

Florida State University Libraries

Electronic Theses, Treatises and Dissertations

The Graduate School

2004

High School Students Physical Activity Levels in Coeducational and Single Gender Physical Education Settings

James C. Hannon



THE FLORIDA STATE UNIVERSITY

COLLEGE OF EDUCATION

HIGH SCHOOL STUDENTS PHYSICAL ACTIVITY LEVELS IN
COEDUCATIONAL AND SINGLE GENDER PHYSICAL EDUCATION SETTINGS

By

James C. Hannon

A Dissertation submitted to the
Department of Sport Management, Recreation Management, and Physical Education
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

Degree Awarded:
Spring Semester, 2004

The members of the committee approved the dissertation of James C. Hannon defended on February 24, 2004.

Thomas Ratliffe
Professor Directing Dissertation

Doris Abood
Outside Committee Member

Anahita Mistry
Committee Member

Charles Imwold
Committee Member

Approved:

Charles Imwold, Chair, Department of Sport Management, Recreation Management, and Physical Education

The Office of Graduate Studies has verified and approved the above named committee members

This dissertation is dedicated to the memory of my loving mother, Peggy Hannon.
Without her none of this would have been possible.

ACKNOWLEDGEMENTS

This dissertation has been a tremendous learning experience and has helped lay the foundation of my professional future. I could not have successfully completed it without the help and support of a great many people. It was my family, friends, and professors that gave me the support and the strength to carry on in times of difficulty. I want to express my thanks to the following individuals for their encouragement and help during this process.

To my mother and father, thank you for your love and support. To my dear Candi your love gave me strength in times of trouble. To Steve Panton and Orlando Rivero thank you for your assistance with data collection. To Billy Franks and Mahtab Munshi, thank you for your statistical assistance. To Linda Wiggins, Jose Morales, Shelton Crews and all the staff, administration, and students of Amos P. Godby High School, thank you for your cooperation.

To my committee members, Dr. Charles Imwold, Dr. Doris Abood, and Dr. Anahita Mistry, you provided insight through your expertise that strengthened my research. Thank you for all you have done.

To my dissertation director, Dr. Thomas Ratliffe, who encouraged and assisted me in every possible way, I thank you. I respect you not only as a teacher and a mentor, but also as a friend.

Finally, I would like to recognize the Centers for Disease Control - Community Cardiovascular Health Program for providing the funding for this project.

TABLE OF CONTENTS

List of Tables	viii
Abstract	x
1. CHAPTER ONE: INTRODUCTION	1
Statement of the Problem	1
Purpose of the Study	2
Significance of the Study	3
Limitations	4
Assumptions	4
Research Hypotheses	5
Definition of Terms	6
2. CHAPTER TWO: REVIEW OF LITERATURE	7
Adolescent Physical Activity Levels – Current Status and Problems	7
Issues and Concerns with Coeducational and Single Gender Physical Education on Physical Activity Levels	10
Measurement of Physical Activity – Issues and Techniques	15
Coeducational and Single Gender Studies on Physical Activity in Physical Education	18
Conclusions	21
3. CHAPTER THREE: METHODS	23

Participants and Setting	23
Instrumentation	26
Digi-walker Pedometers	26
Observational Recording Instrument	27
Survey Instrument	28
Procedures	28
Statistical Analysis	32
4. CHAPTER FOUR: RESULTS AND DISCUSSION	34
Comparison of Steps per Minute during Game Play by Gender and Race	35
Males versus Females	35
African-American versus Caucasian Females	35
African-American versus Caucasian Males	36
Comparison of Teacher Effect on Students Steps per Minute	37
Female Teacher versus Male Teacher – Coeducational Group	37
Female Teacher versus Male Teacher – Coeducational Split Group	38
Treatment Group Differences in Steps per Minute for each Activity by Gender and Race	39
Female Treatment Group Comparisons	39
Male Treatment Group Comparisons	40
Single Teacher Treatment Group Comparisons	43
Results from Modified Observational Recording Record of Physical Educator’s Teaching Behavior	45
Survey Instrument Results	47
Summary of Results for Research Hypotheses	51
Research Hypothesis One	51
Research Hypothesis Two	52
Research Hypothesis Three	52
Research Hypothesis Four	52
Discussion	53
Activity Levels by Race and Gender	53
Activity Levels in Coeducational versus Single Gender Settings.	54

5. CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS	57
Conclusions	59
Recommendations	60
Recommendations for Future Research	60
Recommendations for Practitioners and Teachers	60
APPENDIX A: PARTICIPANT INFORMATION FORM	62
APPENDIX B: REVIEW BOARD APPROVALS	64
APPENDIX C: INFORMED CONSENT FORMS	67
APPENDIX D: MODIFIED OBSERVATIONAL RECORDING RECORD OF PHYSICAL EDUCATOR'S TEACHING BEHAVIOR	70
APPENDIX E: SURVEY INSTRUMENT	72
APPENDIX F: ACTIVITY LESSON OUTLINES	75
APPENDIX G: PEDOMETER DATA RECORDING SHEET	83
REFERENCES	85
BIOGRAPHICAL SKETCH	91

LIST OF TABLES

1.	Students Age, Height, and Weight by Gender and Race	24
2.	Students Average Body Fat Percent and Body Mass Index with Classifications	25
3.	Students Participating in Flag Football by Setting, Class, Gender, and Race	29
4.	Students Participating in Ultimate Frisbee by Setting, Class, Gender, and Race	30
5.	Students Participating in Soccer by Setting, Class, Gender, and Race	30
6.	Male and Female Students Steps per Minute by Activity	35
7.	African-American and Caucasian Female Students Steps per Minute by Activity	36
8.	African-American and Caucasian Male Students Steps per Minute by Activity	37
9.	Comparison of Student Steps per Minute by Teacher in Coeducational Physical Education Game Play Settings	38
10.	Comparison of Student Steps per Minute by Teacher in Coeducational-split Group Physical Education Game Play Settings	39
11.	Students Steps per Minute during Flag Football Game Play by Setting....	41
12.	Students Steps per Minute during Ultimate Frisbee Game Play by Setting	42
13.	Students Steps per Minute during Soccer Game Play by Setting	42
14.	Female Teachers Students Steps per Minute during Flag Football Game Play by Setting	43

15.	Female Teachers Students Steps per Minute during Ultimate Frisbee Game Play by Setting	44
16.	Female Teachers Students Steps per Minute during Soccer Game Play by Setting	44
17.	Average Teacher Verbal Interaction per Class of Flag Football by Gender and Race	45
18.	Average Teacher Verbal Interaction per Class of Ultimate Frisbee by Gender and Race	46
19.	Average Teacher Verbal Interaction per Class of Soccer by Gender and Race	46
20.	Students Feelings towards Coed and Single Gender Physical Education...	47
21.	Students Most Preferred Activity	48
22.	Students Feelings towards Flag Football, Ultimate Frisbee, and Soccer ...	48
23.	Students Feelings towards Team Sport and Individual Activities	50
24.	Students Feelings towards Activity Choice, Dressing Out, and Hard Exercise	51

ABSTRACT

Interviews conducted with teachers and students suggest that girls may accumulate more physical activity receiving physical education class separate from boys. Few studies have actually measured student's physical activity levels in coeducational and single gender settings. The purpose of this study was to investigate the effects of coeducational and single gender game play settings on the activity levels of African-American and Caucasian, male and female high school physical education students. Participants were 209 students enrolled in six physical education classes at an ethnically diverse, low to middle socioeconomic, Northwestern Florida high school. Three experienced physical education teachers, one female and two males, conducted all classes. Students participated in the schools regular team sport curriculum of flag football, ultimate Frisbee, and soccer. Two coeducational classes remained coeducational during game play, two coeducational classes were split into male and female teams for game play, one class was exclusively females-only, and one class was exclusively males-only throughout the study. Digi-walker pedometers were worn by students and used to monitor activity levels during 30 minutes of game play in each physical education class over six lessons in each team sport unit. Results indicated that boys were more active than girls in each activity regardless of setting. Caucasian males were more active than African-American males, and Caucasian females were more active than African-American females. Contrary to expectations, there were no differences in activity levels for girls (overall and by race) in this study between coeducational and single gender flag football, ultimate Frisbee, and soccer game play settings. Contrary to expectations, male students were less physically active in males-only than coeducational and coed-split ultimate Frisbee and soccer game play. Lower activity levels of African-American males made a significant contribution to these differences. Teacher interaction

rate may have contributed to the differences or lack of differences between groups, particularly in the males-only setting. Survey results indicate that team sport preferences by gender and race may have contributed to differences in overall activity levels. Implications of coeducational and single gender physical education are complex and need further study.

CHAPTER ONE
INTRODUCTION

Statement of the Problem

Low levels of physical activity have been reported in a growing number of children and adolescents, with this problem being most prevalent among preadolescent and adolescent girls (Sallis, Prochaska, & Taylor, 2000). A recent study by Sallis, McKenzie, Alcaraz, Kolody, Faucette, and Howell (1997) showed that as early as 4th and 5th grade, girls show less baseline levels of physical activity than boys. The U.S. National Risk Behavior Survey conducted in 1990 assessed more than 11,000 students in grades 9 through 12 on the criterion of vigorous activity for at least 20 minutes per day and a minimum of three days per week. Results showed that the proportion of girls who were active varied from 31% in 9th grade down to 17% in 12th grade. Conversely, 50% of all boys met the physical activity criterion (Heath, Pratt, Warren, & Kann, 1994). Bradley, McMurray, Harrell, and Deng (2000) reported beginning in the seventh and eighth grades, more than half of girls (55.7%) reported mostly sedentary activities. This percent increased with each grade through high school.

As startling as the lack of physical activity is among female youth, even more startling is the fact that African-American female adolescents tend to be the most inactive among all sub-populations of female youth (Sopko, Obarzanek, & Stone, 1992). Several studies have identified African-American women as being the least active with reported rates of obesity as high as fifty percent (Ainsworth, Keenan, Strogatz, Garrett, & James, 1991; Gillum, 1987; Liu et al., 1989; Washburn, Kline, Lackland, & Wheeler, 1992; Wing et al., 1989). Recently, African-American females have been identified as the least active

among high school students (Centers for Disease Control and Prevention, 1996; Kim et al., 2002). The Centers for Disease Control and Prevention (1992) reported that the rate of moderate to vigorous physical activity was lower in African-American girls (17.4%) than Caucasian girls (27.5%), and Latino girls (20.9%). Bradley et al. (2000) reported beginning as early as the fourth and fifth grades, African-American girls reported being sedentary more than Caucasian girls (47.54% vs. 37.5%), maintaining this pattern through the ninth and tenth grade year (77.78% vs. 60.22%). Unfortunately, the amount of research on African-American adolescent females' activity levels is limited. This could be due in part to the fact that reasons for the decrease in physical activity among all female adolescent groups is complex and still under question.

It has been hypothesized that the perceived lack of physical activity could be related to unpleasant experiences in the physical education setting (Taylor, Yancy, Leslie, Murray, Cummings, Sharkey, Wert, James, Miles, & McCarthy, 1999). Research indicates this is particularly true among adolescent females in co-educational physical education classes (Osborne, Bauer, & Sutliff, 2002; Taylor et al., 1999). Researchers and teachers have begun to question whether girls may benefit from having physical education separate from boys (Olafson, 2002; Osborne et al., 2002; Taylor et al., 1999). The idea that single gender physical education classes may result in greater participation for female students has gained a considerable amount of attention (Davis, 2000). In order to assess whether single gender classes would increase physical activity levels, studies that use reliable and valid measurement tools are needed.

Purpose of the Study

The purpose of this study was to compare activity levels, as measured by pedometer steps per minute, of high school aged Caucasian and African-American females and

males participating in coeducational and single gender settings during ultimate Frisbee, soccer, and flag football team sport activity units.

Significance of the Study

It has long been recognized that physical education has the potential to influence students' physical activity levels (Sallis & McKenzie, 1991). Since the mandating of coeducational classes as a result of Title IX, researchers have hypothesized that girls low activity levels may be a result of unpleasant experiences in physical education related to lack of enjoyment, and lack of opportunity due to male dominance (Carroll & Loumidis, 2001). Interviews conducted with both physical education teachers and students indicate that girls may accumulate more physical activity receiving physical education class separate from boys (Osborne et al., 2002; Taylor et al., 1999).

Few studies have actually measured student's physical activity levels in coeducational and single gender settings in physical education (McKenzie, Prochaska, Sallis, and LeMaster, in press; Schmitt, 2002). Those studies conducted, including a pilot study conducted by the researcher; indicate that girls receive more physical activity in coeducational versus single gender settings. Results also indicate boys receive similar amounts of physical activity regardless of the setting. No studies to date have assessed the physical activity levels of African-American students in coeducational and single gender groupings. No studies to date have followed separate groups of students across several activity units. It is possible that physical activity levels will vary depending upon the type of activity students are participating in. It is also possible that there will be differences in activity levels between Caucasian and African-American students. Therefore, a study that collects and analyzes physical activity measures of African-American and Caucasian students across several activity units in coeducational and single gender groupings is significant in that it would add to the limited available research data.

This study is also significant in that it would aid in determining the most effective grouping strategies across several team sport activities for maximizing student's physical activity levels. This study also has implications for effective teacher training. If teacher educators are aware of how to maximize activity levels of students participating in various team sports they can pass this information on to those training to become physical education teachers. This may help future teachers to provide equal opportunity for adolescent females to participate and perceive physical education as a more positive experience.

Limitations

The following limitations were applied to this study:

1. This study was limited to students attending a high school located within an urban area in the Southeastern United States.
2. A sample of convenience was used. Students participating in the study were taken from intact classes.
3. Three different teachers were used in the study. Characteristics and procedures used by three different people may have affect the results.
4. This study was limited to three team sport activities. Individual type activities or different team sport activities may elicit different results.

Assumptions

The following assumptions served as the basis of conduct for this study:

1. It was assumed that all students represented a normal population sample of Caucasian and African-American, male and female high school students.
2. It was assumed that students would maintain their normal activity patterns despite wearing the pedometers and despite being observed by the researcher.

Research Hypotheses

The following hypotheses were addressed by this study:

1. Adolescent Caucasian and African-American males will be more active, as measured by pedometer steps per minute, than adolescent Caucasian and African-American females in both coeducational and single gender high school physical education settings regardless of the activity.
2. Adolescent Caucasian and African-American males will accrue similar amounts of activity, as measured by pedometer steps per minute, in the coeducational and single gender high school physical education settings regardless of the activity.
3. Adolescent Caucasian and African-American females will be more active, as measured by pedometer steps per minute, in the coeducational versus single gender settings regardless of the activity.
4. Caucasian females will be more active, as measured by pedometer steps per minute, than African-American females in both coeducational and single gender high school physical education settings regardless of the activity.

Definition of Terms

For the purpose of this study, the following terms were defined:

Coeducational Game Play: Coeducational game play is when students are grouped in mixed gender teams. Teams consist of an equal mix of males and females competing with and against each other.

Single Gender Game Play: Single gender game play is when students are grouped in same gender teams. Teams consist of only males or only females competing against other only male or only female teams.

Pedometer: (Welk, 2002), These are battery-operated devices containing a spring-suspended, horizontal lever arm that moves up and down. This motion opens and closes an electrical circuit in response to vertical accelerations of the waist that occur during walking and running. The electronic circuitry accumulates steps and provides a digital display.

CHAPTER TWO

REVIEW OF LITERATURE

The following review of related literature is topically structured to include information to date on the topic of adolescent physical activity levels in coeducational and single gender physical education settings. Thus, this review examines relevant research on the current status and problems associated with adolescent physical activity levels, issues and concerns with coeducational and single gender physical education, measurement techniques, including the use of pedometers as a valid and reliable measurement tool for use with children and adolescents in a field setting, and studies examining the effects of coeducational and single gender settings on physical activity levels of students in physical education. Special note is given to the lack of current research in settings composed of primarily African-American adolescent students.

Adolescent Physical Activity Levels – Current Status and Problems

The benefits of a physically active lifestyle are immense. Physical activity reduces the risk of obesity, developing cardiovascular disease, coronary heart disease, hypertension, colon cancer, diabetes mellitus, osteoporosis, and premature mortality in general (USDHHS, 1996). Despite this knowledge, more than 60 percent of American adults are not physically active on a regular basis, and 25 percent are completely inactive. Even more startling is the fact that nearly 50 percent of American youth ages 12-21 are not

physically active on a regular basis (USDHHS, 1996). As a result, the prevalence of pediatric obesity is increasing in the United States. Recent reports indicate a range of 20-30% of children and adolescents are clinically obese depending upon criterion used (Kucsmarski, 1993; Gortmaker, Must, & Sohol, 1996).

Low levels of physical activity appear prevalent in a significant number of children and adolescents, but are most prevalent among preadolescent and adolescent girls (Sallis, Prochaska, & Taylor, 2000; Sallis, Bouno, & Roby, 1993). The U.S. National Risk Behavior Survey conducted in 1990 assessed more than 11,000 students in grades 9 through 12 on the criterion of vigorous activity for at least 20 minutes per day and a minimum of three days per week. Results showed that the proportion of girls who were active varied from 31% in 9th grade down to 17% in 12th grade. Conversely, 50% of all boys met the physical activity criterion (Heath, Pratt, Warren, & Kann, 1994). Bradley, McMurray, Harrell, and Deng (2000) reported beginning in the seventh and eighth grades, more than half of the girls (55.7%) reported mostly sedentary activities. This percent increased with each increase in grade. A recent study by Sallis, McKenzie, Alcaraz, Kolody, Faucette, and Howell (1997) showed that as early as 4th and 5th grade, girls show less baseline levels of physical activity than boys. McKenzie et al. (1995) observed 293 third-grade physical education lessons in 95 schools. Overall, boys spent less time standing (40.5 vs. 44.4% of lesson time) while being very active (18.7% vs. 16.1%) and engaging in MVPA (38.5 vs. 33.9%) more often than girls.

A recent study on middle school students' physical activity levels by McKenzie, Marshall, Sallis, and Conway (2000) conducted in 24 schools over a five month period, three days per week, found that boys engaged in more MVPA (46.4 vs. 39.5%) and expended more energy (0.079 vs. 0.074 kcal/kg/min) than girls. Boys were coded very active more (17% vs. 12% of the lesson time), during skill drills (18.5 vs. 11.9%), game play (17 vs. 14%), and free play (24.3 vs. 10.9%) activities. The System for Observing Fitness Instruction Time (SOFIT) was used to obtain simultaneous recordings of student activity levels, lesson context, and teacher behaviors (McKenzie, Sallis, & Nader, 1991). Another recent study conducted over a one month period, using accelerometers to monitor activity levels, found that boys had higher Caltrac activity counts across all

physical education classes (18.3 vs. 15.5) than girls (LeMura, Andreacci, Carlonas, Klebez, & Chelland, 2000).

As startling as the lack of physical activity is among female youth, even more startling is the fact that African-American female adolescents tend to be the most inactive among all sub-populations of female youth (Sopko, Obarzanek, & Stone, 1992). Several studies have identified African-American women as being the least active with reported rates of obesity as high as fifty percent (Ainsworth, Keenan, Strogatz, Garrett, & James, 1991; Gillum, 1987; Liu et al., 1989; Washburn, Kline, Lackland, & Wheeler, 1992; Wing et al., 1989). Recently, African-American females have been identified as the least active among high school students (Centers for Disease Control and Prevention, 1996). The Centers for Disease Control and Prevention (1992) reported that the rate of moderate to vigorous physical activity was lower in African-American girls (17.4%) than Caucasian girls (27.5%), and Latino girls (20.9%). Bradley et al. (2000) reported beginning as early as the fourth and fifth grades, African-American girls reported being sedentary more than Caucasian girls (47.54% vs. 37.5%), maintaining this pattern through the ninth and tenth grade year (77.78% vs. 60.22%). Kim et al. (2002) assessed leisure time physical activity in 1213 black and 1166 white girls between the ages of 9-10 to 18-19 years old. Between these ages, physical activity decreased 100% in the black girls and 64% in the white girls. Unfortunately, the amount of research on African-American adolescent females' activity levels is limited. This could be due in part to the fact that reasons for the decrease in physical activity among all female adolescent groups is complex and still under question.

Rowland (1999) states that as a child grows the biological drive for exercise energy expenditure declines and extrinsic factors affecting activity levels become more influential reaching a critical peak during adolescence. Factors involving peer acceptance, physical capabilities, sexual attractiveness, and self-concept can make vigorous physical activity not cool for many teenagers. Females face historic social pressures which link physicality and athleticism to masculinity. The desire to appear feminine can cause many females to avoid physical activity. This is compounded by a female's burgeoning sexuality at puberty and desire for attractiveness to the opposite sex. Adolescent females are also challenged by a change in body composition at puberty. Rising estrogen levels in the early teen years promote an increase in body fat that serves

as an inert load that must be carried during weight-bearing physical activity. This makes exercise more difficult, and may cause avoidance of physical activity.

Bungum and Vincent (1997) point out that many of the community sports programs available during the elementary and middle school years disappear once high school is reached. High school sports programs are tailored to the elite high-skilled athletes. Opportunities for participation by everyone are unusual due to financial constraints of interscholastic programs. Finally, it has been hypothesized that the perceived lack of physical activity among females could be related to unpleasant and inequitable experiences in the physical education setting (Taylor et. al., 1999). Issues related to physical education will be discussed in the next section.

Issues and Concerns with Coeducational and Single Gender Physical Education on Physical Activity Levels

It has long been recognized that physical education has the potential to influence students' physical activity levels in and outside of school (Sallis & McKenzie, 1991). Previous research, however, indicates that unpleasant experiences in physical education related to lack of enjoyment, lack of opportunity, poor self-image, and lack of athletic competence has been a factor negatively affecting physical activity participation (Carroll & Loumidis, 2001). Research indicates this is particularly true among adolescent females in coeducational physical education classes (Osborne, Bauer, & Sutliff, 2002; Taylor et al., 1999).

One possible explanation for girls' lower levels of enjoyment and activity during coeducational physical education is the traditional emphasis on team sports (Williams, Bedward, & Woodhouse, 2000). Metheny (1965), reflecting upon the attitudes of college aged women in the early 1960's, was the first to propose that acceptable sports for girls and women were individual activities that emphasized aesthetics. Research has supported Metheny's model indicating that girls prefer individual activities, such as

dance and gymnastics, while boys tend to prefer team sports (Carroll & Loumidis, 2001; Bradley et al., 2000; Williams et al., 2000; Goudas & Biddle, 1993). Goudas and Biddle (1993) in a sample of 254 eighth and ninth grade boys and girls found that 22.5% of girls preferred individual activities, and 29% of boys preferred games. In the same sample, only 9.6% of girls preferred games, and 5.7% of boys preferred individual activities. A similar study by Williams et al. (2000), in a sample of 2,993 high school students, found 74% of girls preferred individual games, and 83% of boys preferred team games. Fromel, Vasendova, and Krapkova (2000) found that girls prefer activities with an esthetic orientation, such as rhythmic gymnastics. Measures of energy expenditure indicated that girls were able to expend more calories during country dance (2.57 kcal·kg·45min) than during volleyball classes (2.10 kcal·kg·45min). Prusak and Darst (2002) suggest this inclination towards individual activities among girls could be related to a desire towards socialization. When given the choice of picking walking activities that were more competitive, game-like, or social, the girls chose activities that were social.

This preference along gender lines extends to after-school activities (Bradley et al., 2000). Carroll and Loumidis (2001), in an examination of 922 students' weekly activity patterns, found that boys (161.26 minutes) spent significantly more time participating in team sports than girls (49.57 minutes). Conversely, girls (40.16 minutes) spent more time participating in individual sports than the boys (30.93 minutes). Bradley et al. (2000) reported that boys played more traditional team sports (football, basketball, and soccer) outside of school, whereas girls participated in more individualized activities (dancing, bicycling, rollerblading, and walking). This has implications in physical education suggesting that girls may be better off receiving physical education separate from boys in order to focus on more enjoyable individual type activities.

The preference for individual activities among adolescent girls could also be influenced by the lack of opportunity to participate in team activities during coeducational physical education due to dominance and preference given to boys (Olafson, 2002; Davis, 2000; Taylor et al., 1999). The mandating of coeducational classes, as a result of Title IX, does not guarantee equal treatment of boys and girls in physical education class (McBride, 1990). Scraton (1990) interviewed physical

education department chairs and teachers, and found the dominant assumption of girls' physical education teachers is that girls are less physically capable than boys, and should avoid activity that could be of danger to them. Nilges (1998) conducted a study to determine how girls are perceived in physical education and implies that girls are treated as second-class citizens in the physical education classroom. Griffin conducted a study of middle school activity patterns for boys and girls. According to Griffin (1984), some teachers argue that boys hold back in physical education, and that class becomes watered down because of girls' low skill level. In Griffin's (1985) study the teachers complained that boys play too rough for girls, and that girls won't really try in a game. It is widely recognized by physical education teachers that male students ask more questions, use more equipment, make more demonstrations, are more active, and interact more with teachers than female students (Jones, 1989).

As a result of the male dominance in physical education, researchers have begun to question girls about their experiences in physical education, and whether they may prefer having physical education separate from boys (Cockburn, 2001; Olafson, 2002; Osborne et al., 2002; Taylor et al., 1999). Cockburn (2001) conducted a survey of 75 ninth-grade girls' feelings towards coeducational physical education. Almost one-third of respondents said they were discouraged by being in class with boys. Similarly, almost a quarter said they would be encouraged by being in a class with just girls. Other aspects of physical education that girls did not enjoy included the risk of injury, aggression, and rough physical contact. These risks are generally associated with male sports and boys' physical education.

Olafson (2002) conducted 46 individual interviews and three focus group interviews with adolescent girls about their experiences in school. The girls indicated that physical education is many times embarrassing for them. Many of the girls felt like the boys were staring at them. Changing into shorts and a t-shirt put the girls' bodies on display for the males. One girl commented that boys would make comments about her chest size. Girls also felt that the boys would make fun of them if they did something incorrect in an activity. One girl commented that she just stood on the field and avoided contact with the ball so that no one could comment. Many of the girls in the study disliked the focus on traditional team sports and military style forms of exercise. Girls' only physical

education was mentioned by many participants as a possible way to increase attendance and enjoyment of physical education. Girls stated they would be more comfortable being active in a girls' only class with a female physical education teacher.

In a related study, Osborne et al. (2002) conducted separate interviews with 12 (six boys, six girls) seventh and eighth grade students to assess their feelings about coed and girls-only physical education. All of the participants in the study had experience in coeducational and separate gender physical education. Of the themes emerging from the data, only varied interaction was positive in support of coed classes. The students welcomed the opportunity to interact with the opposite sex. The remaining five themes (interpersonal issues, effort/cooperation, same gender interaction, contact sports, and flexibility/low intensity sports) were all in favor of separate physical education. The girls felt that boys were not cooperative enough in class, and the boys felt that girls did not exhibit a high enough effort. Both boys and girls valued the opportunity separate classes allowed for same sex interaction. The boys and girls also felt that separate classes would allow them to focus on activities more suited for them. The girls and boys thought that wrestling and football are activities that are best suited for boys. The girls felt that they would enjoy the opportunity to participate in less intense activities like gymnastics, dance, and volleyball.

Taylor et al. (1999) focused solely on 34 Latino and African-American adolescent girls' feelings towards physical education and revealed similar results. Results of focus group interviews indicated that girls viewed physical education classes as inequitable and unpleasant. Girls felt that the boys received more privileges in class. For example, the boys get to play, and the girls just sit around and watch. One girl said that when the teacher divided teams into boys and girl teams, he spent all the time with the boy teams. When the boys and girls play together, the girls noted that the boys take the ball away and keep girls from getting it. The girls mentioned a preference for activities like gymnastics and track, but did say they had fun playing basketball when they learned to play correctly. The girls also thought it was a good idea to have physical education separate from the boys. This way they could have more opportunity to participate.

Lirgg (1993) conducted one of the few studies that examined the perceptions of middle school and high school students assigned to a 10 lesson unit in basketball in either

coeducational or same-sex classes. Participants included 199 middle school students (105 boys, 94 girls), and 190 high school students (97 boys, 93 girls) who attended four middle class suburban schools. Participants completed a background questionnaire, a Likert-type basketball self-perceptions scale, and a class gender preference questionnaire. Findings indicated that male students perceived basketball to be more useful and more masculine than did female students. Also, both male and female middle school students were found to prefer same-sex physical education, while high school students preferred coeducational physical education. Males assigned to coeducational classes were significantly more confident in their ability than boys in same-sex physical education. Finally, although not statistically significant, there was a trend towards greater confidence in same-sex classes for females.

Treanor, Graber, Housner, and Wiegand (1998) studied middle school students' perceptions of coeducational and same-sex physical education classes. Participants in the study were students (N = 466; 263 males, 203 females) from the sixth, seventh, and eighth grades enrolled in a year-long multi-activity physical education program in which classes were coeducational in the fall semester and same-sex in the spring semester. At the end of the spring semester, all students anonymously completed a 20-item questionnaire designed to elicit opinions from students regarding their affinity towards physical education, perceived abilities, and preferences for coeducational and same-sex classes. Results indicated that males rated themselves as having more skill, strength, and endurance than females. Females rated themselves as significantly more overweight than males. Males rated themselves as liking physical education higher than females across all grade levels with the difference increasing from sixth grade (males = 3.31 vs. females = 3.10) to seventh grade (males = 3.30 vs. females = 2.67) to eighth grade (males = 3.20 vs. females = 2.48). Significant correlations also indicated that students who liked physical education more showed a slight preference for same-sex physical education in terms of learning more, receiving more practice time, cooperating better, and playing individual sports better.

The idea that single-gender physical education classes may result in a higher number of interactions with teachers and participation opportunities for female students because there will be less competition with male students, has gained a considerable amount of

attention (Davis, 2000). Another advantage to girls' only classes is that females would not be subject to sexual objectification and the male gaze (Olafson, 2002). Finally, girls' only classes would allow girls to participate in activities that they tend to find highly enjoyable and allow them to develop skill in activities they otherwise might not have an opportunity in (Osborne et al., 2002). In order to assess whether girls' only classes would be of benefit to increase physical activity, studies that use objective and reliable quantitative measurement tools are needed.

Measurement of Physical Activity – Issues and Techniques

Many different methods have been used over the years to measure physical activity levels in various settings with different populations. Some of the methods available to assess physical activity levels include indirect calorimetry and doubly labeled water, self-report, direct observation, heart rate monitors, activity monitors, and pedometers (Welk, 2002). Doubly labeled water and indirect calorimetry provide the most accurate measures of energy expenditure, however, they are costly, invasive, and do not provide information on specific patterns of physical activity (Coleman, Saelens, Wiedrich-Smith, Finn, & Epstein, 1997).

Self-report techniques are the most common measures of physical activity because of low financial cost, low participant burden, ease of administration, and ability to capture both quantitative and qualitative information (Welk, 2002). Limitations of self-report techniques include problems with interpretation of physical activity in different populations, and display of only moderate reliability and validity with children and adolescents (Baranowski, 1988).

Direct observation techniques provide reliable and valid estimates of activity and provide excellent qualitative and quantitative information. Limitations of direct observation techniques are that they are very time consuming in training observers and

collecting data, they can be expensive, and observer presence may influence normal activity patterns (Durant, Baranowski, & Puhl, 1992; Welk, 2002).

Heart rate monitors provide direct measurement of a physiological response to activity. Their ability to collect and record data allows for a good description of intensity, frequency, and duration of physical activity and information is easily downloaded into a computer. Limitations of heart rate monitors are that they are very costly for assessing large numbers of participants, heart rate can be affected by variables other than changes in physical activity, they take a long time to put on and take off, and they may be uncomfortable over long recording periods (Freedson, 1991; Welk, 2002).

Activity monitors provide an objective indicator of bodily movement (acceleration) and are useful in both laboratory and field settings. They provide an indicator of activity intensity, duration, and frequency, are noninvasive, and allow for ease of data collection and analysis. Limitations of activity monitors are their high cost, inaccurate assessment of energy expenditure over a large range of activities, and lack of field based equations to accurately estimate energy expenditure in specific populations (Welk, 2002). Finally, pedometers offer a cost effective and reliable method of assessing physical activity in laboratory and field settings.

Pedometers have been shown to be a reliable and valid way of measuring activity levels of adolescents in field settings (Easton, Rowlands, & Ingledeew, 1998). The pedometer is a mechanical motion sensor worn on the hip at the mid-axial line that assesses distance covered, in the form of step counts, by measuring acceleration and deceleration using a level arm, spring, and gear assembly (Welk, Differding, Thompson, Blair, Dziura, & Hart, 2000). Observed physical activity is reported to correlate highly with the pedometer in young children (Freedson, 1991).

The Digi-Walker pedometer has been shown to have exceptional validity and reliability. A recent review of five contemporary electronic pedometers (Freestyle Pacer, Eddie Bauer, L.L. Bean, Yamax DW-500, and Accussplit) by Bassett, Ainsworth, and Leggett (1996) reported the Digi-Walker to be most accurate in terms of step counts and distance walked. In a field evaluation along a 4.88-km sidewalk, the Digi-Walker recorded number of steps and distance to within 1% of actual values. During treadmill

walking at various speeds (54, 67, 80, 94, and 107 m/min) the Digi-walker pedometer was significantly better at tracking distance and number of steps than the other models.

Kilanowski, Consalvi, and Epstein (1999) compared activity measurement during recreational physical activity and classroom activities in the natural environment of children using pedometers (Digi-walker Yamax SW-200), triaxial accelerometers (TriTrac-R3D), and direct behavioral observation (Children's Activity Rating Scale). Participants included seven male and three female children (average age 10.1 ± 1.7 years old) enrolled in a summer day-school program at the University of Buffalo. Classroom activities included desk work, computer work, and art work. Recreational activities included soccer, basketball, baseball, dodge ball, and dancing. Results revealed correlations between all measures were significant for recreational and classroom activities combined, and during recreational periods alone ($r's > .90, p < .001$). Correlations between the pedometer and accelerometer were significantly lower during classroom activities ($r = .50, p < .05$) which may be explained in part by the pedometer being sensitive only to vertical movement. The correlations between pedometers during recreational activity periods indicate that the pedometer is able to measure high activity levels similar to the triaxial accelerometer and to behavioral observation techniques.

Two similar studies by Easton, Rowlands, and Ingledew (1998) with British children, and Louie et al. (1999) with Chinese boys, compared Digi-Walker pedometers (Yamax DW-200), heart rate telemetry, uniaxial accelerometry, and triaxial accelerometry, by correlation with gas analysis (SVO₂). Both studies used 21 children aged 8-10 years old from public school settings. Procedures included two regulated and three unregulated play activities. Regulated activities consisted of treadmill walking (4 and 6 km/h) and running (8 and 10 km/h). Unregulated play activities consisted of playing catch, playing hopscotch, sitting, and crayoning. Participants wore heart rate monitors, accelerometers, and pedometers simultaneously during each activity. A pediatric face mask attached to 3-m long, 40-mm diameter tubing collected expired air during each activity. The obtained oxygen uptake was expressed as a power function ratio standard, with body mass raised to the power of 0.75 (SVO₂). In both studies, the correlations of hip pedometry, uniaxial accelerometry, and heart rate telemetry with SVO₂ were similar to each other, whether looking at all activities combined or treadmill activities alone. In both studies, for

unregulated play activities, the correlation of hip pedometer with SVO2 ($r = 0.931$ HK, $r = 0.921$ UK) was significantly higher than that of uniaxial accelerometry with SVO2 ($r = 0.881$ HK, $r = 0.852$ UK) or heart rate telemetry with SVO2 ($r = 0.841$ HK, $r = 0.858$ UK). Results support the use of the pedometer as a valid measurement tool of physical activity with children.

Overall, there are many methods of assessing physical activity, all possessing certain strengths and weaknesses, that have been used in research. Studies support the use of an electronic pedometer as a measure of physical activity when observing children and adolescents engaged in a variety of moderate to vigorous physical activities in a field setting. They provide a valid method for assessing activity levels of large samples and for use as a measure and source of feedback during intervention studies. The unobtrusive size and economical cost of pedometers make them useful research tools for measuring physical activity of children and adolescents in various physical education settings, including co-educational and single gender settings.

Coeducational and Single Gender Studies on Physical Activity in Physical Education

There are only three known studies that have measured physical activity of males and females participating in coeducational and single-gender settings. Each study has used a different measurement tool and been conducted in a different school setting. Schmitt (2002) compared the physical activity levels of males and females in coeducational and gender segregated physical education classes using Polar heart rate monitors. Participants included 48 sixth grade students (24 males, 24 females) from an urban elementary school. Participants wore heart rate monitors for six days of game play in an ultimate Frisbee unit. Game play lasted for 30 minutes in each lesson. Three days were in coeducational classes and three were in gender segregated classes. Heart rate was recorded by participants during each lesson at the start, middle, and end of class. Results

indicate that heart rates for males were higher at the beginning, middle, and end of both coeducational and segregated settings. Females spent approximately 5.8 minutes in their target heart rate zone in the segregated setting and 6.2 minutes in the coeducational setting. Males spent approximately 8.3 minutes in their target heart rate zone in the segregated setting and 7.9 minutes in the coeducational setting. Although the number of participants was small, results suggest that males are more active than females regardless of setting. Results also suggest that females receive greater physical activity in coeducational settings and males receive greater physical activity in segregated settings. A limitation of this study was that ultimate Frisbee was a new skill for these children, thus there may have been a learning effect. Another limitation was the use of heart rate monitors to collect data. Downloadable heart rate monitors are very expensive making large scale studies very difficult. The researchers in this study only had twelve downloadable monitors and had to rely on student self reports of heart rate for the bulk of their data.

McKenzie, Prochaska, Sallis, and LeMaster (2003, in press) found similar results for male and female activity using direct observation. A subset of nine schools, from a large activity and nutrition intervention involving 24 middle schools in Southern California participated in the study. The nine schools provided some single gender format classes (20% of all lessons). All lessons observed at the nine schools were analyzed. The sample included 298 lessons taught by physical education specialists. There were 26 boys-only, 32 girls-only, and 240 coeducational lessons taught. Scheduled class length averaged 50 minutes. The System for Observing Fitness Instruction Time (SOFIT) was used to observe each lesson. SOFIT activity codes have been calibrated through heart rate monitoring. Activity codes 1 to 4 (lying down, sitting, standing, walking) describe the students body position, and code 5 (very active) indicates that the student is expending more energy than during ordinary walking. Moderate to vigorous physical activity (MVPA) was considered the sum of codes 4 and 5. During each lesson, observers coded activity levels of four randomly selected students using momentary time sampling (10-second observe, 10-second record intervals). Results indicated that boys-only ($M = 19.2$ min) and coeducational classes ($M = 17.6$ min) provided more MVPA than girls-only classes ($M = 13.4$ min). Boys accumulated similar amounts of MVPA in

boys-only and coeducational classes. Girls tended to accumulate more MVPA in coeducational versus girls-only classes. Boys accumulated more MVPA during coeducational classes versus girls ($M = 19.3$ vs. 15.9 min). Results of this study support the findings of Schmitt (2002) despite using a different measurement tool and population. A limitation of this study was the use of momentary time sampling during direct observation. The 10-second observe, 10-second record interval meant that students were only observed for half the class time. Additionally, only four students were randomly selected per class, thus this may not constitute a true representation of the entire classes' activity levels.

Recently, Hannon and Ratliffe (2003, unpublished) compared activity levels, as measured by pedometer step counts per minute, of high school boys and girls participating in coeducational and single-gender flag football game play. Participants included 78 students (boys = 37, girls = 41) enrolled in two physical education classes at a predominately Caucasian, middle class, North Florida high school. Two experienced physical education teachers, one male with 8 years teaching experience, and one female with 14 years teaching experience agreed to participate in the study. All participants engaged in flag football game play for two weeks in their typical coeducational classes (6 lessons), followed by two weeks in single-gender game settings (7 lessons). Digi-walker pedometers (Yamax-SW 701) were worn by all students and were used to monitor activity levels during participation in each physical education class over a four-week unit. Pedometers remained sealed during use and steps counts were recorded immediately upon their return. Step counts were converted to steps per minute (spm) to account to daily variation in allocated game play activity time. Results indicated that boys were more active than girls in both coeducational (87.1 ± 10.6 vs. 66.2 ± 6.3 spm) and single-gender (88.8 ± 9.5 vs. 57.9 ± 8.6 spm) settings. There was no significant difference in boys' activity levels between coeducational and single-gender settings. Contrary to expectations, activity levels decreased for girls during single-gender game play versus coeducational game play (57.9 ± 8.6 vs. 66.2 ± 6.3 spm). A limitation of this study was the use of flag football, considered a traditionally masculine activity, which could have negatively affected girls' activity levels. Intact classes were used in this study and the characteristics of the class may have influenced the results. A random assignment of

students to each class would help resolve this and strengthen the validity of the study. Two different teachers, a male and female were used so it is possible that the teacher's gender could have an effect on participation levels of boys and girls. Characteristics and instructional procedures used by two different people could also influence the results. A stronger research design would have the same teacher for all classes.

Overall, the previous three studies found similar results suggesting that boys were more active than girls in both coeducational and single-gender settings. Boys demonstrated very little difference in activity levels in coeducational versus single-gender settings, while girls tended to be more active in coeducational versus single-gender settings. These results are consistent in elementary, middle, and high school settings, across various types of activities, and through the use of different measurement instruments. This is contrary to what has been suggested by qualitative research of teacher and student perceptions of coeducational and single-gender physical education in which it has been perceived that girls and boys would be more active in single-gender classes (Osborne et al., 2002). Future research should investigate activity levels during various types of activities, monitor the time the teacher spends with boys and girls, collect data using the same teacher, determine if there is a difference across racial and ethnic groups, and use consistent measurement techniques to allow for easier comparison and generalizability of results.

Conclusions

Overall, research suggests that girls are less physically active than boys in and outside of physical education class (LeMura et al., 2000; McKenzie et al., 2000; Rowland, 1999; Sallis et al. 1999). Several studies have identified African-American female adolescents as being the least active (Ainsworth, Berry, Schnyder, & Vickers, 1992; Centers for Disease Control and Prevention, 1992; Centers for Disease Control and Prevention, 1996). Studies have indicated that inequitable and unpleasant experiences in

coeducational physical education settings may play a role in this reduced level of physical activity among adolescent girls (Taylor et al., 1999). The adolescent girls in the Taylor et al. (1999) study noted a lack of opportunity in physical education. The girls felt that the teachers spent more time with the boys, and that the boys' aggressive nature resulted in less activity for girls. This lack of physical activity leaves adolescent females, particularly African-American, at a higher risk for developing conditions such as obesity and hypertension (Gillum, 1987). A possible solution is more effective interventions which measure physical activity levels among adolescent girls during coeducational and single-gender physical education settings. Pedometers have been identified as being a valid and cost effective tool for measuring physical activity levels of school-aged children and adolescents, and have been used in similar studies (Hannon & Ratliffe, 2003, unpublished).

More research would add to the limited scholarly work on female adolescents' activity patterns in coeducational and single-gender settings during physical education class. It would question the current structure of physical education classes in which evidence has shown females to be left alienated, disappointed, and frustrated with their overall experience. Continued research has implications for effective teacher training to provide equal opportunity for adolescent females to participate and perceive physical education as a more positive experience. It is hoped that these positive experiences will lead to a more active lifestyle that may combat the onset of chronic diseases. Interesting questions for future research include, how much activity adolescent females receive during various types of activities, influence of teacher encouragement on activity levels, and activity levels of various racial and ethnic groups, particularly, African-American adolescent females during coeducational and single-gender physical education settings. This has tremendous implications as African-American adolescent females have rarely been studied and have been identified as being the most at risk for obesity, compromising health and quality of life.

CHAPTER THREE

METHODS

The purpose of this study was to compare activity levels, as measured by pedometer steps per minute, of high school aged Caucasian and African-American females and males participating in coeducational and single gender settings during ultimate Frisbee, soccer, and flag football team sport activity units. This chapter will describe the participants and setting, instrumentation, methodological procedures, and statistical analysis used by the researcher in this study.

Participants and Setting

Participants were approximately 209 high school students enrolled in six intact physical education classes at an ethnically diverse, low to middle socioeconomic status, Northwestern Florida high school. School enrollment totaled 1455 students (684 males, 771 females). Racial and ethnic distribution consisted of 47.84% Caucasian, 46.74% African-American, 2.96% Hispanic, 1.24% Asian, 1.10% Multicultural, and 0.14% American Indian students. Sixty percent of students qualified for the free or reduced cost lunch program.

The participant characteristics of height, weight, body composition, age, gender, and race were obtained prior to data collection from existing school records and a beginning of the semester fitness assessment. The researchers assisted with the fitness assessment to assure for consistency in the measurement protocol. Students were asked to remove

their shoes and fill out an information form prior to testing (see Appendix A). Height was assessed (to the nearest 0.1 cm) using a setsquare and a wall mounted tape measure. Weight was determined (to the nearest 0.1 kg) using a portable medical scale (Health-o-meter, Inc., Bridgeview, IL). Data for gender, race, age, height, and weight are presented in Table 1.

Table 1

Students Age, Height, and Weight by Gender and Race

	n	Age	Height (cm)	Weight (kg)
Females:				
Caucasian:	39	14.6 ± .97	160.8 ± 8.3	62.1 ± 15.5
African-American:	61	14.5 ± .83	162.4 ± 5.2	69.6 ± 18.4
Others:	8	14.2 ± .44	152.4 ± 9.9	55.1 ± 13.8
Total:	108	14.5 ± .86	161.1 ± 7.3	65.8 ± 17.6
Males:				
Caucasian:	53	14.8 ± .74	171.8 ± 7.7	70.8 ± 18.8
African American:	43	14.9 ± 1.00	172.4 ± 8.5	71.5 ± 16.8
Others:	5	15.8 ± 1.1	175.4 ± 14.8	69.8 ± 19.7
Total:	101	14.9 ± .91	172.2 ± 8.4	71.0 ± 17.8

Mean ± Standard Deviation

Body mass index (BMI) and body fat percentage were obtained to provide a potential explanation for any observed differences in student activity levels. It is well documented that excess body fat serves as an inert load that can make movement more difficult (Rowland, 1999). BMI was calculated using height and weight measures. Students were classified as normal weight, overweight, or obese based upon the most current age adjusted BMI definitions (Cole, Bellizzi, Flegal, & Dietz, 2000). Student body fat percent was assessed thru the use of an HBF-103 hand held body fat analyzer (OMRON Healthcare, Inc., Vernon Hills, IL). Bioelectrical impedance analysis (BIA) is frequently

used in physical education settings to assess body composition (Houtkooper, Lohman, Going, & Hall, 1989). Bioelectrical impedance analysis takes very little time, is easy to administer, requires no special training, and is non-invasive, portable and non-threatening. These factors make BIA an attractive option for body composition assessment in physical education. Prior to the day of testing students were instructed to avoid vigorous exercise and to maintain normal hydration 12 hours before testing. An increase in body temperature and/or altered distribution of body water may influence resistance and reactance and therefore the calculation of body fat percent (Lukaski, Bolonchuk, Siders, & Hall, 1990). Immediately prior to testing, students cleaned their hands with an alcohol and water solution and dried them with a paper towel. One of the researchers inputted the student's height (cm), weight (kg), gender, and age into the BIA body fat analyzer. The student then grasped the analyzer by the metal electrode plates transmitting a subthreshold electrical current through the body from arm to arm. Percent body fat was instantly calculated using equations provided by the manufacturer. Data for body fat percent, BMI, and BMI classification are presented in data Table 2.

Table 2

Students Average Body Fat Percent and Body Mass Index with Classifications

	BIA-BF%	BMI	(*Age Adjusted Classification)		
			Normal	Overweight	Obese
Females:					
Caucasian:	27.5 ± 6.5	23.8 ± 5.6	21	12	6
African-American:	30.1 ± 7.8	26.1 ± 6.8	21	19	21
Others:	29.3 ± 7.1	22.9 ± 5.4	4	2	2
Total:	29.1 ± 7.3	25.0 ± 6.4	46	33	29
Males:					
Caucasian:	20.3 ± 9.1	23.7 ± 5.2	29	12	12
African American:	20.4 ± 8.9	23.7 ± 5.6	23	12	8
Others:	15.9 ± 6.8	22.2 ± 2.8	3	2	0
Total:	20.1 ± 8.9	23.6 ± 5.3	55	26	20

Mean ± Standard Deviation (no significant differences within gender by race when tested via ANOVA)

*Classification totals according to BMI and for total number of students in each category

Three experienced physical education teachers, one female and two males, conducted all physical education classes. The female teacher was in her mid-fifties with 32 years of physical education teaching experience. She graduated from an accredited physical education program at a large Southeastern United States University and earned a physical education teaching K-12 certification. She has also completed 12 hours of graduate course work in physical education. One male teacher was in his early forties with 19 years of physical education teaching experience. He graduated from an accredited physical education program at a large Southeastern United States University and earned a physical education teaching K-12 certification. The other male teacher was in his late forties with 27 years of physical education teaching experience in Puerto Rico and the United States. He has an earned Doctorate degree in physical education from a large Southeastern United States University.

Permission to conduct the study was obtained from the University Institutional Review Board, the school district, the school administration, and the teachers prior to the start of the study (see Appendix B). The students and parents provided written informed consent prior to participation in the study (see Appendix C).

Instrumentation

Digi-walker Pedometers

Digi-walker pedometers (Yamax SW-701) were used to monitor activity levels during participation in each physical education class over three activity units. Pedometers have been shown to be a reliable and valid way of measuring activity levels of adolescents in a field setting (Kilanowski, Consalvi, & Epstein, 1999; Rowlands, Eston & Ingledeu, 1997). The Yamax SW-701 has been shown to be the most accurate of the pedometers available (Schneider, Crouter, Lukajic, & Bassett, 2003). Prior to using the pedometers a shake test consistent with a procedure described by Sidman, Vincent, Corbin, Pangrazi, and Vincent (2001) was used to test calibration and validate that the pedometers worked

appropriately. This test consisted of placing the pedometers vertically in the manufacturers supplied box and giving them 100 shakes. The error between shakes and recorded steps was then examined for each pedometer. Deviation from the 100 shakes for all pedometers was less than 3 percent. Results of the procedure demonstrate that the pedometers used provided accurate step count data.

Prior to the start of data collection the students were instructed on how to properly attach the pedometer. Students were instructed to clip the pedometer on the waistband of their shorts or warm-up pants at the midline of the hip. The researchers and teachers observed each student to be sure they attached the pedometers correctly. The students practiced picking up, attaching, wearing and returning their pedometer for one lesson prior to data collection. The lesson consisted of a choice between walking around the outside of the gym and shooting basketballs. Students were assigned a number that correlated with the number on their pedometer. Students used the same pedometer throughout the entire study. The outside cover of each pedometer was covered in solid white or yellow tape and numbered. The students were instructed not to open the secured cases and were told that if they opened the case then the information could not be used. Students were initially told that the researchers were interested in information about their physical education classes and that they would be wearing an object to help collect this information. At the conclusion of the study the students received information on how much activity they accumulated, in the form of steps, during each physical education class.

Observational Recording Instrument

A modified version of a portion of the Observational Recording Record of Physical Educator's Teaching Behavior (Stewart, 1989) was used to monitor the type and rate of teacher/student verbal interactions (see Appendix D). The instrument was originally designed to monitor instructional climate, interaction, teacher behavior, or any combination thereof. Original observer reliability for the interaction portion of the instrument was calculated at ninety-one percent. For the purposes of this study the instrument was used to monitor type of interaction (individual, group, or class) and who the interaction was with or directed at (male, female, Caucasian, African-American).

Prior to data collection observers received training on how to use the instrument and practiced live observation and recording. Inter-observer reliability was calculated on three occasions. Observers scored 91%, 100%, and 100% inter-observer reliability with the master coding done by the researcher. These data were collected to provide information that could help explain any differences between the treatment groups.

Survey Instrument

At the conclusion of the study the students were asked to complete a survey composed of questions in a 3-point Likert type format designed to collect information to help explain the final results (see Appendix E). The questionnaire was designed using questions specifically related to the scope of the study which may help explain any potential differences in physical activity levels between gender, race, and group. Each question had three answer choices including (1) I like it, (2) I neither like nor dislike it, and (3) I dislike it. Some examples of the types of questions asked are: (1) When I participate in coed PE; (2) When I play flag football; (3) When I participate in single gender PE; (4) When we play team sports in class; (5) When we play soccer; (6) When we participate in individual activities in class like weight lifting; and (7) When we play ultimate Frisbee in class. Several questions were used to determine the students' views toward specific team sports and their views toward coed and single gender physical education settings.

Procedures

Adolescent females and males enrolled in high school flag football, ultimate Frisbee, and soccer physical education classes were used as participants for this study. These team sport activity units constitute the regular Fall semester curriculum in physical education at the school used for this study. Prior to the start of data collection the teachers and researcher met to discuss class procedures and game rules. Lessons were

developed to assure similarity between all classes (see Appendix F). Classes met 90 minutes daily in a block schedule format. Steps counts for all students were monitored during game play by using pedometers over at least six lessons in each unit. Two coeducational classes remained coeducational during game play, two coeducational classes were split into males and females teams for game play, one class was exclusively females only, and one class was exclusively males only throughout the entire study. One coeducational class, one coeducational-split class, and the female’s only class were taught by the female teacher. One coeducational class was taught by a male teacher. The other coeducational-split and males only class was taught by the other male teacher. The number of students participating in flag football, ultimate Frisbee, and soccer in the three different settings can be seen in Tables 3, 4, and 5.

Table 3

Students Participating in Flag Football by Setting, Class, Gender, and Race (N = 192)

	<u>Coed</u>			<u>Coed-Split</u>			<u>Girls-only</u>	<u>Boys-only</u>
	FT	MT1	T	FT	MT2	T	FT	MT2
Males:	17	19	<u>36</u>	12	11	<u>23</u>		<u>38</u>
Caucasian:	8	11	19	7	8	15		19
African-American:	9	8	17	5	3	8		19

Females:	15	15	<u>30</u>	15	25	<u>40</u>	<u>25</u>	
Caucasian:	6	6	12	8	11	19	4	
African-American:	9	9	18	7	14	21	21	

FT = female teacher; MT1 = male teacher one; MT2 = male teacher two; T = total

Table 4

Students Participating in Ultimate Frisbee by Setting, Class, Gender, and Race (N = 182)

	<u>Coed</u>			<u>Coed-Split</u>			<u>Girls-only</u>	<u>Boys-only</u>
	FT	MT1	T	FT	MT2	T	FT	MT2
Males:	17	17	<u>34</u>	11	10	<u>21</u>		<u>39</u>
Caucasian:	8	10	18	6	8	14		19
African-American:	9	7	16	5	2	7		20

Females:	13	14	<u>27</u>	15	22	<u>37</u>	<u>24</u>	
Caucasian:	4	5	9	7	9	16	5	
African-American:	9	9	18	8	13	21	19	

FT = female teacher; MT1 = male teacher one; MT2 = male teacher two; T = total

Table 5

Students Participating in Soccer by Setting, Class, Gender, and Race (N = 182)

	<u>Coed</u>			<u>Coed-Split</u>			<u>Girls-only</u>	<u>Boys-only</u>
	FT	MT1	T	FT	MT2	T	FT	MT2
Males:	16	18	<u>34</u>	12	10	<u>22</u>		<u>38</u>
Caucasian:	7	10	17	7	8	15		19
African-American:	9	8	17	5	2	7		19

Females:	14	15	<u>29</u>	13	23	<u>36</u>	<u>23</u>	
Caucasian:	5	5	10	7	10	17	4	
African-American:	9	10	19	6	13	19	19	

FT = female teacher; MT1 = male teacher one; MT2 = male teacher two; T = total

Recent studies of physical activity in single gender game play situations have used males and females in the same class segregated exclusively for game play (Hannon & Ratliffe 2003, unpublished; Schmitt, 2002). It is possible that the females' activity levels

could have been influenced by the presence of males in the playing area. Research suggests that females are subject to sexual objectification and the male gaze when males are present (Olafson, 2003). Females are also in competition for interaction and feedback from teachers when males are present (Davis, 2000). In order to truly assess the potential of single gender physical education for increasing the activity levels of students, research using classes that are exclusively females and exclusively males are needed. In this situation, the males and females would be in separate areas and out-of-sight of each other. Using three settings (coeducational, coeducational-split for game play, and gender separate), in this study was intended to examine physical activity levels for all conditions.

Prior to the start of each class one of the researchers completed the following protocol: a) reset all pedometers to zero, b) put boxes containing pedometers on a bleacher or bench in the activity area for easy access, c) put up numbered signs to identify pedometer numbers included in each box, and d) put up a class list with students names and assigned pedometer numbers.

Students picked up and attached their pedometers immediately prior to game play activity as instructed by their teachers. The pedometers were returned immediately after game play activity. Allocated activity time was determined by using the time when all students had secured their pedometers to when all students had returned their pedometers. Prior to the start of data collection teachers agreed to a common per class game time of approximately 30 minutes.

Every class was observed by one or more of the researchers and notes were taken to verify that the lesson organization and type of activity conducted by each teacher for each group was similar. During game play activity the observer recorded what was happening during the lesson, including field dimensions, equipment used, and team sizes. The observer also watched to be sure students were not opening pedometer cases or shaking pedometers.

During the middle ten minutes of each allocated 30 minutes of game time activity one or more researchers recorded teacher verbal interactions with students. Recorded interactions were limited solely to students engaged in on field game play. Any interactions with students sitting out or students from another class were not recorded.

Every interaction was coded according to type, as well as, gender and race directed at as previously described.

Immediately following the end of activity, participants were instructed to remove their pedometer and return it to the same box they retrieved it from. Between classes the observer recorded step counts from each pedometer on a data sheet (see Appendix G). Each pedometer was then reset to zero and returned to the properly numbered box and slot. The same protocol was used for each class throughout the study.

Upon completion of the last activity unit students were asked to complete a brief 11-item survey. Instructions on how to complete the survey were read aloud to each class and opportunity was given to ask questions before completing the survey. If a student was unable to answer a question, was unable to follow and/or understand directions, or had any other specific or general questions regarding the survey, he or she was instructed to ask the researcher for clarification. Students were told that this was an opportunity to express their own personal views and opinions. Students were told that the survey was to be completed individually and that talking amongst them was prohibited until all surveys had been completed and returned to their teacher or one of the researchers.

Statistical Analysis

Statistical analysis for all data in this study was conducted on a personal computer using Statistical Package for Social Science (SPSS) software (version 11.0, Chicago, IL, USA) and Stata/SE 8.0 (Stata Corporation, College Station, TX). Data were entered into an excel spread sheet and confirmed by another researcher to assure reliability of the results. If a student was found to have tampered (removed or opened the pedometer) with the equipment, his or her data was stricken from the final results for that particular lesson. A trend analysis was used to determine the minimal number of lessons a student could have participated in order to utilize their data. A day by time linear regression showed no

trend in pedometer step counts by lesson for each student. This justified use of all data regardless of how many lessons a student participated in.

Activity step counts were converted to steps per minute to account for individual variances in the amount of daily game time activity. Mean and standard deviation steps per minute were compared between genders, races, activities, and treatments. Data from races other than Caucasian and African-American were discarded due low numbers and lack of contribution to the research hypothesis. A series of ANOVA and t-tests were used to test for differences in activity levels between male and female students, African-American and Caucasian students, coeducational and single gender situations, and between flag football, soccer, and ultimate Frisbee units. A t-test was used to check for any significant teacher effect on male and female student's activity levels during each unit in the coeducational and coeducational-split groups. An alpha level of 0.05 was used for all statistical tests.

Descriptive statistics were used to determine the average per class frequency of teacher verbal interactions by type, as well as, gender and race addressed. Descriptive statistics were also used to summarize survey data. Data was presented as percentages of "I like", "I neither like nor dislike", and "I dislike".

CHAPTER FOUR

RESULTS AND DISCUSSION

This study investigated the effects of participation in coeducational and single gender settings during ultimate Frisbee, soccer, and flag football team sport activity units, on the activity levels, as measured by pedometer steps per minute, of high school aged Caucasian and African-American, females and males. This chapter presents the statistical and descriptive results from the recorded pedometer steps, coded teacher interactions, and student survey responses. This chapter also discusses information related to the following research hypotheses:

1. Adolescent Caucasian and African-American males will be more active as measured by pedometer step counts than adolescent Caucasian and African-American females in both coeducational and single gender high school physical education settings regardless of the activity.
2. Adolescent Caucasian and African-American males will accrue similar amounts of activity as measured by pedometer step counts in the coeducational and single gender high school physical education settings regardless of the activity.
3. Adolescent Caucasian and African-American females will be more active as measured by pedometer step counts in the coeducational versus single gender settings regardless of the activity.
4. Caucasian females will be more active as measured by pedometer step counts than African-American females in both coeducational and single gender high school physical education settings regardless of the activity.

Comparison of Steps per Minute during Game Play by Gender and Race

Males versus Females

An ANOVA was conducted to determine if steps per minute were affected by gender and the type of activity in which students were engaged. Results indicated that gender, $F(1, 559) = 298.32, p < .0000$; and activity, $F(2, 559) = 13.47, p < .0000$, both play a significant role in students steps per minute. In order to better understand the impact of activity mode (flag football, ultimate Frisbee, and soccer) on average steps per minute of male and female students a series of *t*-tests were conducted. Results (see Table 6) indicated a significant difference in the number of steps taken by males versus females during flag football, ultimate Frisbee, and soccer (p -values = .0000) game play. Males were significantly more active during each activity. Examination of descriptive statistics further indicated that ultimate Frisbee resulted in the most steps per minute for both male and female students compared to flag football and soccer.

Table 6

Male and Female Students Steps per Minute by Activity

	Flag Football	Ultimate Frisbee	Soccer
Males:	*91.8 ± 17.5 (n = 97)	*96.5 ± 23.1 (n = 94)	*82.9 ± 22.7 (n = 94)
Females:	54.0 ± 16.2 (n = 95)	66.6 ± 21.3 (n = 88)	59.4 ± 21.7 (n = 88)
Mean ± Standard Deviation	*significantly more active than females during all activities ($p < .05$)		

African-American versus Caucasian Females

An ANOVA was conducted to determine if steps per minute were affected by race and the type of activity in which female students were engaged. Results indicated that race,

$F(1, 271) = 33.83, p < .0000$; and activity, $F(2, 271) = 10.34, p < .0000$, both played a significant role in female students steps per minute. In order to better understand the impact of activity mode on steps per minute of Caucasian and African-American female students a series of *t*-tests were conducted. Results indicated a significant difference in the number of steps per minute taken by Caucasian versus African-American females during ultimate Frisbee ($p = .001$) and soccer ($p = .0001$) game play (see Table 7). Caucasian females were significantly more active during both ultimate Frisbee and soccer. There was no significant difference between races during flag football ($p = .07$) game play. Examination of descriptive statistics further indicated that ultimate Frisbee resulted in the most steps per minute for both Caucasian and African-American female students compared to flag football and soccer.

Table 7

African-American and Caucasian Female Students Steps per Minute by Activity

	Flag Football	Ultimate Frisbee	Soccer
Caucasian:	57.2 ± 18.3 (n = 35)	*77.4 ± 26.2 (n = 30)	*72.2 ± 25.6 (n = 31)
African-American:	52.3 ± 15.1 (n = 60)	60.6 ± 17.4 (n = 58)	50.8 ± 15.2 (n = 57)
Mean ± Standard Deviation	* significantly more active than African-American group ($p < .05$)		

African-American versus Caucasian Males

An ANOVA was conducted to determine if steps per minute were affected by race and the type of activity in which male students were engaged. Results indicated that race, $F(1, 280) = 42.83, p < .0000$; and activity, $F(2, 280) = 15.51, p < .0000$, both had a significant role in male students steps per minute. In order to better understand the impact of activity mode on steps per minute of Caucasian and African-American male students a series of *t*-tests were conducted. Results indicated a significant difference in the number of steps per minute taken by Caucasian versus African-American males

during flag football ($p = .0009$), ultimate Frisbee ($p = .0000$) and soccer ($p = .0007$) game play (see Table 8). Caucasian males were significantly more active during each activity. Examination of descriptive statistics further indicated that ultimate Frisbee resulted in the most steps per minute for Caucasian male students. African-American male students accumulated similar steps per minute during flag football and ultimate Frisbee game play.

Table 8

African-American and Caucasian Male Students Steps per Minute by Activity

	Flag Football	Ultimate Frisbee	Soccer
Caucasian:	*97.3 ± 15.5 (n = 53)	*105.2 ± 17.9 (n = 51)	*89.7 ± 19.6 (n = 51)
African-American:	86.0 ± 18.3 (n = 44)	85.7 ± 25.5 (n = 43)	74.9 ± 23.3 (n = 43)
Mean ± Standard Deviation	* significantly more active than African-American males ($p < .05$)		

Comparison of Teacher Effect on Students Steps per Minute

A series of t -tests for equality of means were conducted to search for a possible teacher effect on the activity levels of students in coeducational and coeducational-split treatment groups. Each treatment group was examined separately due to the use of three different teachers, two in each setting. The girls only and boy's only classes were not examined as they each had only one teacher.

Female Teacher versus Male Teacher – Coeducational Group

Results for male students indicated no significant difference in activity levels during flag football ($p = .309$), ultimate Frisbee ($p = .189$), and soccer ($p = .483$) game play in coeducational settings. Results for female students also indicated no significant difference in activity levels during flag football ($p = .736$), ultimate Frisbee ($p = .444$),

and soccer ($p = .528$) game play. Descriptive statistics can be seen in Table 9. Overall, results suggested no statistical difference in activity levels between the two classes.

Table 9

Comparison of Student Steps per Minute by Teacher in Coeducational Physical Education Game Play Settings

	<u>Female Teacher</u>	<u>Male Teacher</u>
Male Students:		
Flag Football:	87.0 ± 8.1 (n = 17)	91.1 ± 15.2 (n = 19)
Ultimate Frisbee:	106.5 ± 9.5 (n = 17)	100.8 ± 14.9 (n = 17)
Soccer:	87.7 ± 22.0 (n = 16)	82.2 ± 23.8 (n = 18)
Female Students:		
Flag Football:	56.3 ± 11.9 (n = 15)	58.2 ± 18.9 (n = 15)
Ultimate Frisbee:	71.9 ± 22.1 (n = 13)	65.2 ± 24.3 (n = 14)
Soccer:	54.4 ± 19.5 (n = 14)	58.9 ± 19.9 (n = 15)

Mean ± Standard Deviation

Female Teacher versus Male Teacher – Coeducational Split Group

Results for male students indicated no significant difference in activity levels during flag football ($p = .874$) and ultimate Frisbee ($p = .121$) game play in coed-split settings. A significant difference was discovered between classes during soccer ($p = .035$) game play. Results for female students indicated no significant difference in activity levels during soccer ($p = .281$) game play. Significant differences were found between classes during flag football ($p = .044$) and ultimate Frisbee ($p = .002$) game play. Descriptive statistics can be seen in Table 10. Overall, results suggested a potential teacher effect on

the activity levels of males during soccer and females during flag football and ultimate Frisbee game play. These results were considered during treatment group analysis.

Table 10

Comparison of Student Steps per Minute by Teacher in Coeducational-split Group Physical Education Game Play Settings

	<u>Female Teacher</u>	<u>Male Teacher</u>
Male Students:		
Flag Football:	97.4 ± 12.2 (n = 12)	93.6 ± 24.9 (n = 11)
Ultimate Frisbee:	108.1 ± 17.3 (n = 11)	100.8 ± 14.9 (n = 10)
Soccer:	102.1 ± 15.8 (n = 12)	*79.1 ± 27.6 (n = 10)
Female Students:		
Flag Football:	57.8 ± 10.0 (n = 15)	*46.8 ± 18.6 (n = 25)
Ultimate Frisbee:	77.7 ± 19.0 (n = 15)	*57.9 ± 16.7 (n = 22)
Soccer:	65.8 ± 26.5 (n = 13)	58.3 ± 21.7 (n = 23)
Mean ± Standard Deviation	* significantly less active ($p < .05$)	

Treatment Group Difference in Steps per Minute for each Activity by Gender and Race

Female Treatment Group Comparisons

In order to gain a better view of specific treatment group effects, data for males and females were examined separately. Data were coded according to gender and treatment group membership. A one-way ANOVA was conducted with each activity as a dependent variable and gender/treatment group as the factor. Results for females

indicated no significant difference between treatment groups for flag football, $F(2, 94) = 1.36, p < .260$; ultimate Frisbee, $F(2, 87) = .364, p < .708$; and soccer, $F(2, 87) = .081, p < .922$, game play. A similar procedure was then used to test for differences based on race with activity as the dependent variable and race/treatment as the factor. Results for Caucasian females indicated no significant difference between treatment groups for flag football, $F(2, 34) = .892, p < .420$; ultimate Frisbee, $F(2, 29) = .637, p < .537$; and soccer, $F(2, 30) = 1.55, p < .230$, game play. Results for African-American females indicated no significant difference between treatment groups for flag football, $F(2, 57) = .979, p < .382$; ultimate Frisbee, $F(2, 57) = .007, p < .993$; and soccer, $F(2, 54) = .253, p < .777$, game play. A simple means analysis confirmed these results (see Tables 11, 12, & 13). The only apparent mean effect was for Caucasian females during soccer game play in the females-only setting. However, because there were only four participants in the group the data were not considered significant.

Male Treatment Group Comparisons

Data for males were examined using the same procedures as for females. Results indicated a significant difference between treatment groups for ultimate Frisbee, $F(2, 93) = 5.46, p < .006$; and soccer, $F(2, 93) = 4.08, p < .020$, game play. No significant difference between treatment groups was found for flag football, $F(2, 96) = .926, p < .400$, game play. Since there was a significant difference between treatment groups for ultimate Frisbee and soccer game play a post-hoc test (Tukey) was used to compare specific treatment group effects. Results of the post-hoc test indicated a significant difference between the coed-split and males-only group for soccer (.027) and between the coeducational group and males-only group for ultimate Frisbee (.006).

Results by race indicated no significant difference between treatment groups for Caucasian males during flag football, $F(2, 52) = .513, p < .602$; ultimate Frisbee, $F(2, 50) = .792, p < .459$; and soccer, $F(2, 50) = 1.57, p < .220$, game play. Results for African-American males indicated no significant difference between treatment groups for flag football, $F(2, 43) = .741, p < .483$; and soccer, $F(2, 42) = 2.05, p < .142$, game play. A significant effect did exist for ultimate Frisbee, $F(2, 42) = 5.21, p < .010$, game play. Post-hoc testing revealed a significant effect between the coeducational and males-only

group for ultimate Frisbee (.008) game play. A means analysis illustrated African-American male's lower step counts in the males-only setting during ultimate Frisbee game play (see Table 11, 12, & 13). Means analysis also illustrated lower step counts for both Caucasian and African-American males in the males-only setting during soccer game play. Although not significant when examined separately, together they contributed to the overall significant treatment group difference.

Table 11

Students Steps per Minute during Flag Football Game Play by Setting

	<u>Coed</u>	<u>Coed-Split</u>	<u>Females-Only</u>	<u>Males-Only</u>
Males:				
Caucasian:	94.6 ± 12.8 (n = 19)	97.7 ± 17.6 (n = 15)		99.7 ± 16.7 (n = 19)
African-American:	84.3 ± 9.3 (n = 17)	93.2 ± 23.6 (n = 8)		84.6 ± 21.8 (n = 19)
Total:	89.7 ± 12.3 (n = 36)	96.1 ± 19.5 (n = 23)		92.2 ± 17.7 (n = 38)
Females:				
Caucasian:	61.2 ± 18.6 (n = 12)	53.4 ± 17.4 (n = 19)	63.2 ± 22.9 (n = 4)	
African-American:	54.1 ± 14.0 (n = 18)	48.6 ± 17.2 (n = 21)	54.5 ± 13.8 (n = 21)	
Total:	57.0 ± 16.1 (n = 30)	50.9 ± 17.2 (n = 40)	55.9 ± 15.3 (n = 25)	

Mean ± Standard Deviation

Table 12

Students Steps per Minute during Ultimate Frisbee Game Play by Setting

	<u>Coed</u>	<u>Coed-Split</u>	<u>Females-Only</u>	<u>Males-Only</u>
Males:				
Caucasian:	108.9 ± 9.4 (n = 18)	105.5 ± 18.3 (n = 14)		101.5 ± 23.2 (n = 19)
African-American:	98.4 ± 13.9 (n = 16)	90.9 ± 33.6 (n = 7)		*73.8 ± 25.1 (n = 19)
Total:	104.0 ± 12.7 (n = 34)	100.7 ± 24.6 (n = 21)		*87.3 ± 27.7 (n = 38)
Females:				
Caucasian:	81.6 ± 29.0 (n = 9)	72.5 ± 22.2 (n = 16)	85.7 ± 34.8 (n = 5)	
African-American:	60.8 ± 17.9 (n = 18)	60.2 ± 17.7 (n = 21)	60.8 ± 17.5 (n = 19)	
Total:	67.7 ± 23.8 (n = 27)	65.5 ± 20.4 (n = 37)	66.0 ± 23.6 (n = 24)	
Mean ± Standard Deviation		* significantly lower steps per minute ($p < .05$)		

Table 13

Students Steps per Minute during Soccer Game Play by Setting

	<u>Coed</u>	<u>Coed-Split</u>	<u>Females-Only</u>	<u>Males-Only</u>
Males:				
Caucasian:	93.3 ± 20.1 (n = 17)	93.4 ± 20.9 (n = 15)		83.4 ± 17.4 (n = 19)
African-American:	79.2 ± 20.1 (n = 17)	85.0 ± 35.9 (n = 7)		67.3 ± 19.0 (n = 19)
Total:	86.3 ± 21.1 (n = 34)	90.7 ± 26.0 (n = 22)		*75.4 ± 19.7 (n = 38)
Females:				
Caucasian:	67.4 ± 23.7 (n = 10)	70.2 ± 26.1 (n = 17)	92.6 ± 24.5 (n = 4)	
African-American:	49.4 ± 13.9 (n = 19)	51.5 ± 18.1 (n = 19)	51.5 ± 14.0 (n = 19)	
Total:	55.6 ± 19.9 (n = 29)	60.2 ± 23.5 (n = 36)	58.7 ± 22.3 (n = 23)	
Mean ± Standard Deviation		* significantly lower steps per minute ($p < .05$)		

Single Teacher Treatment Group Comparisons

Since a potential teacher effect was present in the coed-split group, it was decided to drop all classes taught by the two male teachers and examine the single female teacher's classes separately. This allowed for a three treatment group comparison for female students and a two treatment group comparison for male students. Similar procedures as described earlier were followed using one-way ANOVA testing for each activity. Similar to the entire sample, results for female students indicated no significant difference between treatment groups for flag football, $F(2, 56) = .216, p < .806$; ultimate Frisbee, $F(2, 55) = 1.35, p < .267$; and soccer, $F(2, 53) = .839, p < .438$, game play. Results for male students indicated no significant difference between treatment groups for ultimate Frisbee, $F(1, 27) = .097, p < .758$; and soccer, $F(1, 27) = 3.67, p < .066$, game play. A significant difference did exist between coeducational and coed-split flag football, $F(1, 28) = 7.57, p < .010$, game play. Although the sample size was very small a comparison by race indicated one significant difference between treatment groups for African-American males participating in soccer, $F(1, 13) = 4.59, p < .053$, game play. When considering only the two group comparison, overall results for males were similar to the entire sample for ultimate Frisbee and soccer, but opposite for flag football. A means analysis illustrated little difference between treatment groups except for male flag football and African-American male soccer game play (see Tables 14, 15, & 16).

Table 14

Female Teachers Students Steps per Minute during Flag Football Game Play by Setting

	<u>Coed</u>	<u>Coed-Split</u>	<u>Females-Only</u>
Males:			
Caucasian:	90.1 ± 8.0 (n = 8)	98.3 ± 10.6 (n = 7)	
African-American:	84.3 ± 7.6 (n = 9)	96.1 ± 15.4 (n = 5)	
Total:	*87.0 ± 8.1 (n = 17)	97.4 ± 11.1 (n = 12)	
Females:			
Caucasian:	57.5 ± 15.7 (n = 6)	60.6 ± 6.6 (n = 8)	63.2 ± 22.9 (n = 4)
African-American:	55.5 ± 9.5 (n = 9)	54.7 ± 12.7 (n = 7)	54.5 ± 13.8 (n = 21)
Total:	56.3 ± 11.9 (n = 15)	57.8 ± 10.0 (n = 15)	55.9 ± 15.3 (n = 25)

Mean ± Standard Deviation

* significantly less steps per minute ($p < .05$)

Table 15

Female Teachers Students Steps per Minute during Ultimate Frisbee Game Play by Setting

	<u>Coed</u>	<u>Coed-Split</u>	<u>Females-Only</u>
Males:			
Caucasian:	112.9 ± 7.5 (n = 8)	111.6 ± 12.9 (n = 6)	
African-American:	100.8 ± 7.3 (n = 9)	103.8 ± 22.2 (n = 5)	
Total:	106.5 ± 9.5 (n = 17)	108.1 ± 17.3 (n = 11)	
Females:			
Caucasian:	86.7 ± 22.6 (n = 4)	91.1 ± 10.6 (n = 7)	85.7 ± 34.8 (n = 5)
African-American:	65.3 ± 19.5 (n = 9)	65.9 ± 17.0 (n = 8)	60.8 ± 17.5 (n = 19)
Total:	71.9 ± 22.1 (n = 13)	77.7 ± 19.0 (n = 15)	66.0 ± 23.6 (n = 24)

Mean ± Standard Deviation

Table 16

Female Teachers Students Steps per Minute during Soccer Game Play by Setting

	<u>Coed</u>	<u>Coed-Split</u>	<u>Females-Only</u>
Males:			
Caucasian:	93.3 ± 20.1 (n = 7)	93.4 ± 20.9 (n = 7)	
African-American:	*78.8 ± 22.8 (n = 9)	104.2 ± 17.6 (n = 5)	
Total:	87.7 ± 22.0 (n = 16)	102.1 ± 15.8 (n = 12)	
Females:			
Caucasian:	65.2 ± 25.8 (n = 5)	83.4 ± 18.4 (n = 7)	92.6 ± 24.5 (n = 4)
African-American:	48.4 ± 13.0 (n = 9)	45.2 ± 18.3 (n = 6)	51.5 ± 14.0 (n = 19)
Total:	54.4 ± 19.5 (n = 14)	65.8 ± 26.5 (n = 13)	58.7 ± 22.2 (n = 23)

Mean ± Standard Deviation

* significantly less steps per minute ($p < .05$)

Results from Modified Observational Recording Record of Physical Educator’s Teaching Behavior

Descriptive data in the form of average number of interactions per lesson, over ten minutes of game play time, for each teacher and activity are shown in Tables 17, 18, and 19. When total average interactions were considered, regardless of type, the girls only class received the most teacher interactions (M = 20.2 flag football, M = 13.8 ultimate Frisbee, and M = 21 soccer) and the boys only class received the least interactions (M = 0.33 flag football, M = 0.83 ultimate Frisbee, M = 5 soccer). Examination of the data revealed that females received slightly fewer teacher interactions compared to males during flag football and soccer, with similar amounts of teacher interactions during ultimate Frisbee in the coeducational game play setting. Data further revealed that females received more teacher interactions than males during flag football, ultimate Frisbee, and soccer in the coeducational-split game play setting.

Table 17

Average Teacher Verbal Interaction per Class of Flag Football by Gender and Race

	<u>Coed</u>		<u>Coed Split</u>		<u>Females-Only</u>	<u>Males-Only</u>
	FT	MT	FT	MT	FT	MT
Individual:	<u>3.67</u>	<u>3.17</u>	<u>3.60</u>	<u>2.50</u>	<u>6.80</u>	<u>0.33</u>
Male:	2.67	2.33	0.40	0.33	N/A	0.33
Female:	1.00	0.83	3.20	2.17	6.80	N/A
White:	2.33	1.33	1.60	0.67	1.80	0.17
Black:	1.33	1.67	2.00	1.83	5.00	0.17
Other:	0	0.17	0	0	0	0
Group:	<u>3.83</u>	<u>4.50</u>	<u>7.60</u>	<u>4.67</u>	<u>13.2</u>	<u>0</u>
Male:	0	0	0.20	0.33	N/A	0
Female:	0	0	7.40	4.33	13.2	N/A
Both:	3.83	4.50	0	0	N/A	N/A
White:	0	0	0	0	0	0
Black:	0	0	0.40	0	0	0
Whole Class:	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0.20</u>	<u>0</u>
Total Interactions:	<u>7.5</u>	<u>7.67</u>	<u>11.20</u>	<u>7.17</u>	<u>20.20</u>	<u>0.33</u>

Note: FT=Female Teacher; MT=Male Teacher; Interaction = verbal comment

Table 18

Average Teacher Verbal Interaction per class of Ultimate Frisbee by Gender and Race

	<u>Coed</u>		<u>Coed Split</u>		<u>Females-Only</u>	<u>Males-Only</u>
	FT	MT	FT	MT	FT	MT
Individual:	<u>2.33</u>	<u>2.67</u>	<u>0.67</u>	<u>1.33</u>	<u>3.50</u>	<u>0.50</u>
Male:	1.50	0.83	0.17	0.50	N/A	0.50
Female:	0.83	1.83	0.50	0.83	3.50	N/A
White:	1.00	1.00	0.33	0.67	1.33	0.17
Black:	1.33	1.67	0.33	0.67	2.17	0.33
Other:	0	0	0	0	0	0
Group:	<u>3.17</u>	<u>2.33</u>	<u>4.83</u>	<u>4.33</u>	<u>10.33</u>	<u>0.33</u>
Male:	0.50	0.17	0	1.50	N/A	0.33
Female:	0.17	0.17	4.83	2.83	10.33	N/A
Both:	2.50	2.00	0	0	N/A	N/A
White:	0	0	0	0	0	0
Black:	0.17	0.17	0	0	0.17	0
Whole Class:	<u>0.33</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Interactions:	5.83	5.00	5.50	5.67	13.83	0.83

Note: FT=Female Teacher; MT=Male Teacher; Interaction = verbal comment

Table 19

Average Teacher Verbal Interaction per class of Soccer by Gender and Race

	<u>Coed</u>		<u>Coed Split</u>		<u>Females-Only</u>	<u>Males-Only</u>
	FT	MT	FT	MT	FT	MT
Individual:	<u>5.80</u>	<u>6.60</u>	<u>8.20</u>	<u>5.83</u>	<u>7.40</u>	<u>2.83</u>
Male:	4.00	4.40	1.40	3.00	N/A	2.83
Female:	1.80	2.20	6.80	2.83	7.40	N/A
White:	2.40	3.40	3.40	3.67	2.20	0.67
Black:	3.40	3.00	4.60	2.17	5.20	2.17
Other:	0	0.20	0.20	0	0	0
Group:	<u>5.20</u>	<u>6.00</u>	<u>7.40</u>	<u>5.00</u>	<u>11.60</u>	<u>2.17</u>
Male:	0	0	2.00	2.00	N/A	2.17
Female:	0	0	5.40	3.00	11.60	N/A
Both:	5.20	6.00	0	0	N/A	N/A
White:	0	0	0	0	0	0
Black:	0	0	0.20	0.20	0.20	0
Whole Class:	<u>1.20</u>	<u>1.80</u>	<u>0</u>	<u>0</u>	<u>2.00</u>	<u>0</u>
Total Interactions:	12.20	14.40	15.60	10.83	21.00	5.00

Note: FT=Female Teacher; MT=Male Teacher; Interaction = verbal comment

Survey Instrument Results

Descriptive statistics are displayed according to similarity of question content. Survey data are presented as percentages of “I like”, “I neither like nor dislike”, and “I dislike” as related to the students perceptions and opinions. The data in Table 20 presents students feelings towards coeducational and single gender physical education. Results showed that the majority of Caucasian and African-American males (54.3%, 58.1%) and females (54.8%, 56.1%) like coeducational physical education. In contrast only 39.1% of Caucasian males, 32.6% of African-American males, 39.1% of Caucasian females, and 32.6% of African-American females reported liking single gender physical education. More importantly 35.5% of Caucasian and 22.8% of African-American females reported disliking single gender physical education.

Table 20

Students Feelings towards Coed and Single Gender Physical Education (N = 177)

	I like it	I neither like nor dislike it	I dislike it
<i>When I participate in coed PE activities (both boys and girls mixed together on teams):</i>			
<u>Males:</u>			
Caucasian:	54.3%	37%	8.7%
African-American:	58.1%	37.2%	4.7%
<u>Females:</u>			
Caucasian:	54.8%	35.5%	9.7%
African-American:	56.1%	31.6%	12.3%
<i>When I participate in single-gender PE activities (only boys or only girls teams):</i>			
<u>Males:</u>			
Caucasian:	39.1%	47.8%	13.1%
African-American:	32.6%	51.2%	16.2%
<u>Females:</u>			
Caucasian:	29%	35.5%	35.5%
African-American:	33.3%	43.9%	22.8%

(Males: n = 46 Caucasian, n = 43 African-American; Females: n = 31Caucasian; n = 57 African-American)

The data in Table 21 presents students preferences for specific activities. The data in Table 22 presents students feelings towards participating in flag football, ultimate Frisbee, and soccer game play. Flag football was reported as the activity most liked and preferred by Caucasian males, African-American males, and African-American females. Soccer was the most liked and preferred activity by Caucasian females. The two most disliked activities were soccer by African-American males (48.8%) and ultimate Frisbee by African-American females (40.4%).

Table 21

Students Most Preferred Activity (N = 177)

<i>What sport did you like the most that we played in class this semester?</i>			
	Flag Football	Ultimate Frisbee	Soccer
<u>Males:</u>			
Caucasian:	52.2%	30.4%	17.4%
African-American:	83.7%	7%	9.3%
<u>Females:</u>			
Caucasian:	16.1%	25.8%	58.1%
African-American:	54.4%	29.8%	15.8%

(Males: n = 46 Caucasian, n = 43 African-American; Females: n = 31Caucasian; n = 57 African-American)

Table 22

Students Feelings towards Flag Football, Ultimate Frisbee, and Soccer (N = 177)

	I like it	I neither like nor dislike it	I dislike it
<i>When I play flag football in class:</i>			
<u>Males:</u>			
Caucasian:	69.6%	15.2%	15.2%
African-American:	79.1%	6.9%	14%
<u>Females:</u>			
Caucasian:	35.5%	45.2%	19.3%
African-American:	61.4%	19.3%	19.3%

Table 22 – continued

	I like it	I neither like nor dislike it	I dislike it
<i>When I play ultimate Frisbee in class:</i>			
<u>Males:</u>			
Caucasian:	56.6%	21.7%	21.7%
African-American:	34.9%	34.9%	30.2%
<u>Females:</u>			
Caucasian:	32.3%	41.9%	25.8%
African-American:	33.3%	26.3%	40.4%
<i>When I play soccer in class:</i>			
<u>Males:</u>			
Caucasian:	50%	32.6%	17.4%
African-American:	23.3%	27.9%	48.8%
<u>Females:</u>			
Caucasian:	58.1%	19.4%	22.5%
African-American:	33.3%	36.8%	29.9%

(Males: n = 46 Caucasian, n = 43 African-American; Females: n = 31Caucasian; n = 57 African-American)

The data in Table 23 presents students feelings towards participation in team sports and individual activities. An overwhelming majority of African-American (86%) and Caucasian (73.9%) males liked playing team sports in physical education class. Among females, the majority of African-Americans (59.6%) liked playing team sports, while the majority of Caucasian females (61.2%) indicated neither liking, nor disliking playing team sports. A majority of African-American males (53.5%) and females (45.6%) also liked participating in individual type activities in physical education class. Caucasian males (45.7%) and females (58.1%) neither liked, nor disliked participating in individual type activities.

Table 23

Students Feelings towards Team Sport and Individual Activities (N = 177)

	I like it	I neither like nor dislike it	I dislike it
<i>When I play team sports in class (like basketball or football):</i>			
<u>Males:</u>			
Caucasian:	73.9%	19.6%	6.5%
African-American:	86%	7%	7%
<u>Females:</u>			
Caucasian:	19.4%	61.2%	19.4%
African-American:	59.6%	31.6%	8.8%
<i>When I participate in individual activities in class (like weight lifting or tennis):</i>			
<u>Males:</u>			
Caucasian:	41.3%	45.7%	13%
African-American:	53.5%	37.2%	9.3%
<u>Females:</u>			
Caucasian:	35.5%	58.1%	6.5%
African-American:	45.6%	36.8%	17.6%

(Males: n = 46 Caucasian, n = 43 African-American; Females: n = 31Caucasian; n = 57 African-American)

The data in Table 24 presents students feelings towards having choices, dressing out, and sweating and breathing hard during activity in physical education. Results indicated that Caucasian males (84.8%), African-American males (86%), Caucasian females (77.4%), and African-American females (75.4%) liked having activity choices in physical education. Results indicated that Caucasian females (54.8%) were the only group with a majority of students who disliked dressing out for physical education class. African-American males (41.9%), Caucasian males (56.5%), and African-American females (68.4%) neither liked, nor disliked dressing out for class. Results also showed that the majority of males and females of both races neither liked, nor disliked sweating nor breathing hard.

Table 24

Students Feelings towards Activity Choice, Dressing Out, and Hard Exercise (N = 177)

	I like it	I neither like nor dislike it	I dislike it
<i>When I am given a choice of activities to participate in class:</i>			
<u>Males:</u>			
Caucasian:	84.8%	13%	2.2%
African-American:	86%	11.6%	2.4%
<u>Females:</u>			
Caucasian:	77.4%	19.4%	3.2%
African-American:	75.4%	24.6%	0%
<i>When I have to dress-out for PE class:</i>			
<u>Males:</u>			
Caucasian:	10.9%	56.5%	32.6%
African-American:	39.5%	41.9%	18.6%
<u>Females:</u>			
Caucasian:	12.9%	32.3%	54.8%
African-American:	10.5%	68.4%	21.1%
<i>When I sweat and breathe hard in PE class during activity:</i>			
<u>Males:</u>			
Caucasian:	19.6%	60.8%	19.6%
African-American:	37.2%	37.2%	25.6%
<u>Females:</u>			
Caucasian:	22.6%	54.8%	22.6%
African-American:	15.8%	45.6%	38.6%

(Males: n = 46 Caucasian, n = 43 African-American; Females: n = 31Caucasian; n = 57 African-American)

Summary of Results for Research Hypotheses

Research Hypothesis One

Research hypothesis one stated that Adolescent Caucasian and African-American males would be more active, as measured by pedometer step counts, than adolescent

Caucasian and African-American females in both coeducational and single gender high school physical education settings regardless of the activity. As hypothesized, results indicated that boys were more active than girls in flag football, ultimate Frisbee, and soccer game play regardless of the setting.

Research Hypothesis Two

Research hypothesis two stated that Adolescent Caucasian and African-American males would accrue similar amounts of activity, as measured by pedometer step counts, in the coeducational and single gender high school physical education settings regardless of the activity. Contrary to the stated hypotheses, male students were less physically active in males-only than coeducational and coed-split ultimate Frisbee and soccer game play. The lower activity levels of African-American males made a significant contribution to these differences. As expected, there were no differences between settings during flag football game play. Also, contrary to expectations, Caucasian males were more active than African-American males in flag football, ultimate Frisbee, and soccer game play regardless of the setting.

Research Hypothesis Three

Research hypothesis three stated that Adolescent Caucasian and African-American females would be more active, as measured by pedometer step counts, in the coeducational versus single gender settings regardless of the activity. Contrary to the stated hypotheses, there were no differences in activity levels for girls (overall and by race) in this study between coeducational and single gender flag football, ultimate Frisbee, and soccer game play settings.

Research Hypothesis Four

Research hypothesis four stated that Caucasian females would be more active, as measured by pedometer step counts, than African-American females in both coeducational and single gender high school physical education settings regardless of the activity. As hypothesized, Caucasian females were more active than African-American females in all settings and in all activities.

Discussion

Activity Levels by Race and Gender

Results from this study indicate that high school aged males on average get more physical activity than females. This was true for each team sport activity in coeducational and single gender settings in this study. This finding supports previous research in which physical activity, measured by accelerometer activity counts, found males to be more active than females across all physical education classes (LeMura, et. al., 2000). These results may have been influenced by the type of activities used in the study. Previous studies have found sex differences in activity preferences, with males demonstrating a strong preference for team sports and females preferring individual activities with an aesthetic orientation (Fromel, Formankova, & Sallis, 2002). In a survey used in this study, Caucasian males (73.9%) and African-American males (86%) indicated liking team sport activities. In comparison only 19.4 % of Caucasian females and 59.6% of African-American females indicated liking team sport activities. Had activities such as aerobic dance or gymnastics been used results may have been different.

When measuring the physical activity levels of Caucasian versus African-American females, results showed that Caucasian females were more active in ultimate Frisbee and soccer game play, but that there was no difference during flag football game play. Although not significantly different statistically, one potential reason Caucasian girls were more active is that their body fat percent ($M = 27.5\%$, $SD = 6.5\%$) and body mass index ($M = 23.8$, $SD = 5.6$) was lower than African-American females ($M = 30.1\%$, $SD = 7.8\%$; $M = 26.1$, $SD = 6.8$). There were also a greater number of African-American females classified as obese ($n = 21$) compared to Caucasian females ($n = 6$). As suggested by Rowland (1999) body fat serves as an inert load that must be carried during weight-bearing physical activity. This makes exercise more difficult, and may cause avoidance of physical activity. The findings from this study are similar to other studies that have found African-American females to be more overweight and obese with higher body mass index and lower physical activity levels than Caucasian school-aged females

(Felton, et. al., 2002; Kimm, et. at., 2002). It is interesting to note that there was no significant difference in activity levels for flag football game play. The reason for this finding could be due to the fact that when surveyed 54.8% of African-American females picked flag football as their favorite semester team sport activity. Only 16.1% of Caucasian females preferred flag football over ultimate Frisbee and soccer. This demonstrates that student preferences may play a role in physical activity levels. This is something teachers may want to consider in attempting to improve the low activity levels seen in African-American female students.

Results indicated that Caucasian males were more active than African-American males across all activities and settings. This is contrary to what was hypothesized, but consistent with Bradley, et. al. (2000) who reported that beginning in the seventh grade African-American males reported more sedentary activities than Caucasian males. Reasons for the results are unclear as both African-American and Caucasian males shared similar body fat percentage and body mass index. They also both expressed a strong liking for team sports. Survey data did reveal that 83.7% of African-American males preferred flag football compared to only 7% for ultimate Frisbee and 9.3% for soccer. In fact, 48.8% of African-American males disliked soccer. Preferences for Caucasian males were more evenly spread out with 52.2% preferring flag football, 30.4% ultimate Frisbee, and 17.4% soccer. Despite African-American male's strong preference for flag football, Caucasian males were still more active during game play. Thus, activity preference may not be a good explanation for the group differences. Further research is needed exploring activity levels of males by race before any conclusive statements can be made.

Activity Levels in Coeducational versus Single Gender Settings

Contrary to what was hypothesized there were no significant differences in activity levels of females overall, and for both African-American and Caucasian females when examined separately, in coeducational and single gender settings. Results of the only known previous studies (Hannon & Ratliffe, unpublished data; McKenzie et. al., in press; & Schmitt, 2002) indicated that females received more physical activity in coeducational settings. These studies were different than the current study in that they took place in middle to high socioeconomic school settings and they did not report measures of teacher

interaction rate with students, or information on student preferences. Studies have demonstrated that higher rates of teacher interactions with students result in significant increases in moderate to vigorous physical activity levels (Schuldheisz & Van der Mars, 2001; Van der Mars, Vogler, Darst & Cusimano, 1998). In this study, teacher interaction rates per lesson for females were higher in the coed-split than the coeducational group and were highest in the females-only group. Teacher supervision seemed to have a positive effect on participation. When the teacher was verbally commenting to the students, providing feedback about performance and encouragement to be active, the step counts were higher. This suggested that had females received similar amounts of interaction in the coeducational setting as the females-only setting that steps per minute may have been highest in coeducational physical education. Previous research has suggested that female students have had unpleasant experiences in coeducational physical education as a result of lack of enjoyment and opportunity (Carroll & Loumidis, 2001; Osborne, et. al., 2002). In this study, when surveyed, Caucasian females (54.8%) and African-American females (56.1%) indicated that they liked coed physical education. On the contrary only 29% of Caucasian and 33.3% of African-American females indicated that they liked single gender physical education. Results support the continued practice of involving females in coeducational physical education to improve physical activity levels and enjoyment.

Results for males were mixed. No significant differences between treatment groups were discovered during flag football game play. There was a significant difference between groups for ultimate Frisbee and soccer game play. Specific differences were discovered between coed-split and males-only soccer, and between coeducational and males-only ultimate Frisbee. In each case the coeducational setting resulted in higher average steps per minute. Lower activity levels among African-Americans in the males-only setting made the greatest contribution to these differences. Previous studies found males to receive similar amounts of activity regardless of setting (Hannon & Ratliffe, unpublished data; Schmitt, 2002). The examination of teacher interaction rates provides one possible explanation for the observed differences. Students in the males-only setting received the lowest average interactions per lesson for flag football (0.33), ultimate Frisbee (0.83), and soccer (5.00). Also, survey results showed that 48.8% of African-

American males disliked soccer game play, and 30.2% disliked ultimate Frisbee game play. Lack of activity enjoyment may have required greater active teacher supervision to maintain activity levels throughout 30 minutes of game play. Another contributing factor may have been class type preference. When surveyed 54.3% of Caucasian and 58.1% of African-American males indicated that they liked coeducational physical education. Similar to results of female students, only 39.1% of Caucasian and 32.6% of African-American males liked single gender physical education. Results of this study support the use of coeducational settings to improve male's physical activity levels and enjoyment of physical education.

Results support the philosophy of Title IX to provide equal participation opportunities for both high school aged males and females in physical education. The varied gender interaction students receive in coeducational settings also supports two national content standards for physical education (NASPE, 1995): Standard 5) Demonstrates responsible personal and social behavior in physical activity settings; and Standard 6) Demonstrates understanding and respect for differences among people in physical activity settings. Students in this study indicated a preference for coeducational physical education. In terms of physical activity levels, males and females accumulated similar or higher steps per minute in coeducational settings then in other settings. If teachers provided an appropriate amount of active supervision in the form of general interactions and performance feedback during coeducational physical education, research supports that activity levels may have been even greater. Overall, issues surrounding coeducational and single gender physical education remain complex. More research is needed using larger sample sizes across various racial groups and social strata to examine students' physical activity levels and perceptions of coeducational and single gender physical education.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to compare activity levels, as measured by pedometer steps per minute, of high school Caucasian and African-American females and males participating in coeducational and single gender settings during ultimate Frisbee, soccer, and flag football team sport units. Participants were approximately 209 high school students enrolled in six intact physical education classes at an ethnically diverse, low to middle socioeconomic status, Northwestern Florida high school. Three experienced physical education teachers, one female and two males, conducted all physical education classes. The student characteristics of height, weight, body composition, age, gender, and race were obtained prior to data collection from existing school records and a fitness assessment.

Students participated in the schools regular team sport curriculum of flag football, ultimate Frisbee, and soccer. Prior to the start of data collection the teachers and researcher met to discuss class procedures and game rules. Lessons were developed to assure similarity between all classes (see Appendix F). Two coeducational classes remained coeducational during game play, two coeducational classes were split into male and female teams for game play, one class was exclusively females-only, and one class was exclusively males-only throughout the study.

Digi-walker (Yamax-SW 701) pedometers were worn by students and used to monitor activity levels during 30 minutes of game play in each physical education class over six lessons in each team sport unit. Prior to the start of data collection students were assigned a pedometer number and practiced picking up, attaching, wearing and returning their pedometer. During the middle ten minutes of each portion of the lesson allocated for game time (approximately 30 minutes) a modified version of a portion of the

Observational Recording Record of Physical Educator's Teaching Behavior (Stewart, 1989) was used to monitor the type and rate of teacher/student verbal interactions (see Appendix D). Upon completion of the last activity unit students were asked to complete a brief 11-item survey about their views of coeducational and single gender physical education, and activity preferences (see Appendix E).

Results were generated using Statistical Package for Social Science (SPSS) software (version 11.0, Chicago, IL, USA) and Stata/SE 8.0 (Stata Corporation, College Station, TX). Activity step counts were converted to steps per minute to account for individual variances in the amount of daily game time activity. ANOVA's with tukey post-hoc tests and t-tests were used to test for differences in activity levels between male and female students, African-American and Caucasian students, and coeducational and single gender settings during flag football, soccer, and ultimate Frisbee units. A t-test was used to test for any significant teacher effect on male and female student's activity levels during each unit in the coeducational and coeducational-split groups. Descriptive statistics were used to describe teacher interaction and survey response data.

Results indicated that boys were more active than girls in each activity regardless of the setting. Caucasian males were more active than African-American males, and Caucasian females were more active than African-American females. This confirms results found in previous studies. Contrary to expectations, there were no differences in activity levels for girls (overall and by race) in this study between coeducational and single gender flag football, ultimate Frisbee, and soccer game play settings. Previous studies (Hannon & Ratliffe, unpublished data; McKenzie et. al., in press; & Schmitt, 2002) had found females to be more active in coeducational settings. Contrary to expectations, male students were less physically active in males-only than coeducational and coed-split ultimate Frisbee and soccer game play. Lower activity levels of African-American males made a significant contribution to these differences. Teacher interaction rate may have contributed to the differences or lack of differences between groups, particularly in the males-only setting. Survey results indicated that team sport preferences by gender and race may have contributed to differences in the overall activity levels. Males have a greater preference for team sports. Males and African-American females enjoyed flag football the most, while Caucasian females preferred soccer.

Conclusions

Based on the findings within the scope of this study the following conclusions are warranted:

1. Caucasian and African-American males are more active, as measured by steps per minute, than Caucasian and African-American females during flag football, ultimate Frisbee, and soccer game play regardless of coeducational or single gender settings.
2. Caucasian males are more active, as measured by steps per minute, than African-American males during flag football, ultimate Frisbee and soccer game play regardless of coeducational or single gender settings.
3. Caucasian females are more active, as measured by steps per minute, than African-American females during ultimate Frisbee and soccer game play regardless of coeducational or single gender settings.
4. Caucasian and African-American females receive similar average steps per minute during flag football game play regardless of coeducational or single gender settings.
5. Females, overall and when examined separately by race, receive similar average steps per minute during flag football, ultimate Frisbee, and soccer game play in coeducational and single gender settings.
6. Males, overall and when examined separately by race, receive similar average steps per minute during flag football, ultimate Frisbee, and soccer game play in coeducational and coed-split settings.
7. Males are significantly less active, as measured by steps per minute, in a males-only setting during ultimate Frisbee and soccer game play.

Recommendations

Future research efforts involving the study of student's physical activity levels in coeducational and single gender physical education settings are crucial in understanding the most appropriate instructional environment. As a result of this study the following recommendations are made for research and practice.

Recommendations for Future Research

The following recommendations may help future research efforts in the area of student's activity levels in coeducational and single gender settings:

1. Increase the number of students in a similar study.
2. Collect data during participation in more team sports, such as basketball or lacrosse.
3. Collect data during participation in individual sports and activities, such as tennis or aerobic dance.
4. Replicate this study using middle and elementary school aged students.
5. Control for the rate and quality of teacher interaction/feedback.
6. Collect data using one teacher over several years using the same activities in order to increase sample size and control for teacher effect.
7. Investigate the effects on physical activity levels of athletes versus non-athletes
8. Investigate the effects on physical activity levels of high skilled versus low skilled students.
9. Continue the use of Digi-walker pedometers as a measurement instrument to allow for better comparisons between studies.

Recommendations for Practitioners and Teachers

The following recommendations may help teachers who are attempting to find the most appropriate methods to increase student's physical activity levels in physical education class:

1. Continue using coeducational physical education classes to promote physical activity and provide the benefits associated with varied interaction between genders and different racial groups.
2. Teacher supervision including feedback and encouragement can help motivate students and make physical education experiences more enjoyable.
3. Remember to provide an equal amount of feedback and encouragement to females and minority students in mixed race and gender settings.
4. Ability grouping, as opposed to gender grouping, could allow the opportunity for more level competition and increased physical activity among lower skilled students.
5. Providing students with choices of activities to pick from at the start of the year may help improve class participation and physical activity levels.
6. Activities that involve intermittent bouts of moderate to intense exercise followed by periods of rest may initially be better and more enjoyable for overweight and obese students versus activities that are continuous in nature.

APPENDIX A
PARTICIPANT INFORMATION FORM

Participant Information Form

Directions: Please complete the information in the box only.

Student Name: _____

Teacher Name/Block: _____

Age: _____ Circle Gender: Male Female

Ethnicity: _____ Caucasian (White non-Hispanic)

 _____ African-American

 _____ Hispanic

 _____ Asian

 _____ Native American (American Indian)

 _____ Other (multi-cultural)

Height: _____ in. _____ cm. Weight: _____ lbs. _____ kg.

Body Composition:

BMI: _____

BIA: _____

Skinfolds: Triceps: _____ _____ _____ Avg. _____

 Calf: _____ _____ _____ Avg. _____

% BF: _____

APPENDIX B
REVIEW BOARD APPROVALS



Office of the Vice President
for Research
Tallahassee, Florida 32306-2763
(850) 644-5260 • FAX (850) 644-4392

APPROVAL MEMORANDUM

from the Human Subjects Committee

Date: July 31, 2003

From: David Quadagno, Chair *DQH*

To: James C. Hannon
2305 Killearn Center Blvd., A-13
Tallahassee, FL 32309

Dept: Sport Management, Recreation Management & Physical Education

Re: Use of Human subjects in Research

**Project entitled: Activity Levels of High School Students during
Physical Education in Different Instructional Groupings**

The forms that you submitted to this office in regard to the use of human subjects in the proposal referenced above have been reviewed by the Human Subjects Committee at its meeting on July 9, 2003. Your project was approved by the Committee.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals which may be required.

If the project has not been completed by July 8, 2004, you must request renewed approval for continuation of the project.

You are advised that any change in protocol in this project must be approved by resubmission of the project to the Committee for approval. Also, the principal investigator must promptly report, in writing, any unexpected problems causing risks to research subjects or others.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols of such investigations as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

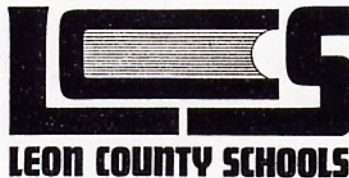
This institution has an Assurance on file with the Office for Protection from Research Risks. The Assurance Number is IRB00000446.

APPLICATION NO. 03.339
Cc: T. Ratliffe

BOARD CHAIRMAN
Dee Crumpler

BOARD VICE-CHAIR
Georgia "Joy" Bowen

DIRECTOR, PROGRAM MONITORING
AND EVALUATION SERVICES
Margarida Southard, Ph.D.



BOARD MEMBERS
Sheila Costigan
Maggie B. Lewis
H. Fred Varn

SUPERINTENDENT
William J. Montford, III

August 15, 2003

James C. Hannon
2305 Killlearn Center Blvd. A-13
Tallahassee, Florida 32309

Topic: "*Physical Activity of Physical Education Students*"

Dear Mr. Hannon:

The Leon County Research Review Board is in receipt of your revised Parent Consent Form. Based on your proposal and modifications made to the Consent Form, your research request will be approved for the period of August 2003 through August 2004. Should you desire to continue your research efforts after this period of time, you must submit a progress report on the status of your research and request renewed approval for continuation of the project. Any significant changes or amendments to the procedures or design of this study must be approved by resubmitting the request for research to the Research Review Board.

You need to contact the principals of the schools in which you wish to conduct your study as soon as possible. The principal is responsible for making the decision relative to his or her school. It is your responsibility to return the enclosed "Principal's Consent for Research Participation," signed by the principal(s) of the school(s) to be involved, prior to the start of any research. Receipt of this consent form by this office will complete the approval process.

In the interest of continued research benefits and the coordination of research interests, please send this office one copy of your results and discussion. This information, and any other relevant information you may have, will be filed in our research library and added to the annotated listing of research projects. We look forward to your results and any suggestions they may offer toward improving the educational process in Leon County Schools.

Please feel free to call me if I can be of further assistance. I can be reached at 488-7007.

Sincerely,

Margarida F. Southard, Ph.D.
Program Monitoring and Evaluation
Chair, Research Review Board

MFS/db

cc: Randolph Pridgeon/Godby, Margo Hall/Leon, Kae Ingram, Malinda Jackson, Mike Odom,
Ronnie Youngblood, Ella Hall

3955 West Pensacola Street • Tallahassee, Florida 32304-2998 • Phone (850) 488-7007 • Fax (850) 922-5979 • Suncom (850) 278-7007

Teaching, Learning, Caring for the Future

Affirmative Action/Equal Opportunity Employer • (850) 487-7105

APPENDIX C
INFORMED CONSENT FORMS

Parental Consent Letter for Participation in a Research Study

Dear Parent:

I am a graduate student under the direction of Professor Thomas Ratliffe in the Department of Sport Management, Recreation Management, and Physical Education/College of Education at Florida State University. I am conducting a research study to determine how much physical activity students are receiving in physical education classes during different activities and in various student groupings.

Your child's participation will involve wearing a pedometer (a device which measures physical activity in steps) during normal class activities throughout the Fall semester. A Pedometer is a small device worn at the hip which measures vertical motion. Pedometers are commonly used in physical education classes. Your child may also be asked to participate in single gender (boys vs. boys, girls vs. girls) and/or coeducational game play. Your participation, as well as that of your child, in this study is voluntary. If you or your child chooses not to participate or to withdraw from the study at any time, there will be no penalty; it will not affect your child's grade. The results of the research study may be published, but your child's name and identity will not be revealed to the extent allowed by law.

Although there may be no direct benefit to your child, the possible benefit of your child's participation is to improve future instruction by allowing teachers to know how much activity students are receiving during various activities and different instructional groupings.

If you have any questions concerning this research study or your child's participation in the study, please call me or Dr. Ratliffe at (850) 644-7588.

Sincerely,

James C. Hannon

* * * * *

I give consent for my child _____ to participate in the above study.
(Insert child's name here)

Parent's Name: _____

Parent's Signature _____ (Date) _____

If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Committee, Institutional Review Board, through the Vice President for the Office of Research at (850) 644-8633.

Child Assent Form For Participation in a Research Study

I have been informed that my parent(s) have given permission for me to participate, if I want to, in a study concerning physical activity levels during physical education classes. I will be asked to wear an instrument called a pedometer. My participation in this project is voluntary and I have been told that I may stop my participation in this study at any time. If I choose not to participate, it will not affect my grade in any way.

Name: _____

Date: _____

APPENDIX D
MODIFIED OBSERVATIONAL RECORDING RECORD OF PHYSICAL
EDUCATOR'S TEACHING BEHAVIOR

Modified Observational Recording Record of Physical Educator's Teaching Behavior (Interactions Only)

Recorder: _____ Teacher/Block: _____

Activity: _____ Date: _____

Time Started: _____ Time Finished: _____

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64

Interaction Codes:

I = Individual	M = Male	W = White
G = Group	F = Female	B = Black
C = Class		

Example 1: If the teacher addresses an individual student who is female and black the interaction would be coded "IFB".

Example 2: If the teacher addresses the entire class the interaction would be coded "C".

Example 3: If the teacher addresses a group of females both black and white the interaction would be coded "GFWB".

APPENDIX E
SURVEY INSTRUMENT

Name: _____

Pedometer Number: _____

Teacher/Block: _____

Gender: **Male** **or** **Female**

Race: _____ **Caucasian**
 _____ **African-American**
 _____ **Hispanic**
 _____ **Asian**
 _____ **Other**

Please respond to the following questions by circling the answer choice that most closely resembles your feelings and opinions using the following answers:

(1) I like it (2) I neither like nor dislike it (3) I dislike it

When I participate in PE with boys

1 2 3

When I play flag football in class

1 2 3

When I participate in PE with girls

1 2 3

When I play team sports in class like basketball or football

1 2 3

When I play soccer in class

1 2 3

When I participate in individual activities in class like weight lifting or tennis

1 2 3

When I play ultimate Frisbee in class

1 2 3

When I am given a choice of activities to participate in class

1 2 3

When I have to dress out for PE class

1 2 3

When I sweat and breathe hard in PE class during activity

1 2 3

What sport did you like the most that we played in class this semester?

Flag Football Ultimate Frisbee Soccer

APPENDIX F
ACTIVITY LESSON OUTLINES

Name of Activity: Ultimate Frisbee

Grade level: 9-12

Equipment: Frisbees, large playing fields

Description of Activity and Procedures: (90 min. class)

- Dress out and attendance - 10 min.
- Warm-up activities - 10 min.
- Move to playing fields - 5 min.
- Skill drills and practice - 15 min.
- Attach pedometers - 5 min.
- Game Play - 30 min.
 - Small teams of 6-7 students in a 50 yard x 50 yard playing area.
 - The objective is for the team with the Frisbee to pass it up the field without dropping it and catch it in the end zone for a score.
 - The other team tries to intercept the Frisbee or knock it down.
 - Each point begins with both teams lining up in front of their respective end zones.
 - The game begins with the defense throwing the Frisbee to the offense.
 - Players on both teams may then move to any part of the field.
 - The Frisbee may be advanced in any direction by completing a pass to a teammate.
 - Players may not run more than 3 steps with the Frisbee and cannot score by stepping over the goal line.
 - The player with the Frisbee has 10 seconds to throw the disc.
 - Players on the opposing team may not guard the passer, but may guard the receivers without contact.
 - When a pass is not completed, the defense immediately takes possession of the Frisbee and becomes the offense.
 - No physical contact is allowed between players.
 - Contact with another player is a foul.

- When a foul disrupts possession, the play resumes as if the possession was retained.
- Return pedometers, closing - 5 min.
- Shower and dress - 10 min.

Name of Activity: Flag Football

Grade level: 9-12

Equipment: Footballs, flags and belts, large playing fields

Description of Activity and Procedures: (90 min. class)

- Dress out and attendance - 10 min.
- Warm-up activities - 10 min.
- Move to playing fields - 5 min.
- Skill drills and practice - 15 min.
- Attach pedometers & flags - 5 min.
- Game Play - 30 min.
 - Small teams of 6-7 students in a 50 yard x 50 yard playing area.
 - No blocking, tackling, or holding the ball carrier.
 - Defensive players must maintain contact with the ground.
 - Ball carriers may not employ straight arm or body contact.
 - The ball is downed or the player is tackled when one flag is detached from the belt or the carrier loses his or her flag.
 - Scoring in flag football:
 - Touchdown = 6 points
 - Point after touchdown = 1 point by run or pass
 - Safety = 2 points
 - The ball is put into play by a kick or throws from the goal line at the start of the game and after each score.
 - The ball must travel 10 yards or be re-kicked.
 - If the ball goes out of bounds after 10 yards, the opponent has the choice of beginning play where it went out of bounds or placing it on his or her 15-yard line.
 - If the ball is kicked into the end zone and the opponents choose not to run it back, play begins on their 15-yard line.
 - A fumbled ball at any time is considered a dead ball and belongs to the team that committed the fumble.

- A fumbled forward pass is ruled as an incomplete pass.
 - Each team has four chances to move the ball from one 15-yard zone to the next.
 - If a team is not successful at moving the ball from one zone to the next in four downs, the ball is awarded to the opponents on the spot where the last stoppage of play occurred.
 - All players on both teams are eligible to catch passes.
 - Forward passes may be thrown from any point back of the line of scrimmage.
 - Lateral passes may be thrown anywhere on the field.
 - Any number of passes may be thrown in a series of downs.
 - Rushers must be 3-yards back at the time of the snap and must wait 3 seconds to rush the quarterback. Quarterback cannot run for 3 seconds.
 - Stationary blocking only is allowed.
- Return pedometers, closing - 5 min.
 - Shower and dress - 10 min

Name of Activity: Soccer

Grade level: 9-12

Equipment: Soccer balls, 6 small cones, 8 large cones, large playing fields

Description of Activity and Procedures: (90 min. class)

- Dress out and attendance - 10 min.
- Warm-up activities - 10 min.
- Move to playing fields - 5 min.
- Skill drills and practice - 15 min.
- Attach pedometers - 5 min.
- Game Play - 30 min.
 - Small teams of 6-7 students in a 50 yard x 50 yard playing area.
 - Positions include 3-4 forwards, 2-3 defenders, and 1 goalie.
 - Positions are rotated every ten minutes of game play.
 - One point is awarded for each goal.
 - Scoring goal kicks may not fly higher than the defenders head.
 - Players must kick the ball or they may use their head or chest to play it.
 - Kickoff:
 - The kickoff is kicked from the center of the field.
 - A kickoff is taken at the start of the game and after a goal is scored.
 - Throw-in:
 - The throw-in is taken when the ball crosses completely over the touch line.
 - It is taken where the ball crosses the line (one meter).
 - It is taken by a player on the team who did not touch the ball last.
 - Opponents must not impede the throw-in.
 - Players must use both hands, and must throw behind and over head with feet on or outside line.
 - If a ball is thrown improperly, a throw-in is awarded to the opposite team.

- The ball is in play when it enters the field after being released.
 - A player cannot score directly off a throw-in.
- Dropped Ball:
 - A dropped ball is taken after a temporary suspension of play.
 - The ball is dropped by the referee and is in play when it touches the ground.
 - The player may dribble, pass, or shoot off the drop.
- Hand Ball:
 - A hand ball is when a player other than the goalie touches the ball with any part of the arm from the shoulder to the fingers.
 - The call will not be made if the player who committed the hand ball, or his or her team, did not get an advantage or possession.
- Foul:
 - Knocking a player down, tripping, or grabbing the jersey are all examples of fouls.
 - Fouls result in free or penalty kicks.
- Corner Kick:
 - This is awarded when a player kicks the ball over the endline (goal line) he or she is defending.
 - A player from the attacking team kicks the ball from the corner closest to where the ball went out.
 - Opponents must be ten yards away.
 - The ball is in play when it is kicked and moves.
 - Offense can score directly off the corner kick.
- Goal Kick:
 - When the ball is kicked over the endline by a player attacking that end, a goal kick is awarded.
 - This means the goalie of that end may kick the ball from the box in front of the goal.

- Opponents must be outside of the penalty area until the ball leaves the area.
 - Out of Bounds:
 - The ball must cross completely over the line to be called out of bounds.
 - A player can be standing out of bounds and not be called if the ball is still not out.
 - Free Kick:
 - Any time any foul or hand ball is committed, the other team receives a free kick.
 - When taking free kicks, the other team must be at least ten yards away.
 - Penalty Kick:
 - This is the direct result of a foul in the large box or penalty box.
 - These can also be the result of a hand ball.
 - The goalie of the team that committed the foul will have to try and stop the kick from the person the other team chooses to take the free kick.
 - The goalie cannot move until the kicker takes his or her first step.
 - All players, except goalkeeper and kicker, must be ten yards outside area, behind penalty mark, and in field.
 - Goalkeeper must be on goal line between goal cones until ball is kicked.
 - Ball is in play when it is kicked forward.
- Return pedometers, closing - 5 min.
- Shower and dress - 10 min.

APPENDIX G
PEDOMETER DATA RECORDING SHEET

Ped. #	Subject #	FF 1	FF 2	FF 3	FF 4	FF 5	FF 6
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							

REFERENCES

- Ainsworth, B., Berry, C., Schnyder, V., & Vickers, S. (1992). Leisure time physical activity and aerobic fitness in African American young adults. *Journal of Adolescent Health, 13*, 606-611.
- Ainsworth, B., Keenan, M., Strogatz, D., Garrett, J., & James, S. (1991). Physical activity and hypertension in Black adults. The Pitt County study. *American Journal of Public Health, 81*, 1477-1479.
- Baranowski, T. (1988). Validity and reliability of self report measures of physical activity: an information processing prospective. *Research Quarterly in Exercise and Sport, 59*, 314-327.
- Bassett, D., Ainsworth, B., & Leggett, S. (1996). Accuracy of five electronic pedometers for measuring distance walked. *Medicine and Science in Sports and Exercise, 28*, 1071-1077.
- Bradley, C., McMurray, R., Harrell, J., & Deng, S. (2000). Changes in common activities of 3rd through 10th graders: the CHIC Study. *Medicine and Science in Sports and Exercise, 32*(12), 2071-2077.
- Bungum, T., & Vincent, M. (1997). Determinants of physical activity among female adolescents. *American Journal of Preventive Medicine, 13*, 115-122.
- Carroll, B., & Loumidis, J. (2001). Children's perceived competence and enjoyment in physical education and physical activity outside school. *European Physical Education Review, 7*(1), 24-43.
- Centers for Disease Control and Prevention. (1996). Youth risk behavior surveillance-United States, 1995. *Morbidity and Mortality Report, 45*, (No. 55-4), 1-83.
- Centers for Disease Control and Prevention. (1992). Vigorous physical activity among high school students. *Morbidity and Mortality Weekly Reports, 41*, 33-35.
- Cockburn, C. (2001). Year 9 girls and physical education: a survey of pupil perceptions. *The Bulletin of Physical Education, 37*(1), 5-24.

- Cole, T., Bellizzi, M., Flegal, K., & Dietz, W. (2000). Establishing a standard definition for child overweight and obesity worldwide: international survey. *British Medical Journal*, 320, 1240-1243.
- Coleman, K., Saelens, B., Wiedrich-Smith, M., Finn, J., & Epstein, L. (1997). Relationships between TriTrac-R3D vectors, heart rate, and self-report in obese children. *Medicine and Science in Sports and Exercise*, 29(11), 1535-1542.
- Davis, K. (2000). A case study in gender equity for basic instruction programs. *Physical Educator*, 57(4), 46-55.
- Durant, R., Baranowski, T., & Puhl, J. (1992). Evaluation of children's activity rating scale (CARS) in young children. *Medicine and Science in Sports and Exercise*, 25, 1415-1421.
- Easton, R., Rowlands, A., Ingledeu, D. (1998). Validity of heart rate pedometry, and accelerometry for predicting the energy cost of children's activities. *Journal of Applied Physiology*, 84, 362-371.
- Felton, G., Dwoda, M., Ward, D., Dishman, R., Trost, S., Saunders, R., & Pate, R. (2002). Differences in physical activity between black and white girls living in rural and urban areas. *Journal of School Health*, 72(6), 250-255.
- Freedson, P. (1991). Field monitoring of physical activity in children. *Pediatric Exercise Science*, 1, 8-18.
- Freedson, P. (1991). Electronic motion sensors and heart rate as measures of physical activity in children. *Journal of School Health*, 61, 220-223.
- Fromel, K., Formankova, S., & Sallis, J. (2002). Physical activity and sport preferences of 10 to 14-year old children: a 5-year prospective study. *Gymnica*, 32(1), 11-16.
- Fromel, K., Vasendova, J., & Krapkova, J. (2000). Esthetic aspects of physical education classes for girls. *Physical Educator*, 57(3), 146-159.
- Gillum, R. (1987). Overweight and obesity in black women: A review of published data from the National Center for Health Statistics. *Journal of the National Medical Association*, 78, 8654-8891.
- Gortmaker, S., Must, A., & Sohol, A. (1996). Television viewing as a cause of increasing obesity among children in the U.S., 1986-1990. *Archives of Pediatric and Adolescent Medicine*, 310(1), S109-S113.
- Goudas, M., & Biddle, S. (1993). Pupil perceptions of enjoyment in physical education. *Physical Education Review*, 16(2), 145-150.

- Griffin, P. (1985). Girls' and boys' participation styles in middle school physical education team sport classes: a description and practical applications. *Physical Educator*, 42, 3-8.
- Griffin, P. (1984). Girls' participation patterns in a middle school team sports unit. *Journal of Teaching in Physical Education*, 4, 30-38.
- Hannon, J., & Ratliffe, T. (2003). *Adolescent male and female activity levels during high school physical education: coeducational and single gender settings*. Unpublished manuscript.
- Heath, G., Pratt, M., Warren, C., & Kann, L. (1994). Physical activity patterns in American high school students. *Archives of Pediatric Adolescent Medicine*, 148, 1131-1136.
- Houtkooper, L., Lohman, T., Going, S., & Hall, M. (1989). Validity of bioelectrical impedance for body composition assessment in children. *Journal of Applied Physiology*, 66(2), 814-821.
- Jones, M. (1989). Gender issues in teacher education. *Journal of Teacher Education*, 40(1), 33-38.
- Kilanowski, C., Consalvi, A., & Epstein, L. (1999). Validation of an electronic pedometer for measurement of physical activity in children. *Pediatric Exercise Science*, 11, 63-68.
- Kimm, S., Glynn, N., Kriska, A., Barton, B., Kronsberg, S., Daniels, S., Crawford, P., Sabry, Z., Liu, K. (2002). Decline in physical activity in black girls and white girls during adolescence. *The New England Journal of Medicine*, 347(10), 709-715.
- Kucsmarski, R. (1993). Trends in body composition for infants and children in the U.S. *Clinical Reviews of Food and Science Nutrition*, 33, 375-387.
- LeMura, L., Andreacci, J., Carlonas, R., Klebez, J., & Chelland, S. (2000). Evaluation of physical activity measured via accelerometry in rural fourth-grade children. *Perceptual and Motor Skills*, 90, 329-337.
- Lirgg, C. (1993). Effects of same-sex versus coeducational physical education on the self-perceptions of middle and high school students. *Research Quarterly for Exercise and Sport*, 64(3), 324-334.
- Louie, L., Eston, R., Rowlands, A., Keung-Tong, K., Ingledew, D., & Fu, F. (1999). Validity of heart rate, pedometry, and accelerometry for estimating the energy cost of activity in Hong Kong Chinese boys. *Pediatric Exercise Science*, 11, 229-239.

- Liu, K., Ballew, C., Jacobs, D., Sidney, S., Savage, P., Dyer, A., Hughes, G., & Glanton, M. (1989). Ethnic differences in blood pressure, pulse rate, and related characteristics in young adults: The Cardia Study. *Hypertension, 14*, 216-226.
- Lukaski, H., Bolonchuk, W., Siders, W., & Hall, C. (1990). Body composition assessment of athletes using bioelectrical impedance measures. *Journal of Sports Medicine and Physical Fitness, 30*, 434-440.
- McBride, R. (1990). Sex-role stereotyping behaviors among elementary, junior high, and senior high school physical education specialists. *Journal of Teaching in Physical Education, 9*(4), 249-261.
- McKenzie, T., Feldman, H., Woods, S., Romero, K., Dahlstrom, V., Stone, E., Strikmiller, P., Williston, J., & Harsha, D. (1995). Children's activity levels and lesson context during third-grade physical education. *Research Quarterly for Exercise and Sport, 66*(3), 184-193.
- McKenzie, T., Marshall, S., Sallis, J., & Conway, T. (2000). Student activity levels, lesson context, and teacher behavior during middle school physical education. *Research Quarterly for Exercise and Sport, 71*(3), 249-259.
- McKenzie, T., Prochaska, J., Sallis, J., & LaMaster, K. (in press). Coeducational and single-sex physical education in middle schools: impact on physical activity. *Research Quarterly for Exercise and Sport*.
- McKenzie, T., Sallis, J., & Nader, P. (1991). SOFIT: System for observing fitness instruction time. *Journal of Teaching in Physical Education, 11*, 195-205.
- Metheny, E. (1965). *Connotations of movement in sport and dance*. Dubuque, IA: William C. Brown.
- National Association for Sport and Physical Education. (1995). *Moving into the future: National standards for physical education*. St. Louis, MO: Mosby.
- Nilges, L. (1998). I thought only fairy tales had supernatural power: A radical feminist analysis of Title IX in physical education. *Journal of Teaching in Physical Education, 17*, 172-194.
- Olafson, L. (2002). "I hate phys. ed.": Adolescent girls talk about physical education. *Physical Educator, 59*(2), 67-74.
- Osborne, K., Bauer, A., & Sutliff, M. (2002). Middle school students' perceptions of coed versus non-coed physical education. *Physical Educator, 59*(2), 83-89.

- Prusak, K., & Darst, P. (2002). Effects of types of walking activities on actual choices by adolescent female physical education students. *Journal of Teaching in Physical Education, 21*, 230-241.
- Rowland, T. (1999). Adolescence: A 'risk factor' for physical inactivity. *President's Council on Physical Fitness and Sports Research Digest, 3*(6): 1-8.
- Sallis, J., Alcaraz, J., McKenzie, T., & Howell, M. (1999). Predictors of change in children's physical activity over 20 months variations by gender and level of adiposity. *American Journal of Preventive Medicine, 16*(3), 222-229.
- Sallis, J., Buono, M., & Roby, D. (1993). Epidemiology of physical activity and fitness in children and adolescents. *Critical Reviews in Food, Science, and Nutrition, 33*, 403-408.
- Sallis, J., & McKenzie, T. (1991). Physical education's role in public health. *Research Quarterly for Exercise and Sport, 62*, 124-137.
- Sallis, J., McKenzie, T., Alcaraz, J., Kolody, B., Faucette, N., & Howell, M. (1997). Effects of a two-year health-related physical education program on physical activity and fitness in elementary school students: SPARK. *American Journal of Public Health, 87*, 234-253.
- Sallis, J., Prochaska, J., Taylor, W. (2000). A review of correlates of physical activity of children and adolescents. *Medicine and Science in Sports and Exercise, 32*(5), 963-973.
- Schmitt, M. (2002). *A comparison of the physical activity levels of males and females in co-educational and gender segregated sixth grade physical education classes.* Unpublished master's thesis, State University of New York, Brockport, NY.
- Schneider, P., Crouter, S., Lukajic, O., & Bassett, D. (2003). Accuracy and reliability of 10 pedometers for measuring steps over a 400-m walk. *Medicine and Science in Sports and Exercise, 35*(10), 1779-1784.
- Schuldheisz, J., & Van der Mars, H. (2001). Active supervision and students' physical activity in middle school physical education. *Journal of Teaching in Physical Education, 21*(1), 75-90.
- Scruton, S. (1990). Gender and girls physical education. *British Journal of Physical Education, 17*(4), 145-147.
- Sidman, C., Vincent, S., Corbin, C., Pangrazi, R., & Vincent, W. (2001). Digital pedometers: checking calibration prior to use in research. *Medicine and Science in Sport and Exercise, 33*, S299.

- Sopko, G., Obarzanek, E., & Stone, E. (1992). Overview of the National Heart, Lung, and Blood Institute workshop on physical activity and cardiovascular health. *Medicine and Science in Sports and Exercise*, 24, S192-S195.
- Stewart, M. (1989). Observational recording record of physical educator's teaching behavior (ORRPETB). In P. Darst, D. Zakrajsek, & V. Mancini (Ed.), *Analyzing physical education and sport instruction* (pp. 249-259). Champaign, IL: Human Kinetics Books.
- Taylor, W., Yancey, A., Leslie, J., Murray, N., Cummings, S., Sharkey, S., Wert, C., James, J., Miles, O., & McCarthy, W. (1999). Physical activity among African American and Latino middle school girls: Consistent beliefs, expectations, and experiences across two sites. *Women and Health*, 30(2), 67-82.
- Treanor, L., Graber, K., Housner, L., & Wiegand, R. (1998). Middle school students' perceptions of coeducational and same-sex physical education classes. *Journal of Teaching in Physical Education*, 18, 43-56.
- U.S. Department of Health and Human Services (1996). *Physical activity and health: A report of the Surgeon General*. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. Atlanta, GA.
- Van der Mars, H., Vogler, B., Darst, P., Cusimano, B. (1998). Students' physical activity levels and teachers' active supervision during fitness instruction. *Journal of Teaching in Physical Education*, 18(1), 57-75.
- Washburn, R., Kline, G., Lackland, D., & Wheeler, F. (1992). Leisure time physical activity: Are there black/white differences? *Preventive Medicine*, 21, 127-135.
- Welk, G. (Ed.). (2002). *Physical activity assessments for health-related research*. Champaign, IL: Human Kinetic Publishers.
- Welk, G., Differding, J., Thompson, R., Blair, S., Dziura, J., & Hart, P. (2000). The utility of the Digi-Walker step counter to assess daily physical activity patterns. *Medicine and Science in Sport and Exercise*, 17, S481-S497.
- Williams, A., Bedward, J., & Woodhouse, J. (2000). An inclusive national curriculum? The experience of adolescent girls. *European Journal of Physical Education*, 5, 4-18.
- Wing, R., Kuller, L., Bunker, C., Matthews, K., Caggiula, A., Miehlman, E., & Kelsey, S. (1989). Obesity, obesity-related behaviors and coronary heart disease risk factors in black and white pre-menopausal women. *International Journal of Obesity*, 13, 511-519.

BIOGRAPHICAL SKETCH

James Conrad Hannon was born April 2, 1970 in Geneva, Illinois. He was raised by his parents James and Peggy on a horse farm in Maple Park, Illinois. James exhibited success in academics, athletics, and theater at Kaneland High School, graduating in 1988. James was recognized in Who's Who among American High School Students.

James went on to attend Southern Illinois University at Edwardsville where he earned a bachelor's degree in Business Administration in 1993. James also competed in track and cross country and was a regular improvisational comedic theater performer at Southern Illinois University. In 1998, James earned a master's degree from Northern Illinois University in Physical Education – Curriculum and Instruction. Recently, James has completed his doctorate degree in Physical Education Teacher Education at Florida State University. While at Florida State University, James earned a graduate teacher of the year award, made professional presentations, published a number of manuscripts, and received a CDC grant in support of his dissertation research. James has also taught elementary and secondary physical education and served as director of personal training and post-rehab fitness at Personal Fitness Programs in Syracuse, NY.

James looks forward to continuing his professional career as an Assistant Professor. James plans on contributing towards research in the areas of pediatric physical activity, nutrition, health and wellness. James hopes his future work will help reverse the trend of overweight and obesity among America's youth.