. Individuals who are physically fit have a reduced risk of injury when compared with unfit individuals (HHS, 2008, p. 35). Incorporating strategies which follow physical activity guidelines can assist individuals in being both active and safe while reducing overall injury risk.

General activity guidelines include a) being regularly physically active to increase physical fitness, b) understanding the risks of physical activity, c) selecting types of physical activity that are appropriate for current fitness levels and health goals, d) increasing physical activity systematically and progressively when necessary to meet guidelines and goals, e) wearing appropriate gear and sports equipment, and f) follow the advice and care of a health-care provider when applicable (HHS, 2008, p. 36). The American College of Sports Medicine describes activity as being dose dependent, where some activity is better than no activity, and more activity is better than some activity (ACSM, 2010).

Specific activity guidelines for Americans recommend that "adults participate in at least 150 minutes (2 hours and 30 minutes) a week of moderate-intensity, or 75 minutes (1 hour and 15 minutes) a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity" (U.S. Department of Health & Human Services [HHS], 2008; American College of Sports Medicine [ACSM], 2010).

Common Measures and Estimates of MVPA

Accurate and objective methods to measure levels of physical activity are important in defining appropriate dose-response relationships between physical activity and health (Spierer, Hagins, Rundle, & Pappas, 2011, p. 659). Additionally, accurate and reliable assessment of physical activity is necessary for any research study where physical activity is either an outcome measure or an intervention. Further, there is no perfect measurement tool and it is; therefore, important to understand strengths and limitations of each measurement.

Accelerometers

An accelerometer is a silent device that measures vertical acceleration and can be used to assess total ambulatory activity levels including activity intensity (Crouter et al., 2006, p. 5). Accelerometers are typically small, wrist size devices that measure body acceleration and provide data on intensity, frequency and total volume of physical activity (Spierer et al., 2011, p. 660). Recent technological advances which include validated algorithms to calculate activity levels and intensity have enabled researchers to objectively assess ambulatory physical activity using accelerometers, thus avoiding many potential sources of errors associated with questionnaires (Dinger & Behrens, 2006, p. 774) or other similar measures such as pedometers. Accelerometer mechanisms generally last longer than pedometer mechanisms and are typically more accurate than pedometers due to less dependence on placement and position for feedback. A limitation of accelerometers is the inability to measure energy expenditure not associated with acceleration (Spierer et al., 2011, p. 660).

Heart Rate Monitor (HRM)

Heart rate monitors (HRMs) are devices that help determine how hard someone is working by measuring the number of heart beats per minute (BPM). Heart rate monitors allow for constant real-time feedback of an individual's heart rate(Bushman, 2011) and can take out much of the guesswork when trying to calculate exercise intensity. Most traditional wireless heart rate monitors include both a chest strap which acts as a transmitter, and a watch which acts as a receiver. More recent technological advances in heart rate monitoring include the use of a wristwatch without the chest strap but studies are on-going to compare the accuracy between the two types of monitors which may also be influenced by the type of activity performed.

Heart rate monitoring could play a vital role in the evaluation of exercise intensity during physical activity.

Pedometers

A pedometer is an instrument which responds to vertical acceleration by recording the distance an individual covers on foot by responding to the motion of the body with each step taken. Pedometers make a noise which sounds like a "click-click" when the suspended lever arm moves up and down in response to the foot strikes of the individual wearing the pedometer.   Pedometers tend to provide limited information consisting mostly of steps (Choi et al., 2007) due to the response to vertical motion only instead of motion and intensity.

A pedometer's accuracy is often dependent on exact placement and position on the individual wearing it. The placement can be difficult to both place and stay in place on an overweight or obese individual. Additionally, the lever arm of the pedometer can drop down and close the circuit which results in a step being counted when one has not been taken. These "false" step counts could result in an inaccurate assessment of an individual's activity levels.

Intensity Perceptional/Rating Scales of MVPA

The perception of perceived exertion (RPE) involves the feelings of effort, strain, discomfort, and fatigue that a person experiences during exercise (Robertson, 2004, p. 5). Several scales for quantifying physical exertion have been developed and validated. Essentially, RPE provides similar information about exercise performance that most physiological responses do. Research continues to use the ratings of perceived exertion as a measurement of physiological responses to physical activity and exercise.

Borg Scale

The Borg Scale of perceived exertion is the first scale to measure perceived exertion (Robertson, 2004, p. 2). The scale assigns a number to specific exercise intensities and was developed in the early 1960's by psychologist Gunnar Borg at the University of Stockholm (Robertson, 2004). The Borg scale is a category scale recommended for virtually all types of exercise. Borg scales are effective tools for monitoring, prescribing, and regulating exercise intensity in adults with normal cognitive ability (Faulkner &Eston, 2008, p. 12).

Figure 1 describes the Borg RPE Scale:

Figure 1

Borg RPE Scale

Borg's RPE Scale	
6	No exertion at all
7	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard (Heavy)
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

Borg RPE scale
© Gunnar Borg, 1970, 1985, 1994, 1998

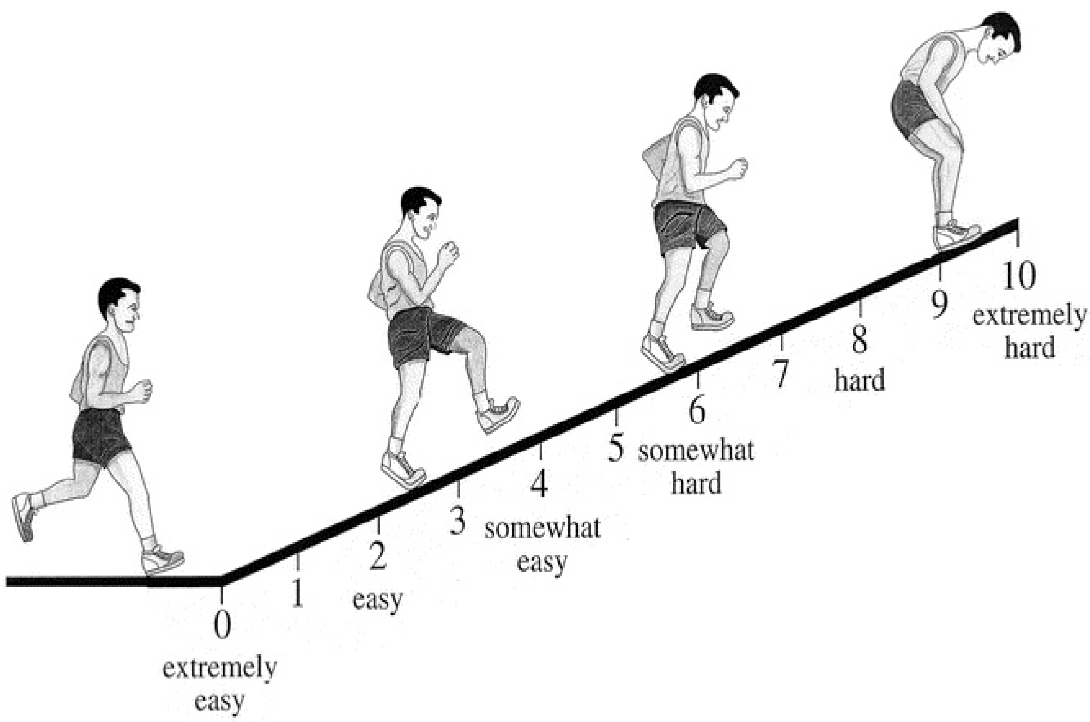
<u>OMNI Scale</u>

The OMNI picture system of perceived exertion was originally constructed for both children and adolescents. This picture system was later followed by the development of an adult version. The developmental sequence of the OMNI is based on the expectation that individuals will participate in physical activity throughout the lifespan (Robertson, 2004); consequently, adults would continue to use the scale to assist them in selecting and regulating physical activity.

Figure 2 describes the OMNI Scale

Figure 2

OMNI Scale



Observational Instruments

SOFIT

SOFIT (McKenzie, 2009, McKenzie, 2010) was developed as a tool for assessing fitness instruction time. SOFIT is a direct observation system that has been used since its development in 1989. This assessment tool provides simultaneous data collection on student activity levels, lesson context, and teacher behavior. The system enables researchers, teachers, and supervisors to make judgments about physical education lessons as they relate to goals. The main outcome variable is the student physical activity levels which can be reported in number of minutes and percentage of lesson time spent in MVPA, VPA, lying down, sitting, standing, and walking, and estimated energy expenditure per lesson.

Interventions

Interventions to physical activity which include the importance of knowledge about the importance of physical activity, or physical activity awareness as well as realistic goal-setting on physical activity levels and health could lead to increased success.

Healthy People

The *Healthy People* project is a set of national health objectives that have driven and helped get funded the interventions which assist in the achievements of these national objectives. The project is in its fourth decade and provides a set of 10-year objectives whose overarching goal is to improve the health of all populations in the United States.

Healthy People 2020

Healthy People202 is a national approach which includes overarching goals providing structure and guidance for achieving the *Healthy People 2020* objectives. The vision, mission and goals are general in nature but offer specific areas of emphasis where action should be taken in order for the US to achieve better health by the year 2020. The framework for *Healthy People 2020* is a result of a collaborative process between a number of federal agencies, public stakeholders, and the advisory committee.

The *Healthy People 2020* vision is a society in which people achieve longevity and health. The mission includes a) identification of nationwide health improvement priorities, b) an increase in public awareness and understanding of the determinants of health, disease, and disability and the opportunities for progress, c) providing measurable objectives and goals that are applicable at the national state and local levels, d) engaging multiple sectors to take action and strengthen policies and improve practices driven by the best available evidence and knowledge, and e) identification of critical research, evaluation, and data collection needs. Overarching goals include a) the attainment of high-quality, longer lives free of preventable disease, disability, injury andpremature death, b) achievement of health equity, elimination of disparities, and the improvement of the health of all groups, c) the creation of social and physical environments that promote good health for all, and d) the promotion of quality of life, healthy development, and healthy behaviors throughout the lifespan (HHS, 2011).

Healthy Campus

Healthy Campus was developed as a companion to Healthy People and establishes national college health objectives and serves as a foundation for improving student health (Deng et al., 2011). The overarching goal is to increase the quality, availability, and effectiveness of educational-based programs designed to prevent disease and injury, improve health, and enhance quality of life. Educational programs should encourage and enhance health and wellness by educating on topics including chronic diseases, injury and violence prevention, mental illness and behavioral health, unintended pregnancy, oral health, tobacco use, substance abuse, and nutrition and obesity prevention (HHS, 2011).

FIC Program

The purpose of the *Fit into College (FIC) Program* was to determine if an interdisciplinary, theoretically based 10-week program could impact physical activity, physical fitness, body weight, dietary intake, and perceptions of exercise and dietary intake among freshman college students at a Mid-western university. Outcomes were measured at baseline, and after the 10-week program. Participants demonstrated gains in their physical fitness and perceived benefits to engaging in exercise and decreased their perceived barriers to engaging in exercise and healthy diet.

Findings indicated that students are entering the university in poor physical condition consistent with the growing problem of obesity observed across the population. Additionally, the findings provide rationale for developing similar programs to address the problem of obesity of students (Topp et al., 2011).

TIGER Study

The Training Interventions and Genetics of Exercise Response (TIGER) Study was an exercise program designed to introduce sedentary college students to regular physical activity under the supervision of trained instructors within a college course setting and, to determine genetic factors influencing responses to exercise. A total of 1,567 participants (39% male), age 18 to 35 years old participated in a 30-week exercise intervention program. Subjects were instructed to exercise between 65% and 85% of their maximum heart rate reserve for 30 minutes three days per week. The structure of a formal class appeared to be a motivating factor in maintaining adherence to study protocol. Additionally, subjects acquired the ability to achieve exercise intensities without the constant feedback of a heart rate monitor (Sailors et al., 2010).

Project GRAD

A San Diego State University's intervention identified as *Project GRAD* (Graduate Ready for Activity Daily) included 338 senior US college students who were allocated randomly to a behavior change intervention, or a general health, knowledge-oriented group. The behavioral intervention was delivered by physical education staff through a 15-week course of lectured and laboratory sessions. Students were encouraged to plan for structured, moderate activity; to increase and maintain their lifestyle activity; and to incorporate muscle strengthening and flexibility exercises in their routine (Sallis et al., 1999).

The intervention results indicated no immediate effects on physical activity patterns of men, and a modest effect among women. Behaviorally-oriented telephone and mail follow-up for 18 months after the course completion also had little impact on PA outcomes at two-year follow-up for men or women. *Project GRAD* conclusions suggested that additional research using larger random samples over long periods of time is needed to determine optimal interventions for PA (Sallis et al., 1999).

Project TEAM

Project TEAM (Teaching Exercise/Activity Maintenance) was a study involving 550 students attending a large Midwestern US university. The campus-based physical activity intervention incorporated skills training and self-monitoring strategies, the intervention aimed to increase total physical activity and cardiovascular fitness, and to enhance the maintenance of post-intervention levels of PA over time. The target group consisted of students enrolled in aerobic dance, jogging, and weight training physical activity conditioning classes. The course included a 50-minute lecture once a week and 45 minute activity labs three times per week. *Project TEAM* conclusions suggested that patterns for participation and key variables are important areas for future research (Ferrara, 2009).

Research suggests that college is an important time for physical activity training and intervention. While not all studies found have had effective intervention results, the notion that increased knowledge of health-related fitness concepts, goal setting and application of exercise principles are common factors for physical activity participation success.

CHAPTER 3

METHODS

Introduction

Traditional measurement tools of moderate to vigorous physical activity (MVPA) are labor intensive in the physical education classroom and typically require the purchase and use of expensive equipment. The SAM was developed as a time efficient and cost effective alternative to other methods for observing, measuring and evaluating PA levels among school based physical education (PE) students. A previous study suggested that the use of the Simple Activity Measurement (SAM) can provide an economical and effective tool to measure MVPA in school based physical education classes (Surapiboonchai, 2012). Preliminary findings have supported the use of SAM as a cost effective alternative to other measurement technologies (Surapiboonchai, 2010).

This study was conducted to validate and measure the reliability of the SAM instrument for assessing MVPA in physical activity classes. Specifically, this study sought to affirm previous validity and reliability results when applied to community college students performing physical activity in PE classes during bouts of MVPA.

Study Design

This test compared data collected from the SAM with data collected concurrently by the Suunto HRM system. The SAM results were grouped into categorical variables of low, moderate and vigorous intensities then compared to low, moderate, moderate to vigorous or vigorous physical activity as determined by the average heart rate for that same period.

A chi-square goodness of fit test for validity was then used. Specifically, a Receiver Operating Curve (ROC) to determine sensitivity and specificity of the SAM for predicting the actual heart rate defined level of physical activity was then created and analyzed.

Participants

Participants used for this study were students attending community college in south Texas. Students enrolled in a variety of physical activity classes were recruited for the study. The student age ranges were from 18-59 years old. Consents were not required for the students to participate in data collection or evaluation activities since classroom activities are required as part of the regular scheduled participation. All students participated in the activities as it was already planned and a part of the general curriculum. Students were observed as a group participating in the assessment. Students were chosen randomly to participate of their free will in the HRM data collection. Those students that chose to participate in the HRM data collection were free to drop from participation at any time. The schools were chosen using a convenience sampling method.

Data Collection

Instrumentation

The SAM observation instrument was used with the Suunto HRM system to assist in the process. Students wore HRMs while participating in PE activities concurrently while the Suunto system recorded their HRs. Age ranges of each observed group were also obtained.

Means for Obtaining the Data (Procedures)

Collaborative Institutional Training Initiative (CITI) certification was obtained after completing the training and examination. Institutional Review Board (IRB) approval was obtained from Texas State University–San Marcos. IRB approval was also obtained from the institutions providing the participants being observed. The SAM observational instrument was used to observe MVPA as a standard collection procedure in college physical activity classes in South Texas. Permission was obtained through the respective kinesiology department chairpersons and individual instructor. Before any of the data were obtained, the individual institutions were provided with a notice of approval from the Texas State University-San Marcos IRB. All observations were conducted by the researcher.

Research Methodology

The SAM observation instrument was used with the Suunto HRM system to assist in the process at the conveniently selected colleges. Students wore HRMs and participated in PE activities concurrently while the system recorded their Hrs. TheSAM Class Observation Form (Form 2010 EZ) can be found in Appendix A andwas used in the PE classes as follows:

1. At the onset of class, indicated by the institutionally designated start time, a line was drawn at the zero and the word “Start” written in the comment section of Form 2010 EZ.
2. A line was drawn for each transition and comments were written in the section space created when the transition line was drawn.
3. In each section an “A” for Activity or “I” for Instruction was written. Additionally, an activity level number based on the observation using the SAM MVPA Scale as a reference was assigned and written within the section.
4. After the observation was complete, a line was drawn and the information was transferred to the SAMOAI Stat Worksheet (SAM Form 2009 EZ).

The SAMOAI Stat worksheet was used as follows:

1. The top portion of the Stat Worksheet will be filled in prior to the observation. The information included the date, school, district, time observed, teacher, unit observed, and total minutes of the class.
2. *Observational Demographics*. Once all students were gathered in the exercise area a head count was taken and entered into the “Observation Demographics”. Demographics also included the number of males observed and females. The boxes that applied to College and Adults were checked.
3. *MVPA Minutes*. In this section, the observer added the number of minutes for each level from the observation worksheet and entered the

minutes in the right column. Each section was assigned a subjective number using the SAM scale. Levels 1-3 minutes were counted and entered in box one on the Stat worksheet; levels 4-6 minutes were counted and entered in box two on the Stat Worksheet; and levels 7-10 minutes were counted and entered in box three of the Stat Worksheet. In box four; boxes one, two, and three were added to give the total minutes observed. The answer in box four should match up the "Total Minutes of Class" box filled out prior to the class period. Box 5A is the total minutes of MVPA and was completed by adding boxes two and three. The percent of MVPA time was calculated in box 5B by dividing 5A by line four and then multiplied by 100.

4. *Instruction and Activity Minutes*. The number of minutes from the observation worksheet for teacher instructional time was calculated and then entered in the right column in box six and the same for the activity time in box seven. Instruction was indicatedon the observation worksheet as "I" and activity as "A".
5. *Transitions*. In this section, the number of transitions from the observation worksheet for instruction (box eight) and activity (box nine) was entered. Boxes eight and ninewereadded to give the total number of transitions (box 10).
6. *Minute Tracker*. In this section, each box represents oneminute. A MVPA level from the observation worksheet, moving from left to right, were then inserted. There are 20 boxes in the first row

representing the first 20 minutes of class observed. The second row represents 21-40 minutes of the class period and the third row 41-60 minutes and so on. Once the minute tracker boxes section was complete, boxes 11-22 were completed afterwards. For this section, in column "C", the number of minutes for each level from the MINUTE TRACKER (for example, count the number of boxes tagged with the number three and enter that number in line 14 in the "C" section) were inserted. Then, a quick glance was performed to make sure all the boxes were accounted for. Then column "A" was multiplied by "C" for each line. Boxes 11-21 were added and the total entered in box 22.

7. *MVPA Level for the Classroom*. In box 23, the number from box 22 was entered. In box 24, the number from box four was entered. By dividing box 23 by box 24, this gave the MVPA level average for the class period entered in box 25.
8. *Fifty Percent of Recommended National Standard*. This section determined if the HEALTHY People 2010 PE class PA standards were met. The national recommendation is 50% MVPA time during PE ("Physical activity and fitness," 2009a). In box 26 the total minutes of class time was entered (from box four) and multiplied by .50 and entered in box 28. For box 29, the number of boxes will be counted that were level four and above in the Minute Tracker. If the number was $\geq$ box 28, then the National Standard was met. This number will also match box 5A.

9. *Estimated Heart Rate Zone*. A check will be entered in the appropriate column for the estimated average heart rate of the class period. For moderate-intensity physical activity, a person's target HR should be 50 to 70% of his or her maximum HR. This maximum rate is based on the person's age. An estimate of a person's maximum age-related heart rate can be obtained by subtracting the person's age from 220. For example, for a 50-year-old person, the estimated maximum age-related HR would be calculated as 220 - 50 years =170 bpm -. The 50% and 70% levels would be:

   50% level: 170 x 0.50 = 85 bpm, and

   70% level: 170 x 0.70 =119 bpm

   Thus, moderate-intensity PA for a 50-year-old person would require that the HR remain between 85 and 119 bpm during PA. For vigorous-intensity physical activity, a person’s target HR is 70 to 85% of his or her maximum HR. To calculate this range, the same formula was followed as used above, except "50 and 70%" was changed to "70 and85%". For example, for a 35-year-old person, the estimated maximum age-related HR is calculated as 220 - 35 years = 185 bpm. The 70% and 85% levels would be:

   70% level: 185 x 0.70 = 130 bpm, and

   85% level: 185 x 0.85 = 157 bpm

   Thus, vigorous-intensity physical activity for a 35-year-old person would require that the HR remains between 130 and 157 bpm during

PA ("Target heart rate andestimated maximum heart rate," 2009b). For i, ii, iii, and iv entries, the following formulas were given:

<u>MODERATE HR ZONE</u>

220 - AGE = bpm X .50 = i

220 - AGE = bpm X .70 = ii

<u>VIGOROUS HR ZONE</u>

220 - AGE = bpm X .70 = iii

220 - AGE = bpm X .85 = iv

Box 30, 31, and 32 require only one check mark in the appropriate box. Referring back to box 25, check the box that corresponds with box 25. This gave the HR zone for the class period.

10. *Curriculum Component*. This section only requiredone mark in box 33, either yes or no to determine if any instant activity was performed during the class period. For this purpose, instant activity will be defined as activity that is performed by the student immediately upon entering the exercise area with little or no instruction from the teacher.

During the same classroom period and day the SAM observation was conducted, HR monitoring was done using the Suunto HRM system. Data from both the SAM and Suunto were analyzed to see if any correlation existed.

1. *Before Training*. The evening before the first session with the Suunto Team Pod, preparation was done. A test on the system was conducted

by placing a heart rate transmitter belt on and watching the monitor for a HR. When satisfied that everything was working correctly, the Netbook was turned off and the Suunto Team Pod was then disconnected and stored away for the next day. The heart rate transmitter belts and sticks were then taken out and labeled with an identification number.

2. *Testing Day*. This researcher arrived early for setup at the school between 15-30 minutes prior to class. Setup included positioning the Suunto Team Pod correctly, so that it covered the whole activity area. The Suunto Team Pod was then connected to the Netbook computer. The Suunto Monitor was then opened. When the students arrived a group were randomly selected and handed their HRM transmitter belts and told how to put them on properly. The Belts window of Suunto Monitor showed the identification numbers of all the heart rate transmitter belts that Suunto Team Pod was receiving a signal from. When the boxes were checked, a popup appeared in the drop down menu with all the student identification numbers also displayed.
3. *During-Class*. The heart rate data of all the monitored students appeared on the screen either as beats per minute or as a percentage of their maximum heart rate. The colors represented the students' heart rate in relation to the target heart rate zone. Red meant the monitored student's heart rate was above the target zone, green within the zone, and blue below the zone. The target zone was set to match the purpose

of the session. Using the colors, observations of each student could be seen if they are training too hard - or not hard enough. At the start of the recorded session, “Record Session” button was clicked and the Suunto Monitor started recording the data received from each belt. During the session, "View Session Graph" button could be clicked to see a graphical representation of the students' real-time heart rates. At the end of the recorded training session, the “Stop Session” button will be clicked to end the session. A pop-up appeared and the name of the session with the date and activity was then inserted. "Save" was then selected and the Suunto Monitor program closed. The Suunto Team Pod was then unplugged.

4. *After-Training*. Once back at home, the Suunto Team Monitor was opened and the name of the session chosen. A graphic appeared showing the HR average of the recorded session. The graph was printed. The data wereanalyzed.

Testing for Validity

The determination for validity, the SAM categories of intensity and individual HRs were compared using achi-square goodness of fit test. A Receiver Operating Curve (ROC) to determine sensitivity and specificity of the SAM for predicting the actual heart rate defined level of physical activity was then created and analyzed.

Specific Treatment of the Data for the Problem

Is SAM a valid and reliable instrument when used in college physical activity classes? Is there a correlation between the SAM observational tool and the Suunto HRM system?

Using the Suunto HRM data, physical activity was compared with the SAM observational instrument using a Pearson Correlation.

Qualifications of the Researcher

I have an educational background which includes a B.S. in Physical Education and a M.Ed. with an emphasis in Physical Education. My teaching interests and focus includes First Aid, Cardio Pulmonary Resuscitation and Emergency Response, Concepts of Fitness and Wellness, Health Behaviors and Quality of Life, Pedagogy, and on-line learning.

Professionally, my experience began in February of 1996 teaching high school physical education. Additional experience was gained by teaching group exercise classes to both college students and various adult populations. Group exercise classes taught included aerobics, cardio-kickboxing, conditioning and more. A personal trainer certification was earned in June of 1997 from the Cooper Institute. A client base with a focus on individuals with chronic diseases has been maintained since that time. Specifically, exercise management and program design experience has included individuals diagnosed with diabetes, obesity, cancer, osteoporosis, and hypothyroidism.

In August of 1997, I began a professional career as an educator within the realm of higher education. Since then, I have gained the experience of teaching for a variety of institutions of higher learning in south Texas. Effective the fall semester of 2009, my professional experience expanded to include that of Department Chairperson of Kinesiology & Health. Duties were split between Department Chairperson (60%) and Assistant Professor (40%) for three years. At the end of the three year term, the fall semester of 2012, I returned to the full-time faculty status of Assistant Professor.

For this research, my perspective was objective. I presented the findings based on the quantitative data generated from using the SAM observational instrument and Suunto HRMs. My role for this dissertation research study was that of researcher, data collector, interpreter, and learner.

Study Supplements

An additional two SAM Stat Worksheets (Form 2010 EZ) was modified and designed by the researcher based on a previous study and engineered for the observer.

1. *Stat Worksheet Modification.* Modification included changes relevant to institutions of higher learning. (Appendix B)
2. *Stat Worksheet Modification.* Modification two included changes relevant to corporations and businesses offering group exercise classes. (Appendix C)

An additional two forms (How to use the S.A.M. Scale & S.A.M.O.A.I SAM Form 2009 LF) forms were modified and designed by the researcher and engineered for the observer. The two modified forms included changes relevant to both institutions of higher learning and corporations or business offering group exercise classes. Further, the modified SAM Forms 2009 LF provided detailed, step-by-step instructions on how to use the SAM to assess MVPA in both institutions of higher learning and group exercise settings.

CHAPTER 4

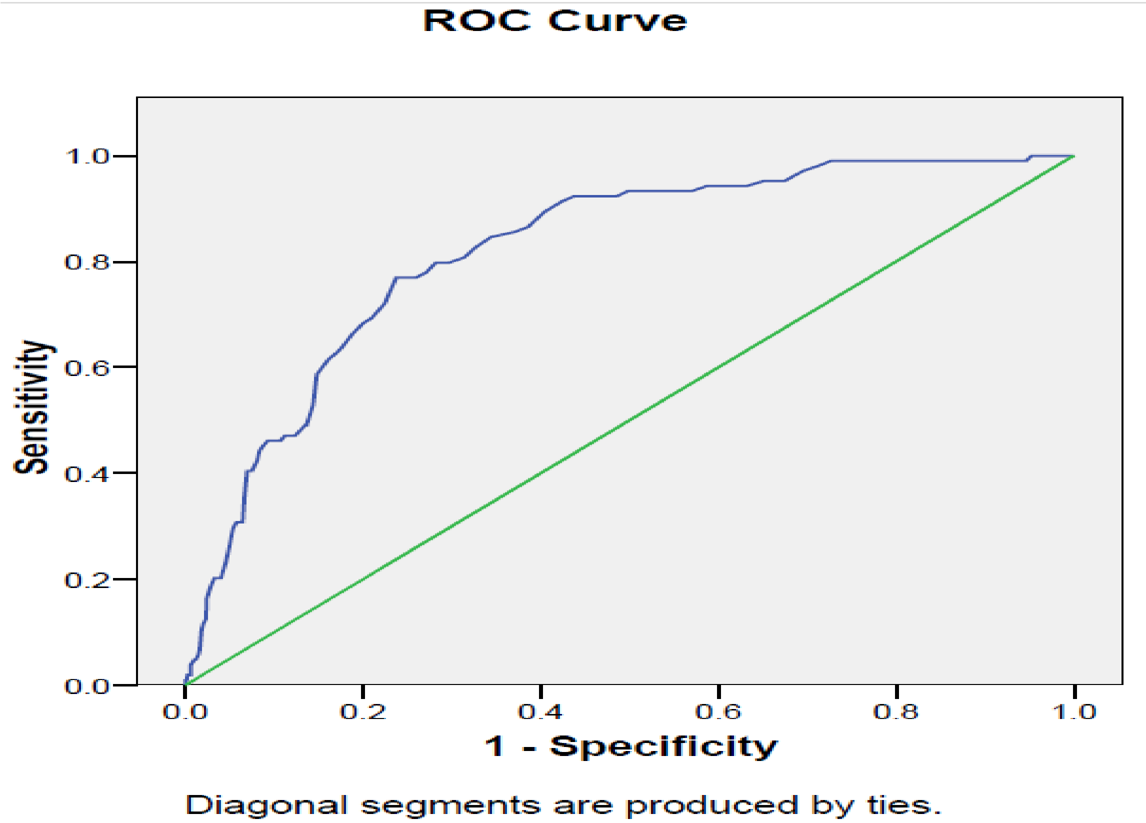
ANALYSIS OF THE DATA

Introduction

The purpose of this chapter is to 1) describe the study population, 2) describe the findings of validation when SAM is used in college physical activity classes, 3) describe the reliability of SAM when used in college physical activity classes and, 4) describe the correlation between the SAM observational tool and the Suunto HRM system. The participants in this study were students attending community college in south Texas.

The SAM Intensity screening was used to correlate across heart rates and across time and transition in low to high intensity college level courses. These data were collected from the SAM with data collected concurrently by the Suunto HRM system. The SAM results were grouped into categorical variables of low, moderate and vigorous intensities then compared to low, moderate, moderate to vigorous or vigorous physical activity as determined by the average heart rate for that same period. A chi-square goodness of fit test for validity was then used. A Receiver Operating Curve (ROC) (Figure 3) to determine sensitivity and specificity of the SAM for predicting the actual heart rate defined level of physical activity was then created and analyzed.

Figure 3. ROC Curve



Study Population

The overall study population consisted of a total of student observations (n=246) across multiple physical activity classes. The SAM intensity averaged 3.89 ± .98 and average heart rate was 116.43 ± 17.81 bpm. In addition, total student observations were increased across class transition observations (n=1918) indicating a similar SAM intensity of 3.52 ± 2.4 and average heart rate of 125.66 +/- 23.91 bpm. Cardio Kickboxing (n=1379) recorded a SAM intensity level of 3.67 +/-2.4, Weight Training (n=258) resulted in 3.93 +/-2.6, and Yoga (n=281 resulted in an average intensity of 2.42+/-1.8.

Findings

Description of the Reliability Testing Findings of the SAM Observational Instrument

The SAM intensity correlated highly with Average heart rate across each subject (r=.236,p<.01). Heart rate across each transition in respective class had a significant correlation (r=.457, p<.01). In addition, Yoga had a significant mean difference at the 0.05 level in SAM intensity levels across all courses, including Kickboxing (-1.25+/-0.15), weight training (-1.51+/-0.2).

Description of the Validation Findings of the SAM Observational Instrument

In addition to high correlations across each subject and transitions observed in each course, The Receiver Operator curve determined that the SAM intensity test is able to accurately predict Heart Rate in College Level Physical activity courses (0.821 +/-0.02).

CHAPTER 5

DISCUSSION AND CONCLUSIONS

Introduction

SAM is a cost effective observational tool to assist the physical educator in the assessment of MVPA. A sedentary lifestyle among individuals has been linked to risk factors associated with chronic disease; specifically obesity, overweight, and high body mass index (BMI). Obesity is an important health indicator because of its positive relationship to many other diseases such as diabetes, hypertension, high blood cholesterol, and cancer (Largo-Wright, Todorovich, & O'Hara, 2008, p. 31). Despite the importance of physical activity (PA) for health and obesity prevention, less than one-third of approximately 32 million adults in the United States engage in regular physical activity (Largo-Wright et al., 2008, p. 33).

Higher education in Texas has historically included and supported physical activity classes as a part of the core curriculum (Texas Higher Education Coordinating Board, 2011). The inclusion of these activity classes as a part of the core curriculum has provided an opportunity for students to gain college credit as well as contribute to significant minutes engaged in regular physical activity. It has been reported that young adults engage in less physical activity with age (U.S. Department of Health and Human Services [HHS], 2010); therefore, increased opportunities for physical activity in higher education could play an important preventative role in disease risk management and prevention.

Recently, community colleges across Texas have experienced extensive budget cuts. Additionally, the Texas Higher Education Coordinating Board recently voted to eliminate physical activity classes as part of the core curriculum effective the fall semester of 2014 (Texas Higher Education Coordinating Board, 2011). Affordable and accurate accountability measures of moderate to vigorous physical activity (MVPA) in physical education (PE) at all levels can assist the physical educator in positively impacting the health, well-being and disease risk among community college students in Texas. Particularly, these measures at the Community College level are important to have if the Texas Higher Education Coordinating board actions are reversed in the future.

An accurate measurement of MVPA in the PE classroom has typically required the purchase and use of equipment like accelerometers, pedometers, and/or heart rate monitors. A previous study reported that the use of the Simple Activity Measurement (SAM) may provide an economical and effective accountability tool to measure MVPA in school based PE classes (Surapiboonchai, in press).

The following paragraphs provide a summary of the findings of this study along with results, limitations, and suggestions for future research.

Review of the Research Study

Students enrolled in a variety of physical activity classes were recruited for the study. Consents were not required for the students to participate in data collection or evaluation activities since classroom activities are required as part of the regular scheduled participation. All students participated in the activities as it was already planned and a part of the general curriculum. Students were observed as a group participating in the assessment. Students were chosen randomly to participate of their free will in the HRM data collection. Those students that chose to participate in the HRM data collection were free to drop from participation at any time. The schools were chosen using a convenience sampling method.

The students with incomplete and missing data were removed and not used as part of the data set. Institutional Review Board (IRB) approval was obtained from Texas State University–San Marcos. IRB approval was also obtained from the institutions providing the participants being observed. The SAM observational instrument was used to observe MVPA as a standard collection procedure in college physical activity classes in South Texas. Permission was obtained through the respective kinesiology department chairpersons and individual instructors. Before any of the data were obtained, the individual institutions were provided with a notice of approval from the Texas State University-San Marcos IRB.

Review of the Literature Findings

The literature review supports the idea that increased knowledge of fitness concepts will result in increased activity (Casebolt, 2009) and that physical activity classes in higher education can provide a venue for students to increase activity and meet the recommended physical activity guidelines.

According to the literature review, physical activity results in a substantial increase in energy expenditure and can provide progressive health benefits. Health enhancing physical activity can include activities such as brisk walking, lifting weights, and yoga. Increased levels of physical activity often lead to improved physical fitness which is generally associated with improvement of good health, disease prevention, and longevity of life (Casebolt, 2009, p. 28).

A sedentary lifestyle, or physical inactivity has been linked to risk factors associated with chronic disease; specifically obesity, overweight, and high body mass index (BMI). Physical inactivity is considered a health concern and long-term insufficient PA is a prevalent and preventable risk factor for chronic disease and death (Zanovec, Lakkakula, Johnson, &Turri, 2009, p. 181). A lack of PA has been identified by the Centers for Disease Control and Prevention as a modifiable health risk behaviors known to cause chronic disease. Physical inactivity is an established risk factor for the development and maintenance of obesity (Stamatakis, Hirani, &Rennie, 2009, p. 765). Obesity is an important health indicator and has been shown to be associated with decreased health and well-being. Studies demonstrate that participation in regular physical activity results in many health benefits. Greater amounts of physical activity can result in additional health benefits and those individuals maintaining a regular physical activity program could derive greater benefits.

Engaging in physical activity is one of the most important steps that Americans can take to improve their health (HHS, 2008, p. 1). A clear understanding of the link between physical activity and health could serve as a catalyst for individuals, groups and communities to commit to and regularly engage in healthy physical activity.

A broad range of evidence has shown that many adults in the United States fall short from meeting the minimal recommendations for physical activity. The increased prevalence of obesity coincides with the steepest decline of physical activity in individuals between the ages of 13 and 18 (Zanovec, Lakkakula, Johnson, &Turri, 2009, p. 176-177).

The college years are influential in shaping adult behaviors, particularly in regard to diet, physical activity, and other lifestyle habits (Desai, Miller, Staples, & Bravender, 2008, p. 109) and the college population is at risk for developing obesity linked to physical inactivity. Public health officials have identified college-age individuals as a neglected but important population for initiatives addressing lifestyle changes to decrease health risks (Zanovec, Lakkakula, Johnson, & Turri, 2009, p. 181). The number of obese and overweight college students has risen in recent years making them at risk of developing a range of diseases and adverse health conditions. In addition, because obesity is not easily reversible, those who are obese or develop obesity as young adults are at an increased risk of obesity through adulthood (Desai et al., 2008, p. 109). Many young adults on college campuses are not meeting the current physical activity recommendations (Casebolt, 2009, p. 28). A substantial number of these young adults leading sedentary lives are at an increased risk for factors which negatively impact health. Students enrolled in physical activity credit on community college campuses are more likely to meet the minimal recommendations for physical activity.

Many college students are overweight and obese and fail to meet the minimum dietary and PA guidelines which place them at significant risk for a number of lifestyle related chronic diseases (Huang et al., 2003, p. 84). The school setting can provide a structured atmosphere to incorporate physical activity while promoting healthy lifestyle choices. Physical activity classes in higher education can also provide a venue for students to increase activity and meet the recommended physical activity guidelines.

Essentially, health benefits could be gained by increasing opportunities for physical activity in physical education settings.

Accurate and objective methods to measure levels of physical activity are important in defining appropriate dose-response relationships between physical activity and health (Spierer, Hagins, Rundle, & Pappas, 2011, p. 659). Additionally, accurate and reliable assessment of physical activity is necessary for any research study where physical activity is either an outcome measure or an intervention. Further, there is no perfect measurement tool and it is; therefore, important to understand strengths and limitations of each measurement.

Synthesis of Findings

The results of this study were consistent with findings that suggest that SAM is a cost effective alternative for the measurement of MVPA in the physical education classroom. The results also suggest that the instructional intervention tool increases accuracy in the assessment of MVPA. The findings support SAM as a valid and cost effective method to assess MVPA in PE. Further, the results of this study affirm the SAM as a valid and reliable instrument when used in college physical activity classes. A significant correlation between the SAM observational tool and the Suunto HRM system has been revealed.

Limitations of the Study

Events occurred during the course of this study which impacted the course of study. This section focuses on the limitations associated with this study.

Problems occurred in the area of class management. In terms of this study, class management refers to the strategies the instructor uses to perform activities which serve to increase activity levels while meeting learning outcomes.

The SAM intensity level for the instructors who effectively managed their class resulted in HRM intensity levels which similarly reflected SAM levels. The instructor whose classroom management skills were not as effective revealed inconsistencies in HRM levels versus SAM intensity levels.

Additionally, classes such as yoga which include meditation and relaxation while engaging in “poses” could decrease heart rate and specificity of training affects when compared to traditional courses which focus on energy expenditure alone.

Implications for Future Research

The SAM tool could be a valuable assessment instrument for assessing MVPA because of its effectiveness and low cost for schools. Studies have been conducted in the physical education setting and revealed that SAM is a reliable and valid tool for the assessment of MVPA in diverse populations from children to adults. However, further testing is needed to establish reliability and validity in additional settings such as one-on-one and health club settings.

Summary and Conclusions

It was found that the SAM is a valid and reliability measure for the assessment of MVPA in college physical activity classes when applied to community college students performing physical activity in PE classes. Additionally, there is a correlation between the SAM observational tool and the Suunto HRM system. Further research is needed to conduct effectiveness of instruction and course specificity of training effects when using the SAM.

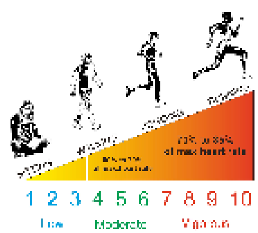
APPENDIX A

SAM Form
2009 EZ

How to use the S.A.M. Scale & S.A.M.O.A.I.

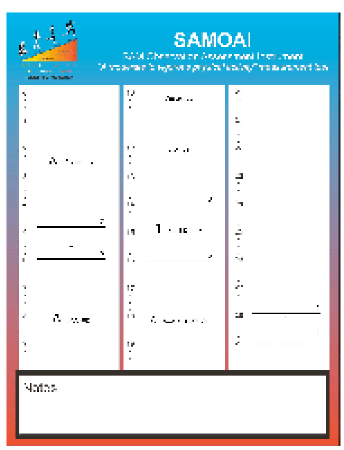
Use the below sample definitions for the S.A.M.O.A.I. tool:

Low	0	example: sitting (no activity to raise heart rate)
	1	example: standing
	2	example: standing (with minor movement)
	3	example: stretching, walking, dress-out
Moderate	4	example: brisk walking
	5	example: fast walk
	6	example: skipping, bouncing walk
Vigorous	7	example: slow jog
	8	example: medium jog
	9	example: fast run; jump rope
	10	example: sprint



How to use S.A.M.O.A.I

The class bell signals the beginning of class and the start of the observation. Draw a line for each transition. You can write comments in the section space that was created when the transition line was drawn. In each section write in "A" for Activity or "I" for Instruction and an activity level number based on your observation using the SAM MVPA Scale as a reference. Fill in the Stat Worksheet when your observation is completed. This instrument can also be used for group or individual assessment.



SAMOAI

SAM Observation Assessment Instrument

"A moderate to vigorous physical activity" measurement tool

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35	45	55
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36	46	56
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37	47	57
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Notes

SAMOAI Stat Worksheet

DATE:		SCHOOL:	DISTRICT:
TIME OBSERVED (Should match line 4 from below):		TEACHER:	
UNIT OBSERVED:	CLASSIFICATION TYPE:	TOTAL MINUTES OF CLASS:	

OBSERVATION DEMOGRAPHICS		
TOTAL OBSERVED: *n* =	BOYS *n* =	GIRLS *n* =
GRADE LEVEL(S) OBSERVED: ☐PRE-K ☐K ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10 ☐11 ☐12 ☐College ☐Adult ☐Senior (65+) *Check all that apply.*		

MVPA MINUTES	
Directions: Add the number of minutes for each level from the observation worksheet and enter the minutes in the right column.	
	MINUTES OBSERVED
1. LOW ACTIVITY (Levels 1-3)	1.
2. MODERATE ACTIVITY (Levels 4-6)	2.
3. VIGOROUS ACTIVTY (Levels 7-10)	3.
4. **TOTAL MINUTES OBSERVED →** Add lines 1,2, and 3 from above.	4.
5A. **TOTAL MINUTES OF MVPA →** Add lines 2 and 3 from above.	5A.
5B. **PERCENTAGE OF MVPA →** Line 5A divide by line 4 x 100.	5B.

INSTRUCTION AND ACTIVITY MINUTES	
Directions: Add the number of minutes from the observation worksheet for teacher instructional time and enter the minutes in the right column. Do the same for activity time.	
	MINUTES OBSERVED
6. **TOTAL INSTRUCTION TIME**	6.
7. **TOTAL ACTIVITY TIME**	7.

TRANSITIONS	
Directions: Enter the number of transitions from the observation worksheet for each:	
8. INSTRUCTION	8.
9. ACTIVITY	9.
10. **TOTAL NUMBER OF TRANSITIONS →** Add lines 8 and 9.	10.

MINUTE TRACKER																			
Directions: Each box represents 1 minute. In each box, insert a MVPA level from the observation worksheet.																			

Directions: In column "C", insert the number of minutes for each level from the MINUTE TRACKER. Then multiple column A*C for each line.				
	(A) MVPA Level	(B) Multiply by "C"	(C) Minutes	(D) "A" * "C" =
11.	**0**	X		11.
12.	**1**	X		12.
13.	**2**	X		13.
14.	**3**	X		14.
15.	**4**	X		15.
16.	**5**	X		16.
17.	**6**	X		17.
18.	**7**	X		18.
19.	**8**	X		19.
20.	**9**	X		20.
21.	**10**	X		21.
22.	Add lines 11 thru 21 →			22.

MVPA LEVEL FOR THE CLASSROOM			
23. ________ Line 22 goes here.	/ Divide	24. ________ Line 4 goes here. Total Minutes of Class	25. ________ **MVPA Level Average for the class period** Box 23 divided by box 24.

50% RECOMMENDED NATIONAL STANDARD – *Healthy People 2010*				
Directions: National recommendations is 50% MVPA time during PE ("Physical activity and fitness," 2009).Fill in the information below to determine if the standard was met.				
26. ________ Total Minute of Class Line 4 goes here.	X	27. .50	28. ________ Recommended minutes of MVPA	29. ________ Count the number of boxes that are level 4 and

	Multiple		National Standard. Box 26 multiplied by box 27.	above in the MINUTE TRACKER. If the number is ≥ box 28, then the National Standard has been met.

ESTIMATED HEART RATE ZONE

Directions: Insert a (√) in the appropriate column for the estimated average heart rate of the class period. **For moderate-intensity physical activity**, a person's target heart rate should be 50 to 70% of his or her maximum heart rate. This maximum rate is based on the person's age. An estimate of a person's maximum age-related heart rate can be obtained by subtracting the person's age from 220. For example, for a 50-year-old person, the estimated maximum age-related heart rate would be calculated as 220 - 50 years = 170 beats per minute (bpm). The 50% and 70% levels would be:

- 50% level: 170 x 0.50 = 85 bpm, and
- 70% level: 170 x 0.70 = 119 bpm

Thus, moderate-intensity physical activity for a 50-year-old person will require that the heart rate remain between 85 and 119 bpm during physical activity.

For vigorous-intensity physical activity, a person's target heart rate should be 70 to 85% of his or her maximum heart rate. To calculate this range, follow the same formula as used above, except change "50 and 70%" to "70 and 85%". For example, for a 35-year-old person, the estimated maximum age-related heart rate would be calculated as 220 - 35 years = 185 beats per minute (bpm). The 70% and 85% levels would be:

- 70% level: 185 x 0.70 = 130 bpm, and
- 85% level: 185 x 0.85 = 157 bpm

Thus, vigorous-intensity physical activity for a 35-year-old person will require that the heart rate remains between 130 and 157 bpm during physical activity ("Target heart rate and estimated maximum heart rate," 2009).

LOW	MODERATE HR ZONE	VIGOROUS HR ZONE
< (i)	220 – AGE = bpm X .50 = i 220 – AGE = bpm X .70 = ii _______ to _______ (i) (ii) For mixed grade levels, use average age.	220 – AGE = bpm X .70 = iii 220 – AGE = bpm X .85 = iv _______ to _______ (iii) (iv) For mixed grade levels, use average age.
30. (√) ☐ MVPA levels 0,1,2,3 check here (see box 25).	31. (√) ☐ MVPA levels 4,5,6 check here (see box 25).	32. (√) ☐ MVPA levels 7,8,9,10 check here (see box 25).

CURRICULUM COMPONENT

33. Was Instant Activity done?	33. 1. ☐ Yes 2. ☐ No

FITNESS COMPONENTS
34. What FitnessGram components were done (Check all that apply)?
☐ PACER ☐ CURL-UPS ☐ PUSH-UPS ☐ TRUNK-LIFT ☐ SIT & REACH
☐ SHOULDER-STRETCH ☐ NONE

References

Physical activity and fitness (2009). Retrieved November 14, 2009, from http://www.healthypeople.gov/hp2020/Objectives/TopicArea.aspx?id=39&TopicArea=Physical+Activity+and+Fitness

Target heart rate and estimated maximum heart rate (2009). Retrieved November 14, 2009, from http://www.cdc.gov/physicalactivity/everyone/measuring/heartrate.html

APPENDIX B

SAMOAI Stat Worksheet – College/University

DATE:		Campus:	Institution:	DISTRICT:
TIME OBSERVED:		Instructor Name:	Rank:	Tenured: Y/N
Course #:	Course Name:		TOTAL MINUTES OF CLASS:	

OBSERVATION DEMOGRAPHICS		
TOTAL OBSERVED: *n* =	MALES *n* =	FEMALES *n* =
CLASSIFICATION LEVEL(S) OBSERVED: ☐ Freshmen ☐Sophomore ☐Junior ☐Senior ☐<18 ☐Adult (18-64) ☐Senior (65+) *Check all that apply.*		

MVPA MINUTES	
Directions: Add the number of minutes for each level from the observation worksheet and enter the minutes in the right column.	
	MINUTES OBSERVED
1. LOW ACTIVITY (Levels 0-3)	1.
2. MODERATE ACTIVITY (Levels 4-6)	2.
3. VIGOROUS ACTIVTY (Levels 7-10)	3.
4. **TOTAL MINUTES OBSERVED →** Add lines 1,2, and 3 from above.	4.
5A. **TOTAL MINUTES OF MVPA →** Add lines 2 and 3 from above.	5A.
5B. **PERCENTAGE OF MVPA →** Line 5A divide by line 4 x 100.	5B.

INSTRUCTION AND ACTIVITY MINUTES	
Directions: Add the number of minutes from the observation worksheet for instructional time and enter the minutes in the right column. Do the same for activity time.	
	MINUTES OBSERVED
6. **TOTAL INSTRUCTION TIME**	6.
7. **TOTAL ACTIVITY TIME**	7.

TRANSITIONS	
Directions: Enter the number of transitions from the observation worksheet for each:	
8. INSTRUCTION	8.
9. ACTIVITY	9.
10. **TOTAL NUMBER OF TRANSITIONS →** Add lines 8 and 9.	10.

MINUTE TRACKER																			
Directions: Each box represents 1 minute. In each box, insert a MVPA level from the observation worksheet.																			

Directions: In column "C", insert the number of minutes for each level from the MINUTE TRACKER. Then multiple column A*C for each line.

	(A) MVPA Level	(B) Multiply by "C"	(C) Minutes	(D) "A" * "C" =
11.	**0**	X		11.
12.	**1**	X		12.
13.	**2**	X		13.
14.	**3**	X		14.
15.	**4**	X		15.
16.	**5**	X		16.
17.	**6**	X		17.
18.	**7**	X		18.
19.	**8**	X		19.
20.	**9**	X		20.
21.	**10**	X		21.
22.	Add lines 11 thru 21 →			22.

MVPA LEVEL FOR THE CLASSROOM

23.		24.	25.
________ Line 22 goes here.	/ Divide	________ Line 4 goes here. Total Minutes of Class	________ **MVPA Level Average for the class period** Box 23 divided by box 24.

50% RECOMMENDED NATIONAL STANDARD – Healthy People 2020

Directions: National recommendations is 50% MVPA time during PE ("Physical activity and fitness," 2009).Fill in the information below to determine if the standard was met.

26.		27.	28.	29.
________ Total Minute of Class Line 4 goes here.	X Multiple	.50	________ Recommended minutes of MVPA National Standard. Box 26 multiplied by box 27.	________ Count the number of boxes that are level 4 and above in the MINUTE TRACKER. If the number is ≥ box 28, then the National Standard has been met.

ESTIMATED HEART RATE ZONE

Directions: Insert a (√) in the appropriate column for the estimated average heart rate of the class period. **For moderate-intensity physical activity**, a person's target heart rate should be 50 to 70% of his or her maximum heart rate. This maximum rate is based on the person's age. An estimate of a person's maximum age-related heart rate can be obtained by subtracting the person's age from 220. For example, for a 50-year-old person, the estimated maximum age-related heart rate would be calculated as 220 - 50 years = 170 beats per minute (bpm). The 50% and 70% levels would be:

- 50% level: 170 x 0.50 = 85 bpm, and
- 70% level: 170 x 0.70 = 119 bpm

Thus, moderate-intensity physical activity for a 50-year-old person will require that the heart rate remain between 85 and 119 bpm during physical activity.

For vigorous-intensity physical activity, a person's target heart rate should be 70 to 85% of his or her maximum heart rate. To calculate this range, follow the same formula as used above, except change "50 and 70%" to "70 and 85%". For example, for a 35-year-old person, the estimated maximum age-related heart rate would be calculated as 220 - 35 years = 185 beats per minute (bpm). The 70% and 85% levels would be:

- 70% level: 185 x 0.70 = 130 bpm, and
- 85% level: 185 x 0.85 = 157 bpm

Thus, vigorous-intensity physical activity for a 35-year-old person will require that the heart rate remains between 130 and 157 bpm during physical activity ("Target heart rate and estimated maximum heart rate," 2009).

LOW < (i)	MODERATE HR ZONE 220 – AGE = bpm X .50 = i 220 – AGE = bpm X .70 = ii _______ to _______ (i) (ii) For mixed grade levels, use average age.	VIGOROUS HR ZONE 220 – AGE = bpm X .70 = iii 220 – AGE = bpm X .85 = iv _______ to _______ (iii) (iv) For mixed grade levels, use average age.
30. (√) ☐ MVPA levels 0,1,2,3 check here (see box 25).	31. (√) ☐ MVPA levels 4,5,6 check here (see box 25).	32. (√) ☐ MVPA levels 7,8,9,10 check here (see box 25).

CURRICULUM COMPONENT	
33. Was Instant Activity done?	33. 1. ☐ Yes 2. ☐ No

FITNESS COMPONENTS

34. What assessment components were done (Check all that apply)?

☐ Body Composition ☐ Curl-ups/Sit-ups ☐ Push-ups ☐ Trunk-lift ☐ Sit & Reach

☐ Sub maximal Exercise ☐1 RM Bench ☐1 RM Leg Press ☐Other

____

References

Physical activity and fitness (2009). Retrieved November 14, 2009, from http://www.healthypeople.gov/hp2020/Objectives/TopicArea.aspx?id=39&TopicArea=Physical+Activity+and+Fitness

Target heart rate and estimated maximum heart rate (2009). Retrieved November 14, 2009, from http://www.cdc.gov/physicalactivity/everyone/measuring/heartrate.html

APPENDIX C

SAMOAI Stat Worksheet – Fitness Club

DATE:	Club/Company:	Facility Location:
TIME OBSERVED:		Instructor Name:
Class:		TOTAL MINUTES OF CLASS:

OBSERVATION DEMOGRAPHICS		
TOTAL OBSERVED: *n* =	MALES *n* =	FEMALES *n* =
CLASSIFICATION LEVEL(S) OBSERVED: ☐<18 ☐Adult (18-64) ☐Senior (65+) *Check all that apply.*		

MVPA MINUTES	
Directions: Add the number of minutes for each level from the observation worksheet and enter the minutes in the right column.	
	MINUTES OBSERVED
1. LOW ACTIVITY (Levels 0-3)	1.
2. MODERATE ACTIVITY (Levels 4-6)	2.
3. VIGOROUS ACTIVTY (Levels 7-10)	3.
4. **TOTAL MINUTES OBSERVED →** Add lines 1,2, and 3 from above.	4.
5A. **TOTAL MINUTES OF MVPA →** Add lines 2 and 3 from above.	5A.
5B. **PERCENTAGE OF MVPA →** Line 5A divide by line 4 x 100.	5B.

INSTRUCTION AND ACTIVITY MINUTES	
Directions: Add the number of minutes from the observation worksheet for instructional time and enter the minutes in the right column. Do the same for activity time.	
	MINUTES OBSERVED
6. **TOTAL INSTRUCTION TIME**	6.
7. **TOTAL ACTIVITY TIME**	7.

TRANSITIONS	
Directions: Enter the number of transitions from the observation worksheet for each:	
8. INSTRUCTION	8.
9. ACTIVITY	9.
10. **TOTAL NUMBER OF TRANSITIONS →** Add lines 8 and 9.	10.

MINUTE TRACKER

Directions: Each box represents 1 minute. In each box, insert a MVPA level from the observation worksheet.

Directions: In column "C", insert the number of minutes for each level from the MINUTE TRACKER. Then multiple column A*C for each line.

	(A) MVPA Level	(B) Multiply by "C"	(C) Minutes	(D) "A" * "C" =
11.	**0**	X		11.
12.	**1**	X		12.
13.	**2**	X		13.
14.	**3**	X		14.
15.	**4**	X		15.
16.	**5**	X		16.
17.	**6**	X		17.
18.	**7**	X		18.
19.	**8**	X		19.
20.	**9**	X		20.
21.	**10**	X		21.
22.	Add lines 11 thru 21 →			22.

MVPA LEVEL FOR THE CLASS

23.		24.	25.
___________ Line 22 goes here.	/ Divide	___________ Line 4 goes here. Total Minutes of Class	___________ **MVPA Level Average for the class period** Box 23 divided by box 24.

50% RECOMMENDED NATIONAL STANDARD – Healthy People 2020

Directions: National recommendations is 50% MVPA time during PE ("Physical activity and fitness," 2009).Fill in the information below to determine if the standard was met.

26.		27.	28.	29.
___________ Total Minute of Class Line 4 goes here.	X Multiple	.50	___________ Recommended minutes of MVPA National Standard. Box 26 multiplied by box 27.	___________ Count the number of boxes that are level 4 and above in the MINUTE TRACKER. If the number is ≥ box 28, then the National Standard has been met.

ESTIMATED HEART RATE ZONE

Directions: Insert a (√) in the appropriate column for the estimated average heart rate of the class period. **For moderate-intensity physical activity**, a person's target heart rate should be 50 to 70% of his or her maximum heart rate. This maximum rate is based on the person's age. An estimate of a person's maximum age-related heart rate can be obtained by subtracting the person's age from 220. For example, for a 50-year-old person, the estimated maximum age-related heart rate would be calculated as 220 - 50 years = 170 beats per minute (bpm). The 50% and 70% levels would be:

- 50% level: 170 x 0.50 = 85 bpm, and
- 70% level: 170 x 0.70 = 119 bpm

Thus, moderate-intensity physical activity for a 50-year-old person will require that the heart rate remain between 85 and 119 bpm during physical activity.

For vigorous-intensity physical activity, a person's target heart rate should be 70 to 85% of his or her maximum heart rate. To calculate this range, follow the same formula as used above, except change "50 and 70%" to "70 and 85%". For example, for a 35-year-old person, the estimated maximum age-related heart rate would be calculated as 220 - 35 years = 185 beats per minute (bpm). The 70% and 85% levels would be:

- 70% level: 185 x 0.70 = 130 bpm, and
- 85% level: 185 x 0.85 = 157 bpm

Thus, vigorous-intensity physical activity for a 35-year-old person will require that the heart rate remains between 130 and 157 bpm during physical activity ("Target heart rate and estimated maximum heart rate," 2009).

LOW	MODERATE HR ZONE	VIGOROUS HR ZONE
< (i)	220 – AGE = bpm X .50 = i 220 – AGE = bpm X .70 = ii ________ to ________ (i) (ii) For mixed grade levels, use average age.	220 – AGE = bpm X .70 = iii 220 – AGE = bpm X .85 = iv ________ to ________ (iii) (iv) For mixed grade levels, use average age.
30. (√) ☐ MVPA levels 0,1,2,3 check here (see box 25).	31. (√) ☐ MVPA levels 4,5,6 check here (see box 25).	32. (√) ☐ MVPA levels 7,8,9,10 check here (see box 25).

CURRICULUM COMPONENT	
33. Was Instant Activity done?	33. 1. ☐ Yes 2. ☐ No

FITNESS COMPONENTS
34. What components were incorporated (Check all that apply)?
☐ Muscular Strength ☐ Muscular Endurance ☐ Flexibility ☐ Aerobic Endurance
☐ Agility ☐Coordination ☐Speed☐Power ☐Reaction Time ☐Balance

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