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Middle School Physical Education Programs: A Comparison of Moderate to Vigorous Physical Activity in Sports Game Play

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Middle School Physical Education Programs: A Comparison of Moderate to Vigorous Physical Activity in Sports Game Play

by

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Abstract

It is believed that Flag Rugby may produce physical activity (PA) in middle school students that is more vigorous than other sports. PURPOSE: To examine the effects of different sports on physical activity in middle school students. METHODS: 101 (55 M; 46 F, ages 11-14, grades 6-8) middle schoolers were randomly selected to participate in three different sports on three separate days during their regular scheduled PE class. The participants engaged in flag football on day one, basketball on day two and flag rugby on day three of the research study. These days were not consecutive. All physiological-related variables were collected using the Stayhealthy RT3™ accelerometer (Monrovia, USA). Enjoyment and competence were measured using the Intrinsic Motivation Inventory (IMI) (McAuley et. al., 1989; Ryan, 1982). The research design utilized a repeated measure analysis of variance (RMANOVA) followed by dependent t-tests. RESULTS: Flag football mean MET values were 4.93 $\pm$ 1.35(SD). Basketball mean MET values were 5.51 $\pm$ 2.02. Flag rugby mean MET values were 6.02 $\pm$ 1.52. These results indicate a significant difference between flag football vs. basketball ($p = 0.023$) and flag rugby vs. flag football ($p < 0.000$), but no significant difference between basketball vs. flag rugby ($p = 0.109$). The results from the enjoyment and competence paired samples t-test found a significant difference between play of flag rugby (6.24 $\pm$ 1.59, enjoyment; 6.00 $\pm$ 1.46, competence) and flag football (5.38 $\pm$ 1.69, enjoyment; 5.26 $\pm$ 1.56) at ($p < 0.000$) for both scales. There was a significant difference

between flag rugby and basketball (5.21 ± 1.80 enjoyment; 5.21 ± 1.68) at ($p < 0.000$) enjoyment and ($p < 0.001$) competence. However, there was no significant difference between basketball and flag football ($p = 0.481$) enjoyment and ($p = 0.827$) competence. DISCUSSION: There is, in fact, a significant difference in physical activity intensities and durations between flag rugby and that of flag football and/or basketball ($p < 0.001$) F, 7.66. Results from this study suggest that there is not a significant difference in between flag rugby and basketball but there is a significant difference in enjoyment and competence between flag rugby and flag football.

Chapter 1

Introduction

The overweightness and obesity epidemic in the United States has a devastating impact on the a majority of the populations' health and the healthcare system. Early in the development of an adolescent's life, learned behaviors, such as regular physical activity, may provide health benefits that last throughout his/her lifetime. Specifically, this population may be more likely to adhere to daily exercise as a result of routine physical education (PE) classes taught at an early age (Larsen-Gordon, Nelson, Popkin, & 2004). Currently, our youth are not meeting national requirements for physical activity. The primary source of physical activity adolescents receive comes from PE. Most states, or 86% require middle schools to provide PE (Burgeson, Wechsler, Brener, Young & Spain, 2001). Although PE classes are a primary source of physical activity for the adolescent, research suggests students are only active about 10% of the current 50-minute allotted class time (Sallis, McKenzie, Alcaraz, Kolody, Faucette & Hovell, 1997).

The American College of Sports Medicine (ACSM) and the American Heart Association (AHA) have recommended specific guidelines for the amount of physical activity required to maintain cardiorespiratory fitness and health for adults (Haskell et.

al., 2007). These guidelines recommend a frequency of training equal to 5 times a week for moderate intensity exercise at a duration of a minimum of 30 minutes, and/or 3 times a week of vigorous intensity exercise lasting for a duration of 20 minutes per session (Haskell et. al., 2007). While the National Association for Sport and Physical Education (NASPE) requirements include daily PE accumulating at least 150 minutes per week for elementary students and 225 minutes per week for middle school and high school students (Corbin & Pangrazi, 2004).

Presently, it appears that a decrease in PA has become accepted as part of the norm, while participation in sedentary activities, such as computer and video game use have gained popularity (Mhurchu, Maddison, Jiang, Jull, Prapaessis, & Rogers, 2008). Observations in the physical education classroom of random middle schools revealed that students engage in moderate to vigorous physical activity for 16% of class time or about 10 minutes (Simons-Morton, Taylor & Snyder, 1994). While sixty minutes per day of moderate-to-vigorous physical activity (MVPA) is recommended, few studies have found adolescents in physical activity for an entire PE class.

One particular research study measured the amount of physical activity performed during weekdays and on weekends for adolescents ranging from ages 9 to 15 years (Nader, Bradley, Houts, MacRitchie & O'Brien, 2008). In this study, it was determined that at nine years of age, children spent more time in MVPA on the weekdays than on weekends. This study also stated that children who were more active during the week were found to be more active on the weekend (Nader et. al., 2008). Finding methods to

increase the duration of physical activity in adolescence is important for promoting healthy lifestyle behaviors.

One mechanism of increasing physical activity is to make the exercise experience more enjoyable and the provision of intramural sports may offer a partial solution (McEwin & Swaim, 2009). A study of adolescent females determined that baseline cardiovascular fitness was positively related to internal self-efficacy. As fitness improved, the females were motivated to continue engaging in moderate activities such as, aerobic dance, basketball, swimming and Tae Bo (McEwin & Swaim, 2009).

Collectively, research suggests that adolescents who enjoy an activity, may engage in the activity for a longer duration and possibly adhere to a more physically active lifestyle. Research indicates that interest in an activity and activity duration are directly related to each other (Garton & Pratt, 1991). That is, greater participation tends to occur in activities that are deemed to be more interesting. Many sport activities are found to be enjoyable in the adolescent population.

One activity that has received relatively little attention or research is the sport of rugby. This sport is relatively new to the United States and current levels of participation are well below that of other sports such as soccer, baseball/softball, and basketball. Even less is known about the youth version of this sport known as flag rugby. Proponents of this sport believe that the fitness stimulus associated with participation is greater than that associated with more traditional American sport options because the nature of play requires movement of all players, but research to date has not been conducted to corroborate these claims. Therefore, the purpose of this study is to compare flag rugby

with other team sports physical activity intensities and durations during performance and perceptions of enjoyment and competence following performance will be measured. This study's seeks to understand the duration and intensity of physical activity of the typical middle school student. This is important for future research as it may relate to the adherence of physical activity in this specific population.

Problem Statement

Rates of physical activity participation among American adolescents are significantly lower than those outlined in public health recommendations and interventions aimed at decreasing childhood obesity to date have been unsuccessful (Sallis et. al., 1997). Children tend to be more active than adults, but as they move into adolescence, activity levels begin to steadily decline (Pate et. al., 2006). Requirements for participation in PE are lower in higher grades with 40% of elementary schools requiring participation and only 5% in high school seniors (Pate et. al., 2006). Because most PE classes do not provide an adequate amount of physical activity to meet the requirements for cardiovascular fitness, developing solutions to increase these amounts in PE is of significant priority. Although, research suggests that students typically engage in moderate to vigorous physical activity (3.0 to 5.9 MET's) less than 40% of a typical PE class period (Simons-Morton et. al., 1994). This falls short of the 50% recommended by the Healthy People 2010 objectives (www.healthypeople.gov, 2010).

Physical activity is known to be related to self-efficacy, self-esteem, self-determination, goal-setting and intrinsic motivation (Ferrer-Caja & Weiss, 2000). Developing self-esteem and intrinsic motivating behaviors is important as adolescents

transition into middle school, high school and throughout adulthood. This provides new knowledge related to the physiological as well as the behavioral aspects associated with a variety of physical education classroom options, specifically popular and easy to learn organized sports. The purpose of this study was to measure physical activity in the adolescent, or middle school PE student. MVPA, duration, level of enjoyment and level of competence are important variables that contribute to this research study. The three sports chosen for this study are thought to produce similar intensities due to their aerobic nature. This study measures MVPA among middle school students engaging in three different sports: flag rugby, flag football and basketball.

Study Variables

The independent variable for this research study was the type of sport activity (flag rugby, flag football or basketball) and the dependent variables were level of moderate-to-vigorous physical activity (MVPA), duration, enjoyment and competence. Criterion for significance for all tests will be set at $p < 0.01$. The proposed sample size is based on power calculations and related literature.

Hypotheses

Ho1: There will be no significant difference in MVPA mean MET values between flag rugby, and that of flag football or basketball.

Ho2: There will be no significant difference in duration of activity between flag rugby and that of flag football or basketball.

Ho3: There will be no significant difference in level of enjoyment between flag rugby, and that of flag football or basketball.

Ho4: There will be no significant difference in level of competence between flag rugby and that of flag football or basketball.

H1: Flag rugby will produce MVPA mean MET values that are significantly greater in duration than that of flag football or basketball.

H2: Flag rugby will produce a significantly greater duration of activity than that of flag football or basketball.

H3: Flag rugby level of enjoyment will be significantly greater than that of flag football or basketball.

H4: Flag rugby level of competence will be significantly greater than that of flag football or basketball.

Operational Definitions

• Physical activity can be defined as the amount of bodily movement an individual engages in on a daily basis (Rowland & Freedson, 1994).

• The Stayhealthy RT3™ accelerometer (Monrovia, USA) is an electronic device that measures accelerations produced by body movement (forward, lateral, and vertical). These devices are clipped to the waistband at the hip level or worn as a belt and function to detect triaxial movement so exercise intensity and duration can be determined.

• Metabolic equivalent of task (MET) is a unit of energy expenditure that is proportional to work load.

•METs used in this study ranges from moderate (3.0 to 5.9) to vigorous (6.0 or greater) physical activity (MVPA) (Haskell et. al., 2007).

• Physical education is a school-based course that provides opportunities for students to engage in enjoyable physical activity (Pate, Davis, Robinson, Stone, McKenzie & Young, 2006).

• Interest-enjoyment and competence are measured in this study using the two subscales of the Intrinsic Motivation Inventory (IMI), a multidimensional measure of subjects' experience with experimental tasks (McAuley & Duncan, 1989).

Assumptions

The accelerometers used in this study were assumed to be easy to calibrate and reuse quickly, and provide accurate counts of PA needed to differentiate the amount of activity, time in PA and the intensity of the activity, moderate or vigorous. The participants were compliant with the instructor and engaged in game play based on the previous skill development section of the current required sport unit. Organized sports-based PE classes provide students the required amount of MVPA needed to meet the guidelines of the ACSM, NASPE and the CDC, or what equals to about 40 minutes of activity per class. This study was designed to measure activity during various sports. Organized sports performed in PE classes provided the middle-school student with the appropriate amount of MVPA (Larsen-Gorden, McMurray, & Popkin, 2000). The purpose of this study was to measure the activity of sports in PE classes. The assumption was that sports will keep adolescents interested and active during the entire class period therefore, contributing to improved cardiorespiratory fitness.

Limitations

The PE instructor's management of the adolescent group might have created a limitation to the study. For example, the instructor of the participants managed participants activity by keeping the class focused, motivated and physically active, therefore, allowing for the maximum amount of physical activity to be performed. The additional assistance provided by volunteers and interested parties allowed appropriate time for accelerometer placement. This research study was designed to measure PA in the population using accelerometers. Although accelerometers are found to be accurate tools for measuring various forms of physical activity, there can be downloading glitches, turnover time loss and some error associated with the conversion of counts to MET's based on inaccurate accelerometer counts, also noted in other research studies (Sirard & Pate, 2001). These were chosen specifically for the ease of measuring this particular population and for gathering data to obtain current MVPA durations.

The two subscales of the perceived choice in interest-enjoyment and competence, the Intrinsic Motivation Inventory (IMI), could have created a limitation to this study as adolescents might have a slight bias toward the experience of participating in a new sport. Previous research suggests the scale is an accurate measure of interest-enjoyment and competence. It can be modified by using subscales of the original version, as in this study. Therefore, the user can select as many or as few items as he/she wishes (Ryan, 1982). The generic wording also allows for modification for the task of interest (McAuley, Duncan, & Tammen, 1989).

Delimitations

The sample was comprised of middle-school adolescents, ages 11-14. The study was limited to one school in a large metropolitan school district, in the state of Florida. This sample may not have been representative of the greater population, since the students attending this school are required to participate in PE five days a week for approximately 50 minutes a session. The students chosen for the study were identified by class period and by attendance records. Students were chosen on the first day of collection (flag football) based on the return of parental consent and assent forms. The students that had returned these forms were allowed to participate in the study. The findings of this study contribute to research and the associated results provide insight into sports play in school PE programs.

This particular study analyzed only three of the many sports an adolescent may learn in PE. These sports (flag football, basketball and flag rugby) were chosen based on the similarity of aerobic performance and movement patterns. These particular sports appear to produce a significant amount of MVPA, when chosen as PE units, or as extracurricular activities (Larsen-Gordon, Nelson, & Popkin, 2004). These sports were also chosen based on the district requirements for this academic semester. The scheduling of the PE units were followed by the district's semester requirements. This design allowed any range of participant activity and weight status as this study was seeking to understand physical activity patterns in all middle school students. Experience in other sports, such as flag football and basketball may have provided an advantage for

some participants. The instructor was chosen based on experience and availability to volunteer. Participants in this study attended this instructor's daily PE class (periods two through seven).

Chapter 2

Review of Literature

Significant increases in obesity and overweight percentages of the nation's adolescence have been a topic of recent research. There is an immediate need to find a solution for the development and adherence of physical education programs in the nation's school systems. Understanding exercise behavior and the characteristics of individual activities in an adolescent population is important for exercise adherence (Sallis et. al., 1997). Some research suggests that organized sports taught in physical education settings can improve adolescent fitness, allow more activity with less instruction while appearing to be more enjoyable (Simons-Morton, Wendell, Snider & Huang, 1993).

The decline in physical activity among the middle school population is partly due to the flexibility a student may have in choosing extracurricular activities. On average, public school children receive physical education three times per week for an average of 47 minutes per class (Ross & Gilbert, 1985; Simons-Morton, et. al., 1994). In a recent study, the CDC found that the total amount of time that a middle school student can spend in a physical education class is 40 minutes (Lee, Burgeson, Fulton & Spain, 2006). At the middle school level, Burgeson and colleagues (2001) found that only 6% of middle schools provided daily PE for the entire school year and 15% offered daily PE for at least half the school year. The percentage of schools that require physical education in

each subsequent grade decreases, from 32% of middle/junior high schools in grade 6 to 5% of senior high schools in grade 12 (Burgeson et. al., 2001). This research suggests the absence of daily required PE classes has contributed to the rise in overweight and obese middle school students.

Among adolescents ages 12 to 19, 16% are overweight (≥ 95th percentile BMI for age) and 31% are overweight or at risk of becoming overweight (≥ 85th percentile BMI for age) (Hedley, Ogden, Johnson, Carroll, Curtin & Flegal, 2004). Most studies have reported associations between measures of adiposity in children and levels of physical activity (Berkey, Rockett, Gillman, & Colditz, 2003). This research study suggests that increased levels of adiposity are a result of non-activity and poor dietary behaviors. Research has well documented and confirmed that physical activity may benefit adolescents by increasing their aerobic fitness, bone mass, and HDL cholesterol and by reducing their risk of obesity and hypertension (McKenzie et. al., 1996). The research strongly suggests our youth deserve the benefits of daily PA.

Recently, there have been a number of published studies indicating an increased benefit of interventions in middle school PE classes. These interventions aim to increase PE physical activity and implement proper dietary behaviors, in an effort, to decrease cardiovascular and metabolic disease risk factors. In a recent evaluation of a two-year middle school PE intervention, M-SPAN, found that only 6-8% of secondary schools provided daily PE or its equivalent to all grades throughout the school year (McKenzie, Sallis, Prochaska, Conway, Marshall and Rosengard, 2004). This study observed 24 middle schools and found lesson time that is allocated more efficiently can improve

MVPA for middle school students (McKenzie et. al., 2004). In this intervention the instructors were also able to effectively maximize activity by allowing for additional game play time (see Appendix A).

Many children have limited or no access to community physical activity sports programs. Therefore, schools have become the primary location for providing physical activity settings for adolescents. PE programs can potentially influence physical activity by providing time for it and making it more enjoyable. In the Lifestyle Education for Activity Program (LEAP), eighth grade females increased daily physical activity, enjoyment of PA, enhanced PA self-efficacy and class participation during and after the program intervention (Pate et. al., 2005). After this study was completed, a one-year follow-up determined that 80% of the girls in the study were enrolled in PE classes in the ninth grade.

Adolescents are currently less active than children and less likely to participate in PE. Because schools are the primary location for physical activity, it is important that the adolescent be required to participate in school PE. The time spent in PE class should provide more than 50% activity duration. The PE class should provide the adolescent various forms of activity that he/she may enjoy. Research suggests, with enjoyment of activity comes adherence to activity (Ferrer-Caja & Weiss, 2000). Therefore, if PE classes afforded more time for the adolescent to engage in physical activity, the student may find an activity he/she enjoys and may adhere to a more physically active lifestyle.

Teaching sports to meet physical activity requirements

Many studies have demonstrated the associated health benefits to those, including the young, who participate in sports (Pate et. al., 2006). Sports are often taught at an early age with 98% of schools teaching group or team activities (Pate et. al., 2006). A common trend among research is the relationship of sports programs and the promotion of athletic skills and healthy lives (Perkins & Noam, 2007). Sports based youth development programs have been studied to understand how organized sport activities (tennis, soccer, basketball, baseball, etc.) contribute to learning development of our youth (Perkins & Noam, 2007). This research suggests that sports-based programs for our youth tend to lead them toward positive social and behavioral development. Engaging in sports provides our youth benefits such as, positive social norms, support for efficacy, skill building, active learning and opportunities for recognition (Perkins & Noam, 2007).

Sports such as basketball and soccer have the potential to promote cardiovascular fitness and typically generalize to a child's community (Sallis et. al., 1997). These sports enhance skill related fitness. All conditioning and many sports activities are performed to improve or maintain components of physical fitness (see appendix B). This figure displays various activities that promote cardiovascular benefits.

To meet the requirements of the U.S. Department of Health and Human Services, PE classes should be taught to engage students in physical activity for at least 50% of class time, in what they suggest are preferably lifetime activities or those, which may be conveniently engaged in as adults, such as tennis or jogging (Simons-Morton et. al., 1993). This particular study found the highest proportions of activity came from

activities such as jogging, walking, football and dodgeball. They also found that scrimmages or game play provide the largest proportion of MVPA (Simons-Morton et. al., 1993).

Sports-based youth programs, such as the nonprofit organizations Harlem RBI and Tenacity, have been successful in using skill based sports like tennis, baseball and softball to increase the middle school populations' physical activity. Tenacity has developed and implemented programs that improve physical health and skills of at-risk Boston middle school students (Berlin et. al., 2007). It is essential for research to focus on the middle school years, as adolescents are beginning to make their own choices during this developmental stage of life (Berlin et. al., 2007).

The SPARK intervention investigated by Sallis and colleagues (1997) found one health related physical education program provided children substantially more physical activity and significantly contributed to their physical activity requirements. This study used accelerometers and heart rate monitors to measure MVPA. They found that aerobic dance, walking/jogging, jumping rope, as well as playing sports, including basketball and soccer were considered to provide the appropriate amount of intensity to promote cardiovascular fitness (Sallis, et. al., 1997). Among others, this study shows a significant difference in MVPA of regularly active adolescents as compared to less active control groups.

In a study of prepubescent footballers (American soccer), Vincente-Rodriguez and colleagues reported that football participation was associated with improved physical fitness, reduced fat mass and increased lean body mass (2003). This study's primary

focus was to compare the football players' physical fitness with similar (age and height) control subjects. The control subjects only participated in physical education classes two times a week for 45 minutes each. The football players had at least one year experience with the game, playing three times weekly for an hour (Vincente-Rodriguez, Jiminez-Ramirez, Ara, Serrano-Sanchez, Dorado, & Calbet, 2003). The results of this study indicated the footballers had less fat and better physical fitness than the control group. Interestingly, in this study, they note that during a football match, an adult male covers a mean distance of close to 11 km at an average intensity similar to that observed during marathon running (Vincente-Rodriguez, et. al., 2003; Bangsbo, 1994).

Consistent with other research studies comparing sports participation for PA in adolescents, Ara and colleagues suggested the addition of sports participation benefits aerobic fitness in adolescents and that sports participation can contribute to a lowered body fat percentage (Ara et. al., 2004). In this study, the experimental and control groups were of similar age, body mass height and BMI. The aim of this study was to show the advantages of sports participation for adolescents and the associated physiological benefits thereof. The experimental subjects were to participate in an additional 3 hours per week of sports related physical activities on top of the 80-90 minutes of PE classes (Ara et. al., 2004). Sports participation appears to provide the adolescent with enhanced physical fitness and skill development. Keeping adolescents' interested and active may improve the health status and skill development of this population.

Physical Education Instruction Qualifications

A study on the effects of a 2-year physical education program (SPARK) on physical activity in elementary school students found that students were more active in specialist-led (40 min.) and teacher-led (33 min.) classes than in control group where untrained classroom teachers led the class (Sallis et. al., 1997). The specialist-led teachers were certified physical education specialists, whereas the teacher-led group were classroom teachers that were trained to develop class-management and instructional skills.

In a separate study by McKenzie and colleagues (2004), it was suggested that allowing the student to engage in free play or game play increased PA levels more than modifying the structure of the class. Consequently, it appears that not only can MVPA be increased in this population but it is more likely to occur with game play rather than constant instruction. This finding may be an important reason for teaching adolescents organized sports in PE. As an adolescent becomes familiar with a sport he/she may spend a significant amount of time in game play thus possibly increasing the health benefits associated with exercise.

The Child and Adolescent Trial for Cardiovascular Health (CATCH) physical education intervention program implemented PE consultants to provide on site training and follow up every two weeks for two and a half years. Instructional units included: aerobic games, aerobic sports, jump rope and rhythmic activities. These students were found to engage in more MVPA during lessons than those in control schools post intervention (51.9% vs. 42.3%) (Mckenzie et.al., 1996). The CATCH intervention had

effects that remained from five to seven years. A recent review of physical activity in schools found that moderate levels of PA were retained in PE from the CATCH program, primarily due to game play. Although, vigorous levels had dropped off, the study suggested that the teachers may need more training to effectively reach higher fitness levels (Pate et. al., 2006).

The majority of schools (80%) require newly hired PE teachers to have undergraduate or graduate training in PE or a related field, and 73% required new teachers to be certified, licensed or endorsed in PE (Burgeson et. al., 2001). Some school systems follow a state or national standard for PE curriculum (Pate et. al., 2006). While it appears necessary to have qualified PE instructors to teach skill, it does not seem to significantly affect the amount of time adolescents spend in PA. It may be more important that the PE instructor have sufficient class management and motivational skills.

Physical Activity Enjoyment

Research suggests in an attempt to gain adolescent physical activity adherence, it is important the activity be enjoyable. Some of the more popular sports appear to include; basketball, football, baseball, lacrosse, gymnastics, swimming, tennis and soccer (Hoffman, Kang, Faigenbaum & Nicholas, 2005). In this particular study, it was found that significant correlations were observed between seasonal sport activity and fitness performance, suggesting that seasonal sport participation may have a positive effect on fitness performance in children (Hoffman et. al., 2005).

In the previously mentioned LEAP intervention, it was suggested that PE classes be modified for enjoyment purposes (Pate et. al., 2005). These adolescents were more

likely to adhere to and maintain MVPA when they were participating in a sport they found interesting. It was suggested that a PE course be designed to seek the interest of the adolescent, thereby contributing to the maintenance of activity. In the LEAP intervention, the eighth grade girls enjoyed various activities they participated in during the program. This study suggests the enjoyment these girls experienced from attempting various activities may have led to their adherence to PA. A year later a follow-up study found that some of these girls continued to be physically active into the ninth grade (Pate et. al., 2005).

In a study of 53 boys, ages 12 and 13, participation in two different instructor led Rugby game sports were observed (Browne et. al., 2004). There was no difference in skill development and understanding of the game between the two groups and both made significant improvements while also enjoying the game. The sport education group was taught by the same teacher who also taught the traditional group. The sport education group began game play within the first five lessons, whereas the traditional unit could only play if the students' were successful at the drills first (Browne et. al., 2004). The results of the study indicated that both groups made significant improvements in skills such as passing, receiving and running and both groups enjoyed the Rugby sport unit (Browne et. al., 2004).

Consistent among research studies is a trend toward more practice/game playtime for students to engage in longer PA durations. As adolescents begin to improve skill, they also begin to play more vigorously and for longer durations. It appears that teaching skill

and allowing for game play are commonly found to be successful techniques in providing students more PA in PE.

Physical activity has been shown to positively correlate with increased psychological benefits such as self-efficacy, self-esteem, self-determination, goal-setting and intrinsic motivation (Ferrer-Caja & Weiss, 2000). It is well known that the adolescent age group can and does experience added pressures to "fit in." The Ferrer-Caja and Weiss (2000) study suggests with intrinsic motivation, people feel a need to be competent and self-determining. Once one has attained a certain amount of skill, perceived success, or self-efficacy will improve. If an adolescent is intrinsically motivated, interest in the activity may appear. This may result in continuous and regular practice. With the adolescent in mind, it appears to be essential to teach various types of activities, thereby increasing the chances the individual will find an activity he/she enjoys. Research has found that teachers can motivate students through various styles and behaviors. Therefore, it would benefit the teacher to fulfill this role in the PE classroom (Ferrer-Caja, & Weiss, 2000). It is anticipated that a motivated teacher may produce a motivated student and with this behavior an increase in activity may result.

The widespread topic of obesity has become a major focus for existing research. Attempts to measure daily activity levels of the adolescent population are becoming increasingly important to improve their health. It is understood that lifestyle behaviors learned at an early age tend to be consistent throughout the life cycle. Adolescent physical education class attendance often declines from elementary to middle and high school grades (Pate et. al., 2006). Due to the requirements of the school, the adolescent

may no longer choose to participate. This may be the most critical time to engage the adolescent in physical activity.

It is beneficial for the adolescent to attend regular PE classes, not only for the development of physical fitness but to improve learned motor and behavioral skills. It is important to understand the type of activities children of this age group tend to enjoy. The goal of this research project is to determine the duration of MVPA performed during physical education classes by measuring three (flag rugby, flag football and basketball) sports of similar intensities and durations. Because the ACSM recommended guidelines require 20- 60 minutes of moderate to vigorous physical activity per day, it is important to find effective solutions to reach and maintain these guidelines. The implementation of organized sports into required PE courses may provide the solution to adolescent cardiovascular, muscular and motor skill development. This research study was designed to measure intensity and duration of adolescent activity within various sport units taught during PE classes. This study provides recent data detailing the amount of MVPA in each of the three sports being performed, including: flag football, basketball and flag rugby.

Chapter 3

Methods

Participants

One hundred and one male (55) and female (46) physical education students were recruited from a local middle school to participate in this study. Every effort was made to have an even distribution of male and female participants. The age of the students ranged from 11-14 years, their mean age (+/- SD) was 12.01 (0.84) and they were enrolled in grades six through eight. The students of this school are considered upper middle class. School district demographics indicate that the students were primarily White (69%) or Latino (15%), but also included: African-American (6%), Asian (4%) and Native American (<1%). The percentage of students on free or reduced lunches at the time of this study was 20%. The ratio of sixth, seventh and eighth graders are 349, 320, and 404 respectively. The students attending this school must attend a 50 minute PE class each day of the school week.

The participants in the study were chosen based on the class period they attended. To maintain the same participants for each treatment, the class periods were chosen based on one instructor's six consecutive PE classes. The participants in the study were enrolled in the PE instructor's daily class periods. Approximately 12-25 students were chosen from each period (two, three, four, five, six and seven) based on the return of the parental consent and adolescent assent forms. It was important to allow every student to

participate that returned a signed consent form so the study would have a diverse group of adolescents: 6th-8th grade, males and females and ages 11-14. This also increased the chances of maintaining the same participants for each experimental trial.

Each participant was sent home with informed consent forms to have signed by his/her parents and assent forms for each participant to sign. Upon return of forms, the participant was cleared to participate in the research study. Each participant was measured for height and weight. This information was recorded and saved, along with the participant's age and gender and was provided to the researcher on a separate form. These measurements were taken before the first day of data collection and provided the most accurate data for purposes of the study and the accelerometers being used as required for accurate measurement.

Each participant involved in the study followed his/her daily routine for PE class. This class started with dress out, where participants are allowed five minutes to change into their required PE uniforms, then they would sit for roll call. As attendance was taken, the participating students received their accelerometers which, were then activated by the researcher and this began the counting of activity. The student wore the accelerometer for the entire class period and returned them to the researcher at the end of the class period after they completed the activity. The students then completed the eight item based enjoyment and competence scale.

Instrumentation

Variables of interest for this study include: exercise duration, exercise intensity and enjoyment and competence. All physiological-related variables were collected using

the Stayhealthy RT3™ accelerometer (Monrovia, USA). Interest-enjoyment and competence were measured using the two perceived choice subscales of the Intrinsic Motivation Inventory (IMI) (McAuley et. al., 1989; Ryan, 1982). The research design utilized a repeated measure analysis of variance (RMANOVA).

Accelerometers provide objective, nonreactive and reusable tools for assessing PA (Sirard & Pate, 2001). The triaxial accelerometers used in the Sirard & Pate (2001) review suggest these accelerometers perform equally well on children and adolescent subjects. These devices are clipped to the waistband at the hip level or worn as a belt and function to detect triaxial (forward, lateral, and vertical) movement. It measures the acceleration of bodily movement in three directions, vertical (X), anterior– posterior (Y) and medio–lateral (Z), converting this movement into raw counts (Hendrick, Bell, Bagge, & Milosavljevic, 2009). Each use of the accelerometer requires calibration and programming before activity and data downloading after the completion of activity. Additionally, data that is obtained from accelerometers must be filtered and analyzed to create data points that allow for determination of exercise intensity and energy expenditure. These accelerometers are designed to detect both the patterns of PA and total activity (Sirard & Pate, 2001).

Although there were some errors, or glitches with the data, accelerometers were chosen as reliable instruments for collecting data within this specific population. Accelerometers can be easily positioned on the clothing of the adolescent. Accelerometers are also known to detect various intermittent activity patterns, characteristically applying to the adolescent (Trost, 2001). The findings from Trost

(2001) suggest that three-dimensional accelerometers provide better evaluations of free play activities in children than heart rate monitors and uniaxial accelerometers.

Interest-enjoyment and competence were measured using the two perceived choice subscales of the Intrinsic Motivation Inventory (IMI) (McAuley et. al., 1989). This scale included four items designed to assess interest-enjoyment of recently completed physical activity and four items that assess the participant's perceived competence in each activity. Scaling for the items uses a seven-point Likert scale that allows respondents to indicate agreement with statements regarding enjoyment of the activity and perceived competence in the activity (McAuley, Duncan, & Tammen, 1989). This measurement scale provided the following choices for a response to each statement: 1-"not true at all," 2-3 "not true," 4-"neither true or not true," 5-6-"true" and 7-"very true" (see Appendix C).

The IMI was chosen as a reliable means of assessing an individual's level of intrinsic motivation for physical activity as it relates to the underlying dimensions of interest-enjoyment and perceived competence (McAuley et. al., 1989). Reliability of the measures used in this study were determined by the coefficient alpha for interest-enjoyment at (0.84) and perceived competence at (0.80) (McAuley et. al., 1989). Therefore, it was chosen as a valid instrument to be used in this current study. The reliability of the scale used in the previous study is such that redundant items can be excluded for a shorter version (McAuley et. al., 1989). For the purposes of this study, redundant and negatively worded items were eliminated. Therefore, the final questionnaire became four positively worded statements related to enjoyment and four

positively worded statements related to competency. Adolescents were asked to complete these forms directly after performing the activity, therefore it was important to keep the forms short and unambiguous for the participant.

Procedures

Informed consent forms were provided to the parents of the students that were asked to participate in the study. The students also received Assent forms and were asked to sign them if they agreed to participate in the study (see Appendix D). Permission from the school, PE instructor and the county were required by the University of South Florida (USF) Institutional Review Board (IRB). The approval forms were then submitted to the IRB for consideration of the proposed study.

Collection of research data took place in the gymnasium and on the activity field at an area middle school. There were approximately 12-25 students observed as test participants during each physical education class. Among these students were 55 males and 46 females, combing for a total of 101 students. These students were measured with tri-axial accelerometers, which measure movement within the three bodily planes, including frontal, sagittal and transverse. Upon arrival for class, students were equipped with the RT3 accelerometers during attendance. The accelerometers were activated immediately before clipping to each waistband. They were worn for the entire class period. At the end of the class period, students were asked to circle the appropriate answer on the interest-enjoyment/competency form indicating how much they enjoyed the activity and how well they felt they performed. This likert type scale chosen by the researcher included only positively worded statements.

Before data collection, each accelerometer was calibrated for the upcoming class period. Thereafter, each time a participant returned the accelerometer, the interest-enjoyment/competence forms were collected and the data from the accelerometer was downloaded and saved. The recording of data was an average of about 40 minutes. Upon completion of the class period each student returned the RT3 unit for data downloading. The research team was on site with two laptop computers and two docking stations, to facilitate the computer interfacing required before and after the activity. The data was downloaded and analyzed for an accurate detailing of MVPA duration. The research team interacted with the students and the PE instructor within only the context of data collection and did not offer any instructional cues or otherwise engage in any student discussions related to the activity or research project. This sequence was enacted for each of the three experimental conditions.

Data collection required three school days; one for each sport activity. Additionally, piloting of the data collection required one extra visit for one class period. In the early stages of development of the study, it was thought that six days of data collection would occur and would be limited to three periods of PE class (every other class) for each day. Three days of collection were found to be appropriate for this age group as it is difficult to measure the same students for each sport performed on separate days. The school schedule is known to have interruptions as students may be attending various field trips and school functions and are also known to be absent on occasion, due to illness or injury. Therefore, it is not expected that every student enrolled in a class will be present at every meeting.

Interest-enjoyment/competence-related data collection took place using questionnaires printed on cardstock (thicker paper) directly following the PE class as accelerometers were returned for data download and calibration. The three experimental conditions for this study include: flag football, flag rugby and basketball. Participants were chosen based on one school instructor's class periods for any given weekday. The students were asked to participate in their regular class period in the sport unit they had recently completed (learned skill, practiced and performed). The class periods chosen were assigned by the instructor. Each student participated in each one of the sports on different occasions, equaling three class periods.

All experimental conditions were assessed in an area they were familiar (outdoor activity field) with their existing physical education instructor. The instructor has been trained to deliver each sport. The middle school physical education class in this district is 50 minutes in length, but game playtime is typically limited to approximately 40 minutes due to the changing of clothes and required attendance. This study included 6th-8th graders. The sixth grade students do not "dress out" (change clothing) but do a warm up walk while the others are dressing. All seventh and eighth graders are required to dress out and are allowed five minutes to do so. Next, roll call is taken. On a typical day all students from each instructor's class will do calisthenic activities for five minutes. The classes are then dismissed to attend their sport unit. During the days of data collection, the calisthenics were skipped so the participating students could separate and begin playing their sport. Each day of data collection, the sport activity was completed in this manner and all sports were played outside. The sixth grade students were attending the

following periods: two, five, six and seven. The seventh and eighth grade students attended third and fourth periods.

During the researchers visit to the school PE class, it was observed that the PE instructors allowed games that were small sided (four on four or three on three). The smaller the teams, the more active the participant. The PE instructors were quick to set up the games, observed and corrected students when needed and encouraged all students without much disruption of game play time. As previously noted in the research, the PE instructor plays an important role in the activity of the students (Ferrer-Caja & Weiss, 2000). This is important to note as the PE instructor chosen for this sample of students was well prepared, organized and seemed to be well respected by the students of her class. During observation it was noticed that she was thorough in instruction and managed the students by observing, correcting and providing encouragement. The PE instructor for this sample had 30 years experience with 10 years at this particular location.

Upon completion of the PE class, the students returned the accelerometer to the researcher. The accelerometer was then placed into one of two docking stations that were attached to each of the laptops being used. The data was then downloaded and saved into a separate file for each class period for each sport. When all data was collected, Statistical Package for the Social Sciences (SPSS) software was used to organize and analyze the results of the study. If a participant missed any of the three sports, the participant was dropped from the study. After completion of data entry, to be sure each student attended each sport, the names of the students were then deleted.

For the flag rugby unit, the Rugby Association provided additional instruction to the participants on Tuesday and Wednesday the week of flag rugby data collection. For the purposes of this study, flag rugby was chosen as an alternative sport for the school district's requirements. Therefore, it was important that the participants had additional instruction in order to provide the participant with similar instruction time as dedicated to the other sports.

Statistical Analysis. Repeated measures analysis of variance (RMANOVA) was the primary statistical test for this research design. The independent variable for this research study was the type of sport activity (flag rugby, basketball or flag football) and the dependent variable was the intensity of play, duration and level of enjoyment and competence during physical activity. Separate RMANOVA's were run for each dependent variable. Criterion for significance for all tests was set at $p < 0.01$. The sample size was based on power calculations and related literature.

Chapter 4

Results

Local middle school students attending PE class were measured for physical activity intensity and duration in three sports on three separate, non-consecutive days (separated by sport unit). This study was designed to understand activity patterns related to playing sports in PE class. The results of this study suggest a strength in reliability of the chosen IMI used to measure interest-enjoyment and competence for adolescents. Analysis of the two subscales by way of the Cronbach's alpha reliability statistics scores indicates excellent reliability (see Table 1 below).

Table 1

Internal Consistency of Enjoyment and Competence Subscales of Intrinsic Motivation Inventory by Sport Type

Sport	**Enjoyment**	**Competence**
Flag Football	0.94	0.90
Basketball	0.95	0.93
Flag Rugby	0.97	0.94

Cronbach's alpha reliability coefficient normally ranges between 0 and 1.0. The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale (Gliem & Gleim, 2003). Therefore, suggesting that when the student stated, for example he/she "enjoyed the sport," he/she also thought "it was fun to do." This means that the items were highly related to each other. In this study, the reliability

was consistently above (0.70) which is considered reliable. Therefore, the two subscales used in this study were considered to have excellent reliability.

The results of this study indicate that there is a significant difference in MVPA within the game play of flag rugby and that of flag football and basketball. Of the 101 participants, mean MET values were measured and moderate values were chosen as 3.0 to 5.9 METs, whereas, vigorous values were designated by 6.0 or greater. Flag football mean MET values were 4.93 ± 1.35 (Mean ± SD). Basketball mean MET values were 5.51 ± 2.74. Flag rugby mean MET values were 6.02 ± 1.52. These results indicate a significant difference between flag football and basketball ($p = 0.023$) and flag rugby and flag football ($p < 0.001$), but no significant difference between basketball and flag rugby ($p = 0.109$).

Table 2

Mean Performance Scores for Sports Participants

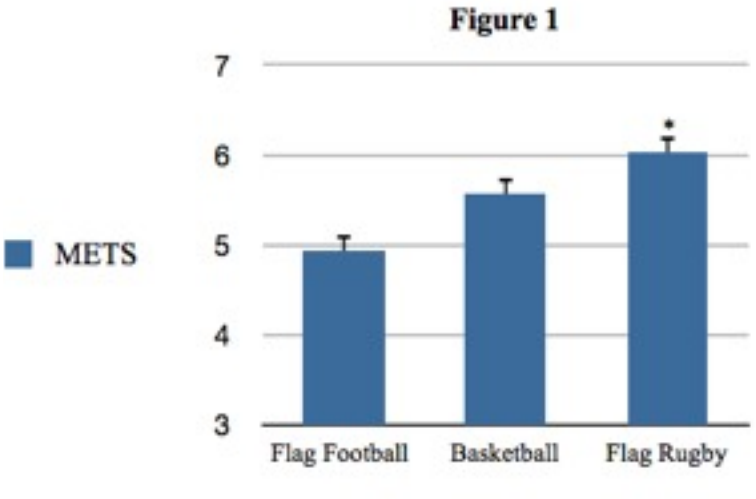
Variable	**Flag Football**		**Basketball**		**Flag Rugby**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
MET	4.93	1.35	5.51	2.74	*6.02	1.52
Duration	39.26	4.78	40.55	5.92	*41.76	4.84
Enjoyment	5.38	1.69	*5.21	1.80	*6.24	1.59
Competence	5.26	1.56	*5.21	1.68	*6.00	1.46

Note. (*) indicates a significant difference in mean MET values and duration between flag rugby and flag football and a significant difference in enjoyment and competence between flag rugby and basketball and flag rugby and flag football, with a p-value of less than 0.001

Results of the study indicate that the participants physical activity was in vigorous ranges (6.02 ±1.52) METs during flag rugby game play. Flag football produced an average stimulus in the moderate range (4.94 ± 1.35) of MET values. Basketball produced a stimulus at the higher end of the moderate range (5.57 ± 2.74) of MET values (see Figure 1 below). There was a significant difference in mean METs between flag football and basketball play, ($p = 0.023$). There was not a significant difference in mean METs between basketball and flag rugby play ($p = 0.109$). However, there was a significant difference ($p < 0.001$) between the flag rugby and flag football game play.

Figure 1

Mean MET Performance and Standard Error Values



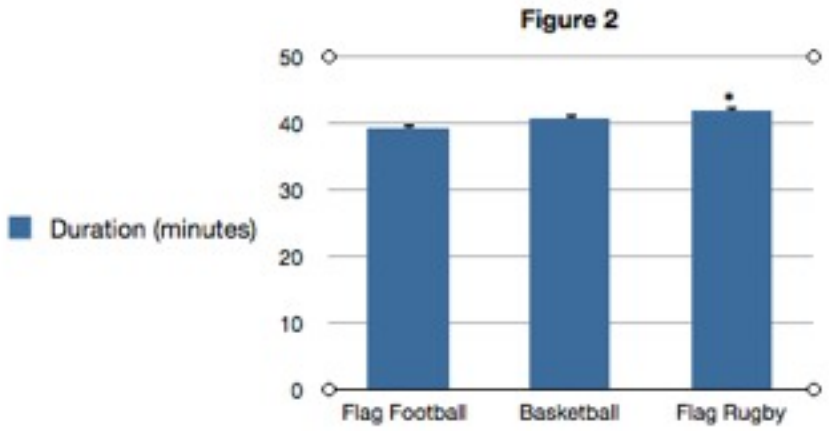
Note. (*) indicates a significant difference between flag rugby and flag football with a p-value less than 0.001.

In this study, flag football produced an average duration of activity of 39.26 ± 4.78, basketball 40.55 ± 5.92 minutes and flag rugby 41.76 ± 4.84 minutes of activity (see figure 2 below). There was no significant difference between duration of flag football and basketball activity ($p = 0.080$). There was no significant difference between

basketball and flag rugby ($p = 0.098$). However, there was a significant difference between flag rugby and flag football durations ($p < 0.001$).

Figure 2

Mean Activity Duration and Standard Error Values

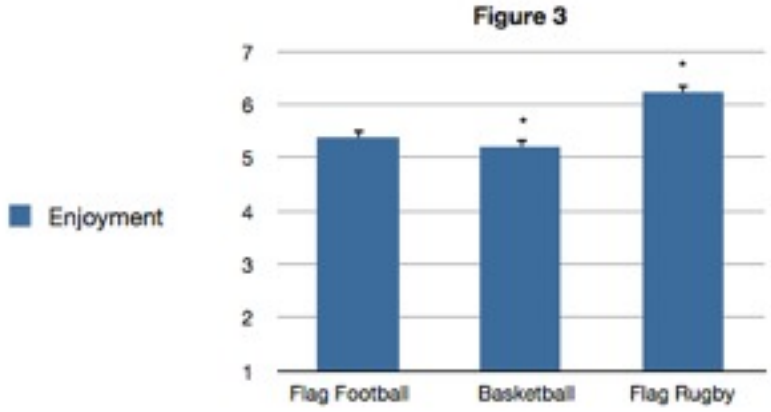


Note. (*) indicates a significant difference between flag rugby and flag football with a p-value less than 0.001

Results from the interest-enjoyment subscale of the IMI found that participants were interested and enjoyed flag rugby play (6.24 ± 1.59) significantly more than flag football (5.38 ± 1.69), at ($p < 0.001$) (see Figure 3 below) They also found flag rugby to be more enjoyable than basketball (5.21 ± 1.80) at ($p < 0.001$). However, there was no significant difference between enjoyment of basketball and flag football ($p = 0.481$).

Figure 3

Mean Enjoyment and Standard Error Values

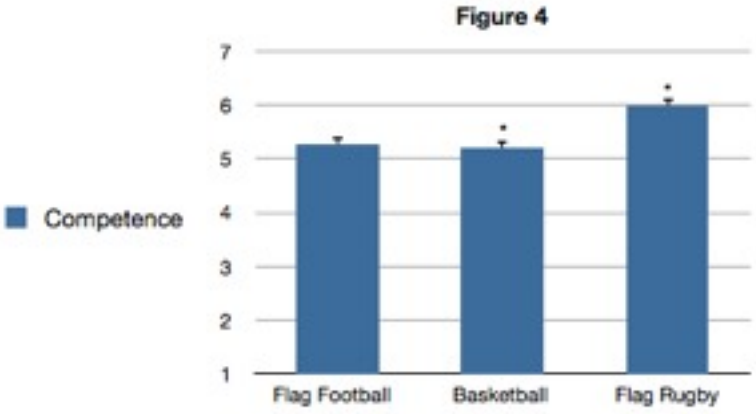


Note. (*) indicates a significant difference between flag rugby and basketball and flag rugby and flag football with a p-value less than 0.001

Results for the competence subscale of the IMI found participants felt significantly more competent playing flag rugby (6.00 ± 1.46) than flag football (5.26 ± 1.56) ($p < 0.001$) (see Figure 4 below). There was also a significant difference in competence between flag football and basketball (5.21 ± 1.68) ($p < 0.001$). However there was no significant difference between flag rugby and basketball ($p = 0.827$) competence.

Figure 4

Mean Competence and Standard Error Values



Note. (*) indicates a significant difference between flag football and basketball and flag rugby and flag football with a p-value less than 0.001

Chapter 5

Discussion

The rates of childhood overweightness and obesity have become a topic of concern for the nation. As PE requirements become less restrictive at the middle school level, the rates of PA have declined in adolescents (Pate et. al., 2006). It is important to understand activities adolescents enjoy. Research suggests that enjoyment is related to adherence (Ferrer-Caja & Weiss, 2000). Sports play is known to be more interesting for the adolescent (Perkins & Noam, 2007). Some sports activities are taught at an early age, with skill development improving over time. Other sports are simply easy to learn, such as flag rugby and while, skill development can be improved, it is a sport all ages can learn (Mathesius & Strand, 1994). PE classes appear to be more popular when adolescents are taught various sports activities that maintain their interest (Pate et. al., 2006).

The first null hypothesis states there will be no significant difference between flag rugby, flag football, and basketball mean MET values. Results from the repeated measure analysis of variance (RMANOVA) find there is, in fact, a significant difference between flag rugby and that of flag football and/or basketball ($p < 0.001$). The most significant difference was between flag rugby and flag football ($p < 0.001$). In this case the null hypothesis has been rejected.

The second null hypothesis states there will be no significant difference between duration of flag rugby and flag football or basketball play. Results from the RMANOVA find a significant difference between flag rugby, flag football and basketball ($p = 0.003$). Therefore the second null hypothesis has been rejected.

The third null hypothesis states there will be no significant difference between interest-enjoyment of flag rugby, flag football or basketball play. The RMANOVA finds there is a significant difference between flag rugby, flag football and basketball enjoyment ($p < 0.001$). Therefore the null hypothesis has been rejected.

The fourth null hypothesis states that there will be no significant difference in feelings of competence between flag rugby, flag football or basketball play. Results from the RMANOVA find that there is a significant difference in competence between flag rugby, flag football and basketball ($p < 0.000$). Therefore, the null hypothesis has been rejected.

This research study is consistent with the findings from the 2006 study by the CDC (Lee, Burgeson, Fulton & Spain, 2006); attaining 40 minutes of activity is possible, given the appropriate choice of activity for the student. Although, it has been found that students typically engage in moderate to vigorous physical activity (3.0 to 5.9 METS) less than 40% of a typical PE class period, this was not the case for the students within this sample (Simons-Morton et. al., 1994).

During collection of the final day of the flag rugby sport, many students vocalized enjoyment toward this sport. Because it is a relatively new sport, a limitation to the study was that the student may find more interest in play of the sport. The school district in this

study requires students to learn many types of sports activities to facilitate the process of finding sport activities students may most enjoy. Research suggests that PE courses should be designed to seek the interest of the adolescent, thereby contributing to the maintenance of activity (Pate et. al., 2005).

PE Instruction:

As previously stated, allowing students to engage in game play increases PA levels more than modifying the structure of the class (McKenzie et. al., 2004). It appears that not only can MVPA be increased by such game play and less instruction, MVPA is more likely to occur during game play rather than interrupted instruction (McKenzie et. al., 2004). The current sample used in this study, followed curriculum required by the county school district. The school district requires instructors to teach individual and team sports during the two semesters of each year. This allows the student more variability in finding a sport in which he or she may find enjoyable while, also allowing students to learn, practice and play various sport activities. For example, the PE instructor is given a list of required sports to teach the student during the school semester as well as alternatives to these sports. Therefore, it is at the discretion of the PE instructor to choose the sports from the list that he/she is comfortable teaching. Each sport is taught in the first week, practiced (skill development) the second week and then played for the third week, equalling one sport unit.

During the first day of observation, there were a couple of unexpected interruptions that may have affected the duration of activity in some periods. Most of the accelerometers were pre-programmed before the first day of data collection. As each

student turned in the required consent, assent and the demographic information forms his/her information was entered into an excel sheet for the class period in which the participant was enrolled. Therefore, most of the second period's accelerometers were programmed with the participants height, weight, age and gender before the beginning of class. A majority of the participant's in the study had information saved in an excel file before the first day of collection. Some students turned in their consent forms the day of collection so, this slowed the process somewhat. For these students, entering the demographic information was done after the intern onsite, weighed and measured the student during attendance and sent the participant to the research team to be fitted with an accelerometer. Once this information was entered, it was saved into the excel file for the next sport so that it would be easier to program the information before measurement of the next two sport units.

Although, this study was not seeking total duration of activity solely, it is important to note for research. Because the PE instructor's first class was second period, this was the first period of activity measurement. During the first day of data collection there was a fire drill at the beginning of the second period class. The participants had to evacuate the gymnasium for this purpose, therefore, some time was unaccounted for toward the duration of activity during this transition. There was also some time during the third and fourth period that a volunteer on the research team observed another instructor teaching the class. However, there is no explainable difference in the data from the accelerometer suggesting that this instructor manipulated the time spent in game play. It is thought that the instructors all went through a period of about 5 minutes of revisiting

the rules of the game before allowing game play. It is important to note that this may only have happened in two periods (third and fourth) because the other instructor was teaching the same sport unit at the time this was observed.

It was speculated there would be a need for an entire class period time to download data and upload new data for the next period's students. However, because the researcher and a volunteer learned to use the equipment they were able to effectively download the activity of each student while also entering the new information for next group of students. This was completed within the five minute dress "in" and "out" time totaling ten minutes.

It is difficult to obtain the consent forms from parents and students. Instead of restricting the sample to these students, it was decided that it would be more important to measure as many students as possible, from all class periods. This was not only a strength of the study but also a weakness to the study as this idea to measure students in all periods was decided among the committee a week prior to the first day of data collection. This didn't provide much time for consent and assent form return for other three periods that were not previously chosen. However, a strength of the study was the allowance for participation of all students from various periods during the entire school day. Collection of data from the same participants in each sport and maintaining those that were attending the same instructors class was another strength of the study. This limited confusion, saved time and provided accurate body composition and demographic information. The study also kept the same volunteers for each activity. Utilizing the same participants, instructor, procedures and volunteers made the process more efficient,

as all involved understood their role in the collection process, resulting in smooth transitioning time between classes. This is important to note for future studies. Piloting and learning how to use the equipment were important in this study. Errors and glitches were expected and handled appropriately and timely due to the additional experience.

There were two exceptions when extra volunteers were present. There was an intern onsite the first day of collection. The last day of collection, during the first two periods there were two Rugby association representatives were present. It is believed that the Rugby association representatives did not influence the participants but there is no way of knowing if they affected the interest-enjoyment/competence measures the participants completed. It is thought the students may have felt more competent in this sport because it was easy to learn, they found it be fun and understood the rules. The PE instructor stated that it was easy to teach flag rugby to the students and that they enjoyed learning the unit.

While analyzing the data, it was easy to notice patterns of motion in each participant. It is important to note, the accelerometer cannot be stopped by the participant. The accelerometer counts can only be downloaded from the accelerometer on the docking station, which is attached to a computer for this process. There was only one time the accelerometer fell off of a student and the battery fell out causing the loss of data. The accelerometer was reliable in that students could not manipulate any data. This may also be important to note for future studies in adolescents and children, suggesting the accelerometer is a reliable instrument for measuring this population.

At the end of the first day of collection, it was noted that sometimes the accelerometer did not properly delete the information from one student to the next, this error was found primarily in seventh period. This may have also been partly due to the immediate need of the researchers to download one participant's data and upload information on the next student. For period seven, five students names were copied from period six. After all data collection was observed, two of these students were dropped due to missing a class and the other three were found based on their demographic information and completion of the enjoyment and competence scales. For future research, it is important to write down the number of the accelerometer on each participant on a sheet of paper. During the basketball and flag rugby units, students were easily found when referring to this extra sheet of paper. Another strength of the study was having the participant circle their class period (indicated on the interest-enjoyment/ competence form) as well as to write their last name this form. This also was kept the information accurate. This made it easy to match participant data with the interest-enjoyment/competence forms. The names of the students were no longer important after the statistical data was entered and analyzed and so were deleted.

In this study the participants were required to surrender the accelerometers immediately following exercise. This made it easier for the researcher to analyze the duration of the physical activity. As the counts stopped the average was taken from minute one for every participant and stopped at the end of activity counts. The counts were then averaged based on minute one to the end of activity for each participant. This

may be important for future studies as all activity began at the same time but activity of each student did not end at the same time.

Currently there is no one study found to be identical to this study. It should be noted that past research indicates sports play in PE class is known to increase PA while also found to be enjoyable for the participant (McEwin & Swaim, 2009). The results of this study indicate that adolescents enjoy playing sports such as, flag football, basketball and flag rugby. Even though flag football wasn't enjoyed as much, participants were still at moderate intensities for an average of 39 minutes, meaning that sports play is enjoyable. As previously indicated in this study, adolescents may have performed PA for longer durations and intensities when they enjoyed the sport. This study concludes that adolescents in the three sports were maintaining MVPA levels and exceeding the duration required by the CDC, ACSM and NASPE.

This research study contributes to research as it details the behaviors of adolescents physical activity patterns in PE classes. As a suggestion for future studies, it would be important to measure and analyze other sports. Some other sports may be more appealing to females. The difference between middle school male and female activity based on sport enjoyment may be another variable for future studies. This research study did not detail the behaviors between genders but would have the necessary statistics to do so. The purpose of this research was to measure activity in popular organized sports game play. Moderate to vigorous physical activity, duration of activity, and enjoyment and competence during activity were all important variables that may contribute to understanding the patterns of physical activity in adolescents.

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Appendix A

Student Activity

Category	Lesson Minutes					
	Baseline (*N* = 430)		Year 1 (*N* = 711)		Year 2 (*N* = 708)	
	I	C	I	C	I	C
Student activity						
Lying down	0.2 (0.2)	0.6 (0.7)	0.1 (0.1)	.1 (0.1)	0.1 (0.1)	0.1 (0.1)
Sitting	6.5 (1.9)	5.3 (3.2)	5.1 (1.8)	5.8 (2.5)	4.8 (1.8)	5.7 (2.4)
Standing	11.3 (2.9)	12.0 (2.5)	11.5 (2.3)	12.1 (2.3)	13.0 (2.7)	12.4 (2.3)
Walking	11.6 (2.5)	11.5 (1.5)	13.6 (2.1)	12.4 (2.0)	14.3 (2.3)	11.9 (2.3)
Very active	4.9 (1.8)	5.0 (0.7)	5.3 (1.5)	4.6 (1.2)	5.2 (1.0)	5.0 (1.2)
*MVPA	16.6 (3.4)	16.5 (1.4)	19.0 (3.3)	17.0 (2.1)	19.5 (3.1)	16.9 (2.1)
Lesson context						
Management	9.4 (1.2)	9.3 (2.2)	9.7 (1.0)	10.2 (2.0)	11.0 (2.5)	10.9 (2.3)
General knowledge	1.8 (1.4)	1.9 (1.5)	1.9 (1.5)	2.1 (1.0)	1.8 (0.9)	1.7 (1.0)
Fitness know	0.1 (0.1)	0.1 (0.2)	0.1 (0.1)	0.1 (0.2)	0.0 (0.0)	0.2 (0.5)
Fitness activity	10.2 (3.9)	6.6 (2.7)	9.0 (3.8)	7.4 (2.2)	8.0 (3.4)	7.7 (2.9)
Skill drills	1.5 (1.3)	2.1 (1.3)	3.3 (2.3)	2.6 (1.4)	2.9 (3.0)	1.8 (1.0)
Game play	9.3 (5.1)	10.6 (4.9)	9.3 (2.6)	9.9 (3.6)	10.2 (5.2)	8.9 (5.5)
Free play	1.1 (2.5)	3.5 (2.8)	2.4 (1.7)	2.9 (2.6)	3.5 (2.9)	3.9 (6.0)
Lesson factors						
Length (min)	34.5 (4.0)	34.0 (4.9)	35.7 (4.2)	35.0 (4.0)	37.4 (5.1)	35.2 (4.3)
Class size (no. students)	35.9 (3.1)	37.8 (4.2)	35.1 (4.4)	39.2 (4.7)	37.3 (3.9)	39.0 (5.6)
Observed per school	17.9 (1.4)	17.9 (1.0)	29.2 (1.5)	30.0 (1.1)	30.1 (1.5)	28.8 (2.9)

N refers to number of lessons observed. MVPA, moderate-to-vigorous physical activity (walking + very active). Class size is the count of students participating during a lesson.
* indicates a time × condition interaction $P < .05$.

Appendix B

Physical Activity Performance

Figure 1. Probability that physical activity performed during selected categories is exercise

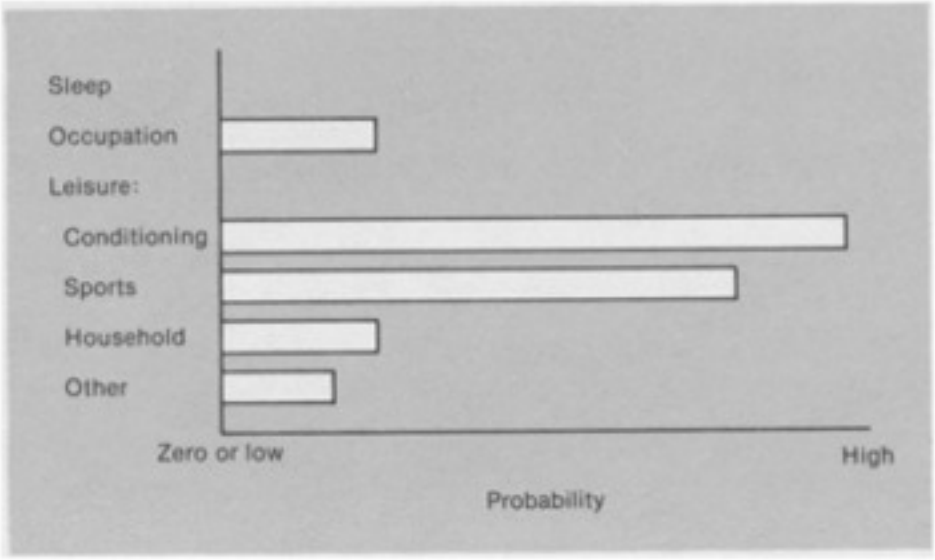
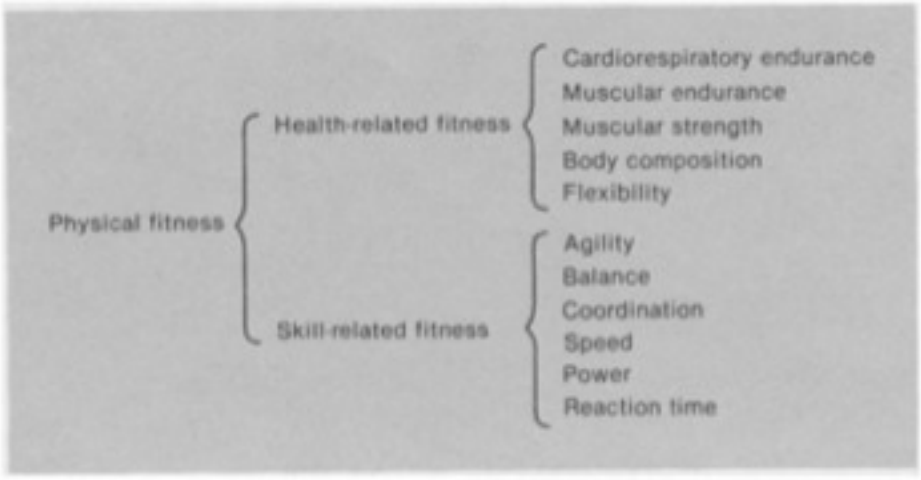


Figure 2. Components of physical fitness



Appendix C

Interest-Enjoyment/Competence Scale

For each of the following statements, please indicate how true it is for you, using the following scale:

Interest/Enjoyment	not at all true			somewhat true			very true
I enjoyed doing this activity very much.	1	2	3	4	5	6	7
This activity was fun to do.	1	2	3	4	5	6	7
I would describe this activity as very interesting.	1	2	3	4	5	6	7
I thougth this activity was quite enjoyable.	1	2	3	4	5	6	7
Perceived Competence							
I think I am pretty good at this activity.	1	2	3	4	5	6	7
I think I did pretty well at this activity, compared to other students.	1	2	3	4	5	6	7
After working at this activity for awhile, I felt pretty competent.	1	2	3	4	5	6	7
I was pretty skilled at Rugby.	1	2	3	4	5	6	7

Appendix D

Consent/Assent Forms

Parental Permission to Participate in Research Involving Minimal Risk

Information for parents to consider before allowing their child to take part in this research study

IRB Study # _____03299____

The following information is being presented to help you and your child decide whether or not your child wishes to be a part of a research study. Please read this information carefully. If you have any questions or if you do not understand the information, we encourage you to ask the research.

We are asking you to allow your child to take part in a research study called:
A Comparison of Sports Activities During Physical Education Classes

The person who is in charge of this research study is Marcia Patience. This person is called the Principal Investigator. However, other research staff may be involved and can act on behalf of the person in charge. She is being guided in this research by Marcus Kilpatrick, Ph.D.

The research will be conducted at _____Middle School

This research is being sponsored for by More Health.

Why is this research being done?

The purpose of this study is to find out how playing sports in physical education classes may

Why is your child being asked to take part?

We are asking your child to take part in this research study because he/she is in the 6th, 7th or 8th grade at Martinez middle school. The researchers are seeking solutions for keeping children active during physical education class, while at the same time, enjoying what he/she is doing.

Should your child take part in this study?

This informed consent form tells you about this research study. You can decide if you want your child to take part in it. This form explains:

- Why this study is being done.
- What will happen during this study and what your child will need to do.
- Whether there is any chance your child might experience potential benefits from being in the study.

- The risks of having problems because your child is in this study.

Before you decide:

- Read this form.
- Have a friend or family member read it.
- Talk about this study with the person in charge of the study or the person explaining the study. You can have someone with you when you talk about the study.
- Talk it over with someone you trust.
- Find out what the study is about.
- You may have questions this form does not answer. You do not have to guess at things you don't understand. If you have questions, ask the person in charge of the study or study staff as you go along. Ask them to explain things in a way you can understand.
- Take your time to think about it.

The decision to provide permission to allow your child to participate in the research study is up to you. If you choose to let your child be in the study, then you should sign this form. If you do not want your child to take part in this study, you should not sign the form.

What will happen during this study?

Your child will be asked to spend about six non-consecutive hours in this study. Each session will last for an hour, or during his/her typical PE class time. This study will not require any significant changes to your child's daily schedule.

Your child will be equipped with an accelerometer, which resembles a pager. It will be attached to his/her clothing. He/she will be asked to participate in his/her regularly scheduled PE class. Because your child has already been engaging in these particular activities, there will not be any harm or risk to your child. Your child will still be instructed by his/her regular PE instructor.

After each PE class, your child will be asked:

- On the basis of a 5-point likert type scale using "1- agree a lot," "2-agree," "3-neither agree or disagree," "4-disagree" and "5- disagree a lot"
- Questions asked will pertain to enjoyment of the activity, was it fun? Did he/she like the activity? Was the activity interesting to learn or frustrating?
- At the end of the enjoyment scale questions, your child will be asked about his/her perceived level of exertion using the Children's OMNI scale: "0" not tired at all, up to "10" very, very tired.

How many other people will take part?

About 100 individuals will take part in this study at _____Middle School.

What other choices do you have if you decide not to let your child take part?

If you decide not to let your child take part in this study, that is okay.

Instead of being in this research study your child can choose not to participate.

Will your child be compensated for taking part in this study?

You will receive no payment or other compensation for taking part in this study.

What will it cost you to let your child take part in this study?

It will not cost you anything to let your child take part in the study.

What are the potential benefits to your child if you let him / her take part in this study?

We do not know if your child will gain any benefits by taking part in this study.

What are the risks if your child takes part in this study?

There are no known risks to those who take part in this study.

Your Rights:

You can refuse to sign this form. If you do not sign this form your child will not be able to take part in this research study and therefore not be able to receive the research related interventions. However, your child's health care outside of this study and benefits will not change.

How Do I Withdraw Permission to Use My Child's Information?

You can revoke this form at any time by sending a letter clearly stating that you wish to withdraw your authorization to use of your child's health information in the research. If you revoke your permission:

- You child will no longer be a participant in this research study;
- We will stop collecting new information about your child;
- We will use the information collected prior to the revocation of your authorization. This information may already have been used or shared with other, or we may need it to complete and protect the validity of the research; and
- Staff may need to follow-up with your child if there is a medical reason to do so.

To revoke this form, please write to:

Principal Investigator Marcia Patience

For IRB Study # Pr00003299

4202 E. Fowler Ave, PED 214

Tampa, FL 33620

While we are conducting the research study, we cannot let you see or copy the research information we have about your child. After the research is completed, you have a right to see the information about your child, as allowed by USF policies.

Privacy and Confidentiality

We will keep your child's study records private and confidential. Certain people may need to see your child's study records. By law, anyone who looks at your child's records must keep them completely confidential.

The records from this study will be stored in a locked drawer in a secure office for faculty use only.

The only people who will be allowed to see these records are:

- The research team, including the Principal Investigator, study coordinator, research nurses, and all other research staff**.**
- Certain government and university people who need to know more about the study. For example, individuals who provide oversight on this study may need to look at your records. This is done to make sure that we are doing the study in the right way. They also need to make sure that we are protecting your rights and your safety.
- Any agency of the federal, state, or local government that regulates this research. This includes the Food and Drug Administration (FDA), Florida Department of Health, and the Department of Health and Human Services (DHHS) and the Office for Human Research Protection (OHRP).
- The USF Institutional Review Board (IRB) and its related staff who have oversight responsibilities for this study, staff in the USF Office of Research and Innovation, USF Division of Research Integrity and Compliance, and other USF offices who oversee this research.
- The sponsors of this study and contract research organization.
- We may publish what we learn from this study. If we do, we will not include your child's name. We will not publish anything that would let people know who your child is.

What happens if you decide not to let your child take part in this study?

You should only let your child take part in this study if both of you want to. You or child should not feel that there is any pressure to take part in the study to please the study investigator or the research staff.

If you decide not to let your child take part:

- Your child will not be in trouble or lose any rights he/she would normally have.

- Your child will still get the same services he/she would normally have.
- Your child can still have their regular PE class.

You can decide after signing this informed consent form that you no longer want your child to take part in this study. We will keep you informed of any new developments which might affect your willingness to allow your child to continue to participate in the study. However, you can decide you want your child to stop taking part in the study for any reason at any time. If you decide you want your child to stop taking part in the study, tell the study staff as soon as you can.

- We will tell you how to stop safely. We will tell you if there are any dangers if your child stops suddenly.
- If you decide to stop, your child can continue receiving his/her regular PE class.

Even if you want your child to stay in the study, there may be reasons we will need to withdraw him/her from the study. Your child may be taken out of this study if we find out it is not safe for your child to stay in the study or if your child is not coming for the study visits when scheduled. We will let you know the reason for withdrawing your child's participation in this study.

You can get the answers to your questions, concerns, or complaints.

If you have any questions, concerns or complaints about this study, call Marcia Patience at (704)607-5220.

If you have questions about your child's rights, general questions, complaints, or issues as a person taking part in this study, call the USF IRB at (813) 974-5638.

If you have questions about your rights as a person taking part in this research study you may contact the Florida Department of Health Institutional Review Board (DOH IRB) at (866) 433-2775 (toll free in Florida) or 850-245-4585.

Consent for My Child to Participate in this Research Study

It is up to you to decide whether you want your child to take part in this study. If you want your child to take part, please read the statements below and sign the form if the statements are true.

I freely give my consent to let my child take part in this study and authorize that my child's health information as agreed above, be collected/disclosed in this study. I understand that by signing this form I am agreeing to let my child take part in research. I have received a copy of this form to take with me.

_____

_____

Signature of Parent of Child Taking Part in Study Date

_____
Printed Name of Parent of Child Taking Part in Study

The signature of only one parent was obtained because:
☒ The other parent is not reasonable available.
Explain:_____
☒ The other parent is unknown.
☒ The other parent is legally incompetent.
☒ The parent who signed has sole legal responsibility for the care and custody of the child.

Statement of Person Obtaining Informed Consent

I have carefully explained to the parent of the child taking part in the study what he or she can expect from their child's participation. I hereby certify that when this person signs this form, to the best of my knowledge, he/ she understands:

- What the study is about;
- What procedures/interventions/investigational drugs or devices will be used;
- What the potential benefits might be; and
- What the known risks might be.

I can confirm that this research subject speaks the language that was used to explain this research and is receiving an informed consent form in the appropriate language. Additionally, this subject reads well enough to understand this document or, if not, this person is able to hear and understand when the form is read to him or her. The parent signing this form does not have a medical/psychological problem that would compromise comprehension and therefore makes it hard to understand what is being explained and can, therefore, give legally effective informed consent. The parent signing this form is not under any type of anesthesia or analgesic that may cloud their judgment or make it hard to understand what is being explained and, therefore, can be considered competent to give permission to allow their child to participate in this research study.

_____
Signature of Person Obtaining Informed Consent Date

_____
Printed Name of Person Obtaining Informed Consent

Assent to Participate in Research

Information for Persons under the Age of 18 Who Are Being Asked To Take Part in Research

IRB Study # _____03299___

Title of study: A Comparison of Sports Activities During Physical Education Classes

Why am I being asked to take part in this research?

You are being asked to take part in a research study about playing sports in PE. You are being asked to take part in this research study because you have participated in PE regularly enough to meet the requirements of the class. If you take part in this study, you will be one of about 100 people at this site.

Who is doing this study?

The person in charge of this study is Marcia Patience. She is being guided in this research by Dr. Marcus Kilpatrick. Other people who you may see while you are on the study include: Thomas Watterson, Dr. Haichun Sun, Sara Flory and other volunteer undergraduate or graduate students.

What is the purpose of this study?

By doing this study, we hope to learn how much activity is involved in various sports.

Where is the study going to take place and how long will it last?

The study will be take place at Martinez Middle School. You will be asked to participate in three visits which will take about one hour. The total amount of time you will be asked to volunteer for this study is three hours over the next three months.

What will you be asked to do?

- You will be asked to participate in a sport you have recently learned.
- You will be asked to where a clipped object on your gym clothing.
- You will be asked to participate as you normally would in your PE class.
- After participating you will be asked a couple of questions regarding how much you enjoyed playing in each sport.

What things might happen if you participate?

To the best of our knowledge, your participation in this study will not harm you.

Is there benefit to me for participating?

We cannot promise that you will receive benefit from taking part in this research study. However, some people have experienced enjoy some sports more than others.

What other choices do I have if I do not participate?

You have the alternative to choose not to participate in this research study.

Do I have to take part in this study?

You should talk with your parents or guardian and others about taking part in this research study. If you do not want to take part in the study, that is your decision. You should take part in this study because you want to volunteer.

Will I receive any compensation for taking part in this study?

You will not receive any compensation for taking part in this study.

Who will see the information about me?

Your information will be added to the information from other people taking part in the study so no one will know who you are.

Can I change my mind and quit?

If you decide to take part in the study you still have the right to change your mind later. No one will think badly of you if you decide to stop participating. Also, the people who are running this study may need for you to stop. If this happens, they will tell you when to stop and why.

What if I have questions?

You can ask questions about this study at any time. You can talk with your parents, guardian or other adults about this study. You can talk with the person who is asking you to volunteer. If you think of other questions later, you can ask them.

Assent to Participate

I understand what the person conducting this study is asking me to do. I have thought about this and agree to take part in this study.

_____

Name of person agreeing to take part in the study Date

_____

Signature of person agreeing to take part in the study

_____

Name of person providing information (assent) to subject Date