INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.
PHYSICAL ACTIVITY LEVELS OF STUDENTS WITH MENTAL RETARDATION

AND STUDENTS WITHOUT DISABILITIES

DISSERTATION

Presented in Partial Fulfillment of the Requirements for

The Degree Doctor of Philosophy in the Graduate

School of The Ohio State University

By

Jennifer Faison Hodge, M. A.

The Ohio State University

2001

Dissertation Committee:

Professor David Porretta, Advisor

Professor Daryl Siedentop

Professor Sandra Stroot

Approved by

Advisor

College of Education
ABSTRACT

The purpose of this study was to compare physical education and recess physical activity levels of elementary students with mental retardation and students without disabilities possessing either high or low cardiorespiratory fitness. The System for Observing Fitness Instruction Time (SOFIT) instrument (validated for use with students with mental retardation) was used to determine physical activity level. The theoretical framework for this study was social cognitive theory. Participants were 19 students possessing high cardiorespiratory fitness, 19 students possessing low cardiorespiratory fitness, and 8 students with mental retardation in grades three, four, and five. Participants were observed and videotaped during physical education (5 to 8 sessions) for a duration of at least 30 minutes and during recess (2 to 5 sessions) for a duration of at least 10 minutes. A 3 (group) X 2 (physical activity setting) factorial design was employed. ANOVAs were used to determine significant differences among the three groups during physical education and recess. A significant difference was obtained across settings for low physical activity (LPA) and moderate to vigorous physical activity (MVPA), illustrating that participants were more active during recess (66%) than physical education (24%). Results also showed that groups were significantly different on LPA, F (2, 43) = 12.85, p = .0001, and MVPA, F (2, 43) = 12.81, p = .0001 during physical education. During physical education the participants possessing high cardiorespiratory fitness were more active (28%) at the MVPA intensity than participants possessing low fitness.
cardiorespiratory fitness (21%) and participants with mental retardation (23%). These findings suggest that students with and without disabilities are more active during recess than physical education. Further, nondisabled students possessing low cardiorespiratory fitness are likely to have lower physical activity levels than nondisabled students possessing high cardiorespiratory fitness. Students with mental retardation have similar physical activity levels when compared to students possessing low cardiorespiratory fitness.
To my mother, Katie Lee Hardy Faison.
Mama, you are the most beautiful African American women in the world.
Your strength, intelligence, and prayers have always been the foundation of my success.

and

To my daddy, Mark Faison.
Daddy, you are the smartest man I know. It is unfortunate that you never saw your "baby" become a teacher and professor.
ACKNOWLEDGMENTS

Dr. David Porretta, you are the main reason I decided to come to The Ohio State University as a master’s student and you have been extremely supportive and always available since day one. Dr. Sandra Stroot, you were always willing to give suggestions to make my work academically competitive. Dr. Daryl Siedentop, your expertise in physical activity and words of professional and personal wisdom will be forever cherished. Also thanks to Dr. Paul Jansma who helped me develop a “tough skin”.

I truly appreciate the support of the Duplin County School System, the students, faculty, and staff of Warsaw Elementary School for their cooperation during my research. Connie Matthis, thanks for sharing your physical education classroom with me.

I would also like to thank my siblings, Bernard, Suzette, Juliet, and Thomas. Without your love and prayers I would have not been able to finish this dissertation. In addition, thanks to those aunts, uncles, cousins, and particularly nieces and nephews who helped me to realize what was really important during this process. Also special thanks and praise to my mother-in-law, Laura Hodge Henley.

Special thanks to Dr. Randa Russell, Dr. Josephine Luck, and all the beautiful African-American female professors who I knew at North Carolina A & T State University who were “living examples” of what I wanted to become.

I would like to thank all the Sport, Exercise, and Education masters and doctoral students from 1996-2001 for all of the good and bad times that we have shared.
throughout the years. You all have helped me to learn to celebrate differences and not just “tolerate” them. (I hope you have learned the same from me.) Dr. Fabio Lisboa, Dr. Julie Maeda, Dr. Daniel Webb, Dr. Francis M. Kozub, Dr. Sue Sutherland, Tammy Burt, Susan Brown, Heather Savage, and Pam Bechtel, thanks for all you have done. Bert Faust, you have been a true friend and have always been there to listen. To my spiritual brothers, Jonathan Ammah and Ian Pena, and my spiritual sisters, Loury Ollison-Floyd and Lillie R. Jenkins, God truly sent you all to give me numerous “words from the Lord”. Harriet Amui, Patrick Akuffo, and the Hawaii Crew (Yvette Ikari, Natalie Hirata, Byron Shang, & Pat Primacio) you were always ready to make me laugh.

I would like to thank my Columbus spiritual family, the Jones. Daddy Bill, your smiles and kisses meant more than you know. Mrs. Jones, your prayers truly helped to sustain me. Little brother, Aaron and little sister, Alicia, your energy and questions kept me going through this process.

Lastly, I would like to thank my husband, Dr. Samuel R. Hodge. You are the most disciplined and hardest working man I know. You have been a mentor, friend, critic, and most of all, my lover through this process. I treasure our private times together. I can always count on your agape love when times get difficult. I will always love you baby! I thank God for you.

"Write the vision, and make it plain, that he may run that readeth it". (Habakkuk 2:2) “Let the words of my mouth, and the mediation of my heart, be acceptable in thy sight, O Lord, my strength, and my redeemer” (Psalms 19:14). God the Father, God the Son, and God the Holy Spirit, thank you for ordering my steps. It is because of your love, grace, and mercy that I fainted not during this process!!!
VITA

December 1, 1969................................. Born - Kenansville, North Carolina

1992................................................. B. S. North Carolina A&T State University
Greensboro, North Carolina

1993 ................................................ M. A. Adapted Physical Education
The Ohio State University

1993-1996.......................................... Health and Physical Education Teacher
Duplin County, North Carolina

1996-1999....................................... Graduate Teaching and Research Assistant
The Ohio State University

1999-2001........................................ Assistant Professor
Health and Sport Sciences Department
Capital University
Bexley, Ohio

PUBLICATIONS


FIELDS OF STUDY

Major Field: Education
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Abstract</th>
<th>ii</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedication</td>
<td>iv</td>
</tr>
<tr>
<td>Acknowledgments</td>
<td>v</td>
</tr>
<tr>
<td>Vita</td>
<td>vii</td>
</tr>
<tr>
<td>List of Tables</td>
<td>xi</td>
</tr>
<tr>
<td>Chapters:</td>
<td></td>
</tr>
<tr>
<td>1. Introduction</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Physical Activity and School</td>
<td>2</td>
</tr>
<tr>
<td>1.1.1. Physical education</td>
<td>4</td>
</tr>
<tr>
<td>1.1.2. Recess</td>
<td>4</td>
</tr>
<tr>
<td>1.2 Physical Activity in an Inclusive Setting</td>
<td>5</td>
</tr>
<tr>
<td>1.3 Measuring Student Engagement</td>
<td>6</td>
</tr>
<tr>
<td>1.4 Measuring Physical Activity</td>
<td>8</td>
</tr>
<tr>
<td>1.5 Physical Activity and Cardiorespiratory Fitness</td>
<td>9</td>
</tr>
<tr>
<td>1.6 Statement of the Problem</td>
<td>11</td>
</tr>
<tr>
<td>1.7 Purpose of the Study</td>
<td>11</td>
</tr>
<tr>
<td>1.8 Research Questions</td>
<td>13</td>
</tr>
<tr>
<td>1.9 Definition of Terms</td>
<td>14</td>
</tr>
<tr>
<td>1.10 Limitations</td>
<td>19</td>
</tr>
<tr>
<td>1.11 Delimitations</td>
<td>19</td>
</tr>
<tr>
<td>1.12 Assumptions</td>
<td>19</td>
</tr>
<tr>
<td>2. Review of Literature</td>
<td>21</td>
</tr>
<tr>
<td>2.1 Theoretical Framework</td>
<td>22</td>
</tr>
<tr>
<td>2.2 Defining Physical Activity</td>
<td>24</td>
</tr>
<tr>
<td>2.3 Measuring Physical Activity</td>
<td>25</td>
</tr>
<tr>
<td>2.4 Student Engagement</td>
<td>31</td>
</tr>
<tr>
<td>2.4.1. BESTPED</td>
<td>31</td>
</tr>
<tr>
<td>2.4.2. ALT-PE</td>
<td>32</td>
</tr>
</tbody>
</table>
2.5 ALT-PE and Students Without Disabilities ............................................ 33
2.6 ALT-PE and Students With and Without Disabilities .......................... 34
2.7 The System for Observing Fitness Instructional Time (SOFIT) ............ 36
  2.7.1. SOFIT and Students Without Disabilities .................................. 38
  2.7.2. SOFIT and Students With and Without Disabilities ..................... 40
2.8 Physical Activity and Physical Education ............................................ 42
2.9 Physical Activity and Recess .............................................................. 42
2.10 Physical Activity and Inclusion ......................................................... 44
2.11 Inclusion and Effective Elementary Physical Education Specialists 46
2.12 Summary ............................................................................................ 47

3. Procedures ............................................................................................. 50
  3.1 Research Site ....................................................................................... 50
  3.2 Participants .......................................................................................... 52
  3.3 Instrumentation .................................................................................... 60
  3.4 Independent Variables ....................................................................... 63
  3.5 Dependent Variable ........................................................................... 64
  3.6 Methodology ....................................................................................... 64
    3.6.1. Permissions .................................................................................. 64
    3.6.2. Observers Training ..................................................................... 65
    3.6.3. Interobserver Agreement ........................................................... 66
    3.6.4. Data Collection .......................................................................... 67
  3.7 Research Design .................................................................................. 70
  3.8 Data Analysis ....................................................................................... 71
  3.9 Summary ............................................................................................. 72

4. Results and discussion ............................................................................ 73
  4.1 Interobserver agreement .................................................................... 73
  4.2 Preliminary grade and gender analyses .............................................. 74
  4.3 Research Question 1 ............................................................................ 74
    4.3.1 Concurrent validity results .......................................................... 74
    4.3.2 Discussion of concurrent validity results for research question 1 . . 76
  4.4 Research Question 2 ............................................................................ 77
    4.4.1 ANOVA results for research question 2 ....................................... 77
    4.4.2 Discussion of results for research question 2 for participants with high cardiorespiratory fitness across settings . . . . . . . . . . . . . . . 79
    4.4.3 Discussion of results for research question 2 for participants with low cardiorespiratory fitness across settings .................. 81
    4.4.4 Discussion of results for research question 2 for participants with mental retardation across settings .............................. 82
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Class totals by grade for students with and without mental retardation (MR)</td>
</tr>
<tr>
<td>3.2</td>
<td>Group totals by grade</td>
</tr>
<tr>
<td>3.3</td>
<td>Demographic information for third grade participants</td>
</tr>
<tr>
<td>3.4</td>
<td>Demographic information for fourth grade participants</td>
</tr>
<tr>
<td>3.5</td>
<td>Demographic information for fifth grade participants</td>
</tr>
<tr>
<td>3.6</td>
<td>Height (in centimeters) and weight (in kilograms) by group</td>
</tr>
<tr>
<td>4.1</td>
<td>Physical education, recess, and combined physical education and recess correlations for heart rate and physical activity</td>
</tr>
<tr>
<td>4.2</td>
<td>Factorial (two-way) ANOVA for LPA by group and setting</td>
</tr>
<tr>
<td>4.3</td>
<td>Factorial (two-way) ANOVA for MVPA by group and setting</td>
</tr>
<tr>
<td>4.4</td>
<td>Mean percentage for LPA and MVPA by group and setting</td>
</tr>
<tr>
<td>4.5</td>
<td>ANOVA for LPA during physical education by group</td>
</tr>
<tr>
<td>4.6</td>
<td>ANOVA for MVPA during physical education by group</td>
</tr>
<tr>
<td>4.7</td>
<td>ANOVA for LPA during recess by group</td>
</tr>
<tr>
<td>4.8</td>
<td>ANOVA for MVPA during recess by group</td>
</tr>
<tr>
<td>4.9</td>
<td>Mean percentage of lesson context categories</td>
</tr>
<tr>
<td>4.10</td>
<td>Mean percentage of teacher behaviors</td>
</tr>
</tbody>
</table>
The United States Department of Health and Human Services (USDHHS) in 1996 released the document, *Physical Activity and Health: A Report of the Surgeon General*. This life-changing document stated the importance of daily, moderate physical activity and provided further evidence that a paradigm shift from a traditional high intensity exercise paradigm to a moderate intensity physical activity paradigm had begun (Pate, 1995). Further, the Surgeon General's report was the first to address physical activity as it relates to health. In short, it was found that lifelong moderate physical activity improves quality of life (USDHHS, 1996).

Similarly, *Healthy People 2000* asserted that light to moderate physical activity could produce measurable health benefits (USDHHS, 1990). Some of the health benefits of moderate to vigorous physical activity (MVPA) include an increase in cardiorespiratory fitness, better psychological health, reduced stress, and decreased cholesterol levels (Sallis & Patrick, 1994). Moreover, an increase in physical activity results in an increase in physical fitness (Pate, Dowda, & Ross, 1991) and reduced high blood pressure in children (Lauer, Burns, Mahoney, & Tipton, 1989). Moderate to
vigorous intensity activities require physical effort commensurate to activities such as fast walking, cycling, or lawn mowing (USDHHS, 1996).

One of the main goals within Physical Activity and Health: A Report of the Surgeon General was the challenge to increase the amount of physical activity engagement of all United States citizens; specifically, the Surgeon General's report stated that all individuals two years of age and older should have at least 30 minutes of moderate intensity physical activity daily (USDHHS, 1996). Another goal was that researchers should employ new methods of examining physical activity. For instance, these methods could include creating new physical activity questionnaires or observational instruments.

Neither of the United States Department of Health and Human Services reports (1990; 1996) contains information pertaining to physical activity for persons with mental retardation (MR). Typically, persons with mental retardation exhibit reduced levels of physical activity (Eichstaedt & Lavay, 1992; Winnick & Short, 1999) and therefore enhancing physical activity levels of persons with mental retardation warrants examination (Rimmer, Braddock, & Pitetti, 1996). Furthermore, data are needed to determine what personal or environmental aspects may increase the likelihood of being physically active. Examining physical activity intensity within school environments may result in information to better understanding physical activity in all school age children.

Physical Activity and School

School settings can provide opportunities for students to develop habits and knowledge related to physical activity (USDHHS, 1990; 1996). Healthy People 2000 objective 1.9 states that students should be active for at least 50 percent of their physical
education class time (USDHHS, 1990). Moreover, objective 1.9 states that physical activity should preferably be of a lifetime nature. Guidelines from the Council for Physical Education for Children (COPEC) recommend that physical activity levels of elementary aged children should be at a moderate intensity for 30 to 60 minutes (COPEC, 1998). In addition, the COPEC states that the physical activity of children should be an accumulation of more than 60 minutes during the school day, including bouts of physical activity that last 10 to 15 minutes at a moderate to vigorous level.

Further, the Center for Disease Control (CDC) guidelines were created with the intent of using physical activity initiatives within the school setting by collaborating with parents, health care professionals, and community organizations to increase the physical activity levels of school age children (CDC, 1997). According to one of the CDC guidelines, schools should implement physical education programs that emphasize enjoyable participation in physical activity and that help students develop the knowledge, attitudes, motor skills, behavioral skills, and confidence needed to adopt and maintain physically activity lifestyles. Another guideline states that schools should have policies established that promote lifelong physical activity.

Two research needs are specified in the document, Physical Activity and Health: A Report of the Surgeon General. One need is to improve the identification and tracking methods of physical activity patterns of individuals with disabilities. The other need is to regularly monitor the prevalence of physical activity among students under the age of 12. To this end, physical educators need to identify periods of time in which physical activity can occur within the school setting. Two ideal opportunities for physical activity to occur within a school setting are during the periods of physical education and recess.
Physical education

Physical education is a subject area within the total instructional program and curriculum of school age students. Siedentop (1998) agrees with the historical view of physical education as being education of-and-through movement. Lumpkin describes physical education as “a process through which an individual obtains optimal physical, mental, and social skills and fitness through physical activity” (1994, p. 9). Physical education curricula may include units such as gymnastics, physical fitness, recreational dance, and sport skills. According to the Individuals with Disabilities Education Act Amendments (IDEA), Public Law 105-17, 1997, physical education is defined as the development of physical and motor fitness, fundamental motor skills and patterns; skills in aquatics, dance, and individual and group games and sports. As stated within this section, physical education is defined in several ways, the key similarity being physical activity or movement.

Recess

Recess is a period of time during the school day in which students are allowed to have less structured play time or break time (Pellegrini & Smith, 1993). Play time may occur outdoors, depending on the weather conditions. Recess may vary in schools according to the number of recess periods occurring during the day, length and structure of the period, and level of supervision. Historically, there are two sides of the recess discourse. Proponents of recess state that it is important for children to release excess energy by moving. Further, school personnel should encourage students to be physically active during recess (Human Kinetics, 1998). Opponents of recess argue that too much time is spent during recess and more time should be spent in academic activities.
Physical activity that occurs during recess has been viewed as a way to enhance social and cognitive outcomes; however, recess is usually not discussed in terms of potential health benefits (Pellegrini & Smith, 1993). Within school settings, physical activity can occur in physical education and recess contexts where, many times, students with and without disabilities participate together.

Physical Activity in Inclusive Settings

The Individuals with Disabilities Education Act (IDEA) Amendments, Public Law 105-17 (1997), suggests that students with and without disabilities be educated in the same class whenever possible (inclusive setting). Furthermore, with more students being educated in inclusive school settings, it is important that physical educators are aware that all students be engaged in physical activity to the maximal extent possible. Within an inclusive physical education setting, examining physical activity engagement time may aid physical education teachers in assessing the effectiveness of enhanced physical activity levels. According to Storey (1993), there is a need to define and measure aspects of a setting containing students with and without disabilities in an attempt to guide service delivery to these populations. Further, Storey states that a variety of methods have been employed to assess the benefits of inclusion. These methods include direct observation techniques, narrative recording, naturalistic inquiries, and interactional analysis.

According to IDEA, (1997), teachers of students with disabilities need to have higher expectations for their students. One way to enhance expectations, as specifically noted within IDEA, is for students with disabilities to be assessed according to the traditional assessment procedures used within their state or district. If the same test or
assessment tools used for students without disabilities are not used, an appropriate alternative assessment is needed. Historically, students with disabilities have not been included in local, state, or national standards related to educational objectives (Kozub, 1998). One way of utilizing similar assessment procedures is to have students with and without disabilities attain at least 50% physical activity engagement time (as suggested by Healthy People 2000).

**Measuring Student Engagement**

It is important that physical educators know how students are spending their time in physical education class. One method of determining how students spend their time during physical education has been to use the Academic Learning Time in Physical Education (ALT-PE) instrument (Metzler, 1979; Siedentop, Tousignant, & Parker, 1982). According to Parker (1989), the most popular direct observation instrument for determining student engagement during physical education is, the ALT-PE instrument. ALT-PE has been used as a systematic approach to examining student engagement in conjunction with teacher effectiveness (Siedentop et al., 1982). ALT-PE is the amount of time during physical education that a student spends actively engaged in relevant motor tasks, responding at a high rate of success (Metzler, 1983). Measuring student opportunities to become physically skilled is the major focus of ALT-PE (McKenzie, Sallis, & Nader, 1991).

Another direct observation tool measuring student engagement is the Behavior of Students in Physical Education instrument (BESTPED) (Laubach, 1975). This instrument measures how students spend their time during physical education. There are four dimensions of the instrument. The first dimension describes what the student is
Another dimension is mode, which describes whether or not the student is
moving. Content and time dimensions identify the activity type and the duration of each
behavior, respectively.

Most ALT-PE studies have examined engagement of students without disabilities
(Godbout, Brunelle, & Tousignant, 1983; Metzler, 1979). Godbout et al. (1983) found
that the average motor ALT-PE percentage for elementary students was 30%, whereas
the average motor ALT-PE percentage for high school students was 24%. Metzler (1979)
found that general ALT-PE (cognitive and motor engagement related to the lesson
content) for all elementary students was 32%, while the rate was 21% for high school
students. These findings were specific to students without disabilities.

There have been only a few studies related to variables affecting physical activity
engagement of students with disabilities in inclusive settings (Aufderheide, 1983; Miller,
1985; Vogler, Koranda, & Romance, 2000). Aufderheide found no significant
differences in motor ALT-PE for students with and without disabilities. Miller's results
showed that the ALT-PE of students with disabilities in a general physical education
class was 19%, while the ALT-PE for students with disabilities in an inclusive setting
was 16%. In a segregated adapted physical education setting the physical activity
engagement was 12%. Within these studies, motor responses were recorded; however,
the intensity of the activity within these studies was not specified (McKenzie et al.,
1991). Therefore, there is a need to measure student engagement specifically in terms of
physical activity intensity.
Measuring Physical Activity

Physical activity can be measured using several instruments such as heart rate monitors, accelerometers, self-report questionnaires, and direct observation instruments (Ainsworth, Montoye, & Leon, 1994; Hensley, Ainsworth, & Ansorge, 1993; Klesges, & Klesges, 1987; Welk & Wood, 2000). Heart rate monitors directly measure the number of heartbeats during physical activity via a minute-by-minute method (Freedson, 1991). Accelerometers measure physical activity by assessing body acceleration. One of the most popular accelerometers used throughout physical education research is the Caltrac accelerometer (Klesges & Klesges, 1987; Sallis, Buono, & Roby, 1990). Using heart rate monitors and accelerometers in a school setting can be labor intensive as well as costly; however, an accurate measure of energy expenditure is obtained (Welk & Wood, 2000).

Self-reporting questionnaires or recall instruments also have been used to measure physical activity. Petosa, Weston, Griffeth, and Bergh (1989) investigated the physical activity levels of approximately 1,200 South Carolinian students in grades 5 to 11. A one-day recall was used to determine physical activity engagement time. They found that only 10 percent of the students participated in activity at an aerobic level. Further, as grade level increased, so did the physical activity levels. In addition, males and females had similar activity rates. However, the validity and reliability of self-reporting physical activity intensity and engagement time is problematic, because individuals may overestimate or underestimate their physical activity engagement.

McKenzie et al. (1991) used a direct observation instrument to examine physical activity. Direct observation methods are advantageous in school settings because they allow contextual variables to be recorded (Welk & Wood, 2000). Several direct
observation systems have been used to evaluate student activity levels (McKenzie, 1991; O'Hara, Baranowski, Simons-Morton, Wilson, & Parcel, 1989). McKenzie (1991) developed the SOFIT (System for Observing Fitness Instruction Time) instrument. This instrument measures student activity levels, lesson context, and teacher behaviors. O'Hara et al. (1989) designed a direct observation instrument called the Children's Physical Activity Form (CPAF). Puhl, Greaves, Hoyt and Baranowski (1990) developed the Children's Activity Rating Scale (CARS). To date, SOFIT, CPAF, and CARS are the most widely used observational instruments for determining physical activity levels of students. However, a potential problem with the use of direct observation instruments in general is that only a few students can be coded at once; moreover, observers need to be trained to use the instruments (Welk & Wood, 2000). Moreover, these three instruments have not been validated for students with disabilities.

**Physical Activity and Cardiorespiratory Fitness**

Cardiorespiratory fitness is defined as the “body’s ability to perform high intensity activity for a prolonged period of time without undue stress or fatigue” (USDHHS, 1990, p. 98). There is a relationship with the amount of physical activity engagement of individuals and their cardiorespiratory fitness (Leon, Connett, Jacobs, & Raurama, 1987; Sallis, Haskell, Fortmann, Wood, & Vranizan, 1986). As physical activity increases, cardiorespiratory fitness increases or is improved (USDHHS, 1996). According to Winnick and Short (1999), regular physical activity contributes to cardiorespiratory fitness and cardiorespiratory fitness allows an individual to be involved in quality lifetime physical activity.
The most common way to measure cardiorespiratory fitness in schools is by using the 1-mile walk/run or the Progressive Aerobic Cardiovascular Endurance Run (PACER) (Vincent, Barker, Clarke, & Harrison, 1999). According to Vincent et al. (1999) the PACER is more valid for measuring cardiorespiratory fitness than the 1-mile run. The PACER is a fitness test that is a version of the 20-meter shuttle run test that is multistaged and uses music to help students pace themselves (Leger & Lambert, 1982; Leger, Mercier, Gadoury, & Lambert, 1988; Meredith & Welk, 1999). According to Mahar et al. (1997), the PACER is a better indicator of cardiorespiratory fitness for girls than other standardized cardiorespiratory endurance tests. The Brockport Fitness Test uses a modified PACER version for individuals with mental retardation when measuring cardiorespiratory fitness (Winnick & Short, 1999). This version uses a 16-meter distance instead of a 20-meter shuttle run multistage distance. According to Meredith and Welk, the short distance and the use of music motivate individuals to do the best they can during the PACER test.

According to Rimmer (1994), the cardiorespiratory fitness of individuals with mental retardation is most similar to individuals who are sedentary. Further, Rimmer states that individuals with mental retardation and individuals without mental retardation (but with heart problems) have similar levels of cardiorespiratory fitness. According to Rimmer (1994), students with mental retardation can make significant fitness gains with increased physical activity and fitness training. Moreover, it has been deduced that the most effective approach to increasing cardiorespiratory fitness for individuals with mental retardation to provide a variety of physical activity opportunities that are fun (Eichstaedt & Lavay, 1994; Winnick & Short, 1999).
Statement of the Problem

Children are becoming less and less physically active (USDHHS, 1996). The paradigm shift from a dose-response model using a vigorous exercise prescription producing cardiorespiratory fitness benefits to a dose-response model using moderate to vigorous activity to increase overall health benefits, supports a need to devise appropriate methods of determining physical activity engagement and intensity for all students (Haskell, 1994). Low physical activity is special concern for children and youth because inactivity increases with age (Stephens, Jacobs, & White, 1985). One way to begin studying physical activity in a systematic way is to observe students during physical education and recess periods using direct observations over extended periods of time. Moreover, no comparison of physical activity intensity of individuals with and without mental retardation during physical education and recess has been conducted. To date, a review of the literature reveals no studies using the System for Observing Fitness Instruction Time (SOFIT) instrument to determine the physical activity intensity of students with and without disabilities across inclusive physical education and recess settings. Thus far, SOFIT has been successfully used in observing fitness instruction time with children without disabilities only (McKenzie, 1991; McKenzie et al., 1991).

Purpose of the Study

The purpose of this study was to identify and compare the physical activity intensity of third, fourth, and fifth grade students with mental retardation and students without disabilities (possessing either high cardiorespiratory fitness or low cardiorespiratory fitness) across inclusive physical education and recess settings. The
SOFIT instrument, validated for use with students possessing MR, was used to determine physical activity engagement time (McKenzie et al., 1991).

The theoretical framework for this study is based on social cognitive theory (Bandura, 1986). The underlying premise of this theory is that behavior is an interacting function of environmental, as well as personal factors. Environment and personal factors affect physical activity engagement (Evans, 1989). Examining inclusive physical education and recess settings and how they affect physical activity is one aspect related to social cognitive theory. The participants engaging in physical activity are in two settings; therefore, the change in environment may affect their physical activity levels. Within the physical education setting, participants are instructed by a teacher. In the recess setting there is no instruction by a teacher. Teachers/staff provide supervision only for safety purposes. In addition, within the physical education setting participants engage in a variety of activities determined by the teacher. The participants may not enjoy, nor be familiar with some of these activities. In the recess setting, participants participate in activities that they enjoy and activities that are familiar to them.

Further, the participants in this study (students with mental retardation and students without disabilities possessing high cardiorespiratory fitness or low cardiorespiratory fitness) have personal factors such as fitness status or mental retardation that could result in differences within their physical activity setting. Participants possessing high cardiorespiratory fitness levels may be able to sustain physical activity intensities at a higher level and be engaged in physical activity for longer periods of time than participants possessing low cardiorespiratory fitness. Moreover, these participants differ by gender and body mass index. One gender may have higher physical activity
levels than another gender during physical activity. In addition, students who have high body mass indexes are more likely to be overweight therefore resulting in lower levels of physical activity intensity and engagement because they get tired easier. To further understand how social cognitive theory relates to this study it was important to identify the research questions for the study.

**Research Questions**

The following were the research questions for this study:

1. Is the SOFIT instrument a valid instrument for measuring physical activity engagement for students with mental retardation?

2. Does the percentage of time engaged in physical activity intensity differ during physical education as opposed to recess for elementary students without disabilities who possess high cardiorespiratory fitness, students without disabilities who possess low cardiorespiratory fitness, and students with mental retardation?

3. Does the percentage of time engaged in physical activity intensity differ among elementary grade students with mental retardation as opposed to students without disabilities (possessing either high cardiorespiratory fitness or low cardiorespiratory fitness) during physical education?

4. Does the percentage of time engaged in physical activity intensity differ among elementary grade students with mental retardation as opposed to students without disabilities (possessing either high cardiorespiratory fitness or low cardiorespiratory fitness) during recess?
Definition of Terms

The following were operational definitions used in this study:

**Fitness.** Fitness is a category within the lesson context phase of the SOFIT instrument that refers to activity time is devoted mainly to muscular strength, flexibility, and cardiovascular fitness. Examples of fitness activities include distance running, fitness testing, warm-up activities, and relays of three or less participants. This category is coded by the letter "F" (McKenzie, 1997).

**Free Play.** Free play is a category within the lesson context phase of the SOFIT instrument relating to activity occurring spontaneously and outside of physical education class. Students may choose to participate in free play. Recess is an example of free play. Free play is coded by the letter “O” (McKenzie, 1997).

**Game Play.** Game play is a category within the lesson context phase of the SOFIT instrument referring to activity time that incorporates a game or competitive situation resulting in the application of skills. This activity is conducted with minimal intervention from the teacher. Examples of game play activities include tag games, dance performances, or volleyball games (McKenzie, 1997).

**General Content.** General content is a category within the lesson context phase of SOFIT in which the student is not intended to be involved in physical education knowledge or physical education movement. Transition, break times, and management are examples of general content.

**General Knowledge.** General knowledge is a category within the lesson context phase of SOFIT that is coded when the lesson context refers to technique, rules, history,
social behavior, and strategies or any other information that is not related to physical fitness concepts.

**Inclusive Physical Education.** Inclusive physical education is when students with and without disabilities participate together during the general physical education class.

**Inclusive Recess.** Inclusive recess is a period of time during the school day that students with and without disabilities are allowed to have unstructured play time or break time in the same designated area.

**Intensity.** Intensity is the level or degree of energy expenditure occurring during physical activity or movement.

**Lesson Context.** Lesson context is phase two of the SOFIT instrument that involves coding the type of activity lesson engaged in by the target student (McKenzie, 1997).

**Low Physical Activity (LPA).** LPA is operationally defined as a combination of physical activity engagement that occurs at a level 1 (lying), level 2 (sitting) and level 3 (standing), which are coded independently on the SOFIT instrument, then summed for data analysis purposes (McKenzie et al., 1991).

**Lying.** Lying describes the body positioning of the target student during the coding of the SOFIT instrument for phase one, student activity. It is coded by a number 1. This body position is when a majority of one's body is in a flat position (i.e., prone or supine) along the floor, ground, or another surface (McKenzie, 1997).

**Moderate to Vigorous Physical Activity (MVPA).** MVPA is operationally defined as a combination of physical activity engagement that occurs at a level 4
(walking) and at a level 5 (very active), which are coded independently on the SOFIT instrument, then summed for data analysis purposes (McKenzie et al., 1991).

**Momentary Time Sampling.** Momentary time sampling refers to the presence or absence of the target student activity or lesson context at the end of a set observational interval (Cooper, Heron, & Heward, 1987). (For this study the observational interval is 10 seconds.)

**Physical Activity.** Physical activity is bodily movement produced by skeletal muscles that results in energy expenditure that is continuous and varies from low to high (Caspersen, Powell, & Christenson, 1985).

**Physical Education.** Physical education is the development of physical and motor fitness; fundamental motor skills and patterns; skills in aquatics, dance, and individual and group games and sport (including intramural and lifetime sports). (The Individuals with Disabilities Education Act Amendments, Public Law 105-17, 1997).

**Physical Fitness.** Physical fitness is a category within the lesson context phase that is coded when the lesson is related to knowledge content that involves information specifically about physical fitness concepts, such as endurance, flexibility, cardiovascular fitness, and muscular strength.

**Rural School.** A rural school is located within a town with a population of less than 3,000 in a dispersed community. A majority of the students' parents are at the low to middle socioeconomic level and work in factories or on farms as unskilled or manually skilled laborers.

**Sitting.** Sitting describes the body positioning of the target student during the coding of the SOFIT instrument for phase one, student activity. It is coded by a number
2. The target student's body is positioned in a manner that the weight is off the feet and on the buttocks (McKenzie, 1997).

   **Skill Practice.** Skill practice is a category within the lesson context phase two of the SOFIT instrument that refers to activity time that is devoted mainly to activities with the main goals being skill development, skill refinement, and skill extension. Examples of skill practice activities include dribbling a soccer ball, balance beam skills, and dance steps. This category is coded by the letter "S" (McKenzie, 1997).

   **Standing.** Standing describes the body positioning of the target student during the coding of the SOFIT instrument for phase one, student activity. It is coded by a number

3. The student's body position is in an upright position with one's weight on the feet (McKenzie, 1997).

   **Student Physical Activity Engagement.** Student physical activity engagement is the first phase of the SOFIT instrument that involves coding the physical activity levels or body position of the target individual (McKenzie, 1997).

   **Student with Mental Retardation.** Describes a student who is school aged and has significantly subaverage general cognitive functioning and a reduced rate of learning. This condition exists concurrently with deficits in adaptive behavior, is manifested during the developmental period, and adversely affects a child's educational performance (American Association on Mental Retardation, 1992). The official term used by the North Carolina Department of Education is “mentally disabled”. These students have an intelligence quotient of no less than 40 and no greater than 70. (Public Schools of North Carolina, 1997).
Students without disabilities possessing high cardiorespiratory fitness. Students who have no known disability and who scored in the top 10% for their grade, class, and age on the Progressive Aerobic Cardiovascular Endurance Run within the Healthy Fitness Zone.

Students without disabilities possessing low cardiorespiratory fitness. Students who have no known disability and who scored in the bottom 10% for their grade, class, and age on the Progressive Aerobic Cardiovascular Endurance Run outside of the Healthy Fitness Zone.

System for Observing Fitness Instruction Time (SOFIT). System for Observing Fitness Instruction Time is a direct observation instrument measuring physical activity levels of students and uses a momentary time sampling technique. Physical activity levels are coded according to body position of the target student using one of five categories: lying, sitting, standing, walking, and very active coded 1 to 5, respectively (McKenzie, 1997). Also coded are lesson context and teacher behaviors.

Teacher Behavior. Teacher behavior is phase three of the SOFIT instrument that involves coding what the teacher did during the observation interval (McKenzie, 1997).

Very Active. Very active is the activity code that is given to a student who is expending more energy than is exhibited during walking. It is coded by a number 5. Jogging, hopping, running, and pedaling a stationary bicycle are examples of activities coded within the very active category (McKenzie, 1997).

Walking. Walking describes the activity level of the target student during the coding of the SOFIT instrument for phase one, student activity. It is coded by a number 4. The student is moving from one location to another by having one foot in contact with
the floor at all times. The energy expenditure for this level should be more than for standing and less than for very active (McKenzie, 1997).

**Limitations**

The following were limitations of this investigation:

1. All recess sessions occurred outdoors except one session that occurred indoors, while all physical education classes were conducted indoors.
2. Intact physical education classes were used from one school site; groups were not randomly formed.
3. Results may not be generalizable to other similar settings.

**Delimitations**

The following were delimitations of this investigation:

1. Data were collected during a 4-week period during the 1999 school year.
2. Only one teacher was used in the study. The teacher was a volunteer.
3. The unit of analysis for the study was students.
4. Only pre-selected students without disabilities possessing high or low cardiorespiratory fitness levels and students with mental retardation were participants in the study.

**Assumptions**

The following statements are assumptions to this investigation:

1. The presence of the observer (s) was unobtrusive and did not affect participant behaviors nor data collection procedures.
2. The SOFIT instrument is a valid and reliable tool in determining physical activity for typically developing students (McKenzie et al., 1991).
3. Physical education observation sessions were representative of all physical education instructional units.

4. Recess observation sessions were representative of the typical recess period.

5. The Polar Vantage XL Heart Rate Monitors were calibrated appropriately by Polar Electro Incorporation.
CHAPTER 2

REVIEW OF LITERATURE

This chapter is composed of eight sections. The first section explains in detail the theoretical framework as it relates to this study. Next, physical activity is defined. Methods of measuring physical activity such as calorimetry, pedometers, electronic monitors, and several behavioral observation instruments are described in the third section. The fourth section describes distinctions between Academic Learning Time-Physical Education (ALT-PE) instrument and the Behavior of Students in Physical Education (BESTPED) system as they relate to measuring student engagement during physical education. Section four also addresses studies related to ALT-PE and student engagement (Aufderheide, 1983; DePaepe, 1985; Gagnon, Tousignant, & Martel, 1989; Godbout, Brunelle, & Tousignant, 1983; Lisboa, Butterfield, Reif, & McIntire, 1995). The System for Observing Fitness Instruction Time (SOFIT) instrument is explained in detail and studies using the instrument are presented in the fifth section of the chapter (McKenzie, 1991; McKenzie, 1997; McKenzie et al., 1995; McKenzie, Sallis, Faucette, Roby, & Kolody, 1993; McKenzie, Sallis, & Nader, 1991). Results of a pilot study (Faison-Hodge, 1998) are discussed in the fifth section. The sixth section of the chapter
focuses on physical activity studies pertaining to physical education and recess settings. The seventh section focuses on inclusion in physical education. Finally, chapter Two concludes with a summary.

**Theoretical Framework**

The theoretical framework for the current study is based on social cognitive theory (Bandura, 1986). A review of studies on physical activity within the physical education literature revealed that most studies in this area have been based on the social cognitive theory (Johnson et al., 2000; USDHHS, 1996). Social-cognitive theory proposes that behavior is a function of environmental as well as personal factors. Therefore, social cognitive theory is an interactional model that results in reciprocal causation. Reciprocal causation, also called reciprocal determination, means that environmental factors, thoughts, personal factors, and behaviors all interact in a cyclical manner not in a linear fashion (Evans, 1989).

Environmental and personal factors affect physical activity engagement. The environmental settings of this study (inclusive physical education and recess settings) all affect physical activity behavior. Further, the arrangement of the environment plays a major role in how students with and without disabilities engage in physical activity. For example, differences in physical education and recess settings may result in differences in behaviors, whereas similarities within the two settings may result in similar behaviors of the target student. Therefore, physical activity engagement is dependent upon personal and environmental factors as well as the behavior itself. The lesson context also shapes physical activity engagement. Within the physical education environment, teachers can choose student activities. Teachers may choose lessons focusing on games, skills, or
fitness activities. The participants may not enjoy, nor be familiar with some of these activities. Moreover, during physical education participants are instructed by a teacher, while in the recess setting there is no teacher instruction. Teachers/staff provide supervision only for safety purposes. In the recess setting, participants participate in activities that they enjoy and activities that are familiar to them, therefore increasing the likelihood that they will participate in the activity.

There are several personal factors that will be examined within this study. Disability group, cardiorespiratory fitness level, and grade are factors that may affect physical activity behavior. Students with mental retardation may have difficulty with verbal instructions given by a teacher during physical education. If the instructions are not simple and concrete the participant with mental retardation may not be able to complete the physical activity task due to clarity not due to being unable to physically perform the task. Participants possessing high cardiorespiratory fitness levels are able to sustain physical activity intensities at higher levels and are able to engage in physical activity for longer periods of time than participants possessing low cardiorespiratory fitness. In addition, weight and height may also affect physical activity. Students who have high body mass indexes are more likely to be overweight, therefore resulting in lower levels of physical activity intensity and engagement because they get tired easier. Lastly, gender has been shown to affect physical activity behavior. One gender may have higher physical activity levels than another gender during physical activity (Sarkin, McKenzie, & Sallis, 1997).

A major tenet of the social cognitive theory relates to self-efficacy. Self-efficacy may help explain why students engage in physical activity. Bandura (1997) states that
students with a high level of self-efficacy are more physically active. Thus, a person who
engages in physical activity must believe that she or he possesses the necessary skills to
perform the activity as well as the belief that the activity will result in a valuable outcome
(Bandura, 1986). According to Evans (1989), students who are low skilled in activities
perform at a lower level; therefore, within this study students without disabilities who
possess low cardiorespiratory fitness may have low levels of physical activity
engagement.

Another major aspect of social cognitive theory is that behaviors are influenced
by observation. Observational influence resulted in students having models of certain
behaviors that are important for students with mental retardation. Consequently, students
without disabilities are important because they provide examples of how to successfully
engage in physical activity. Moreover, within the physical education setting, teachers
may provide modeling of physical activity engagement for their students.

Choice is also a part of the social cognitive theoretical framework formula
(Evans, 1989). When students are allowed to choose a particular activity their behavior
may be affected. For example, students' physical activity behaviors may be different
during physical education and recess because they are allowed to choose the activities in
which they will participate. During physical education, students normally participate in
activities that the teacher decides, whereas during recess students can choose their
activities.

**Defining Physical Activity**

According to a review of the literature, the most widely used definition of
physical activity states that physical activity is bodily movement that is produced by the
contraction of skeletal muscle and that substantially increases energy expenditure (USDHHS, 1996). Movement is considered physical activity when the skeletal muscles or voluntary muscular tissue are contracting (Costello & Laubach, 1978). Historically, physical activity has been used interchangeably with exercise. Currently, exercise is now a subcategory of physical activity and refers to an activity that is repetitive, structured, and purposeful with the main goal of improving physical fitness (USDHHS, 1996). Physical activity is described according intensity. Intensity is the level or degree of energy expenditure occurring during physical activity or movement. When defining physical activity, it is vital that individuals understand how physical activity can be measured.

Measuring Physical Activity

Physical activity has been measured in numerous ways (Klesges & Klesges, 1987). There are over 30 different methods of assessing physical activity. Calorimetry, mechanical monitors, electronic monitors, accelerometers, heart rate monitoring, surveys or questionnaires, and behavioral observations are some of the main ways to measure physical activity (LaPorte, Montoye, & Caspersen, 1985).

Calorimetry is one of the most valid and reliable methods of assessing physical activity. This is a method that is expensive, especially when large numbers of participants are examined. Further, calorimetry is obtrusive and is used most often in laboratory settings (Blair, 1984). The calorimeter is used to measure the quantity of heat that is given off by the person's body, which enables the researcher to gauge the body's rate and quantity of energy expenditure (USDHHS, 1996).
One of the easiest mechanical methods to assess physical activity is by using pedometers or step counters. Step counters are clipped at the waist of an individual and measure the vertical dislocation of the body as it moves. As the individual moves, a spring suspended lever arm that is connected to a ratchet rotates (Ainsworth, Montoye, Leon, 1994). With each rotation a click or step is recorded. Step counters have only been used with ambulatory persons. There are several advantages of step counters. One advantage is that step counters are unobtrusive. Another advantage is that step counters can be used by individuals ages 6 years and up and can be used to encourage people to increase their physical activity levels (Hatano, 1993). One disadvantage of the step counter is that it has not been validated. In addition, step counters are not very reliable because they tend to overestimate and underestimate energy expenditure depending on the speed traveled by the person. A last disadvantage of step counters is that they do not measure intensity of physical activity just overall physical activity over a period of time (Ainsworth et al., 1994).

Electronic monitors are another technique of assessing physical activity (Freedson, 1991). The Large-Scale Integrated Activity Monitor (LSI) is a popular example of an electronic monitor. The LSI is able to measure changes in body movements that yield a physical activity score. These changes are measured by electronic motion sensors that usually fit in ones shoes or are worn on the body and use load transducers to measure movement (Hensley, Ainsworth, & Ansorge, 1993). A mercury switch is used which makes the electronic motion sensor more reliable than mechanical methods. In addition, electronic motion sensors are more sensitive to movement; therefore, a greater variety of physical activities are detected (Ainsworth et
The correlation of energy expenditure for children using the LSI has been very low; therefore LSI is not recommended for use with children.

Accelerometers have been used to measure physical activity by sensing acceleration of the body and changing it to energy expenditure units (Hensley et al., 1993). The Caltrac is the most used accelerometer because it is easy to use and it is inexpensive (Freedson, 1991). This instrument is usually worn on the hip (waist) of the participant. In fact, physical activity levels of preschool children age 2 to 4 years have been examined (Klesges, Klesges, Swenson, & Pheley, 1985). A one-hour direct observation and Caltrac counts were used. The results of this study showed that there was a moderate association between the direct observation technique and Caltrac counts.

Strand, Walswick, and Sommer (2000), used the Caltrac motion sensors during physical education to identify the caloric output of fifth and sixth graders. A total of 26 students wore the Caltrac over a 20-day period. The results of the study revealed that outdoor activities resulted in statistically significant energy expenditure than indoor activities. Also, there was no significant difference in male and female energy expenditure.

Heart rate monitoring may also be considered a viable method of monitoring physical activity (USDHHS, 1996). During heart rate monitoring, the heart's response to movement is measured by recording an individual's heart rate. The use of heart rate monitoring is based on the principle that energy expenditure and heart rate have a linear relationship (Freedson, 1991). It is important to note that emotional responses, fatigue, increases in temperature, and activation of specific muscle groups may influence heart rates (Freedson, 1991 & Hensley et al., 1993). However, according to Hensley et al.
sources of heart rate responses not associated with physical activity can be controlled by using heart rate monitoring in conjunction with other physical activity monitoring methods and by recording heart rate responses only for physical activity movement.

The Youth Risk Behavior Survey conducted in 1990 by the U. S. Department of Health and Human Services measured health risk behaviors of youth (Kann et al., 1993). Study results revealed that vigorous physical activity decreased as grade level increased. Specifically, the percent of vigorous physical activity decreased 8.4% for students from grades 9 to 12. Moreover, females were significantly active than males. The vigorous physical activity level was 49.6% for males and 24.8% for females. Along similar lines, African American students were found to be significantly less active (29.2%) than Hispanic and White American students (34.5%).

Behavioral observation instruments are a valid method of measuring physical activity in a natural setting. There are several benefits of this method. One benefit is that contextual variables within the environment can be examined (McKenzie, 1991). This is a preferred method for young children because self-reporting recall instruments or other proxy surveys may be inappropriate or unreliable (Noland, Danner, Dewalt, McFaden, & Kotchen, 1990). According to McKenzie (1991), use of videotapes and training of observers increase the validity and reliability of systematic physical activity observations.

Systematic observation instruments, also known as behavioral observations, allow a trained person (who follows a standard set of guidelines and procedures) to observe, record, and analyze interactions during a specified observation period (Darst, Zakrajsek, & Mancini, 1989). As pointed out by McKenzie (1991), an advantage of an observation instrument that measures physical activity is that it can be used for short or extensive
periods of time and does not require a student to wear an instrument that is obtrusive and/or restricts movement. In that vein, physical activity observation instruments can be an excellent option for use with young children because of its unobtrusiveness (Ainworth et al., 1994). One disadvantage of this type of instrument is that the process of obtaining data may be labor intensive during data collection and data analysis (Hensley et al., 1993).

Baranowski, Hooks, Tsong, Cieslik, and Nader (1987) examined physical activity levels of individuals in grades 3 and 4. The participants were 14 females and 10 males from a low socioeconomic rural setting. Observers recorded physical activity of the participants for two consecutive days. In this study physical activity was defined in terms of trunk movement. There were four categories of movement. These were as follows: (1) 20 or more minutes of trunk movement without stopping; (2) 20 or more minutes of trunk movement with less than 2 minutes of stationary movement; (3) 14 or more minutes of trunk movement without stopping; and (4) 14 or more minutes with less than 2 minutes of stationary movement. Baranowski et al. (1987) reported that students were active for short periods of time. Additionally, boys were more active than girls. As grade level increased, the mean duration of the activity decreased. Furthermore, for day 1, the mean duration for the males was 87 minutes, while for the females it was 58 minutes. Students in this study most often participated in physical activity with their peers (Baranowski et al.).

One instrument that has been used in an attempt to measure the physical activity intensity levels of children has been the Children's Physical Activity Form (CPAF), (O'Hara, Baranowski, Simons-Morton, Wilson, & Parcel, 1989). The CPAF instrument
has four categories: (1) stationary, no movement; (2) stationary, limb movement; (3) slow trunk movement; and, (4) rapid, trunk movement. These intensity levels were compared to the Quantum XL Fitness Monitor that measures heart rate values. During a physical education period of 35 minutes, the heart rate monitor recorded heart rate every 15 seconds for participants (8 to 10 years of age). For every minute of activity, an "intensity of activity point score" was calculated. The goal of this study was to determine if heart rate values increased as intensity levels increased. The findings showed moderately high statistically significant correlations between high heart rates and observed activity.

The Children's Activity Rating Scale (CARS) is a five-level scale that categorizes physical activity intensities (Puhl, Greaves, Hoyt, & Baranowski, 1990). These categories are as follows: Level 1 stationary, no movement; Level 2 stationary with movement; Level 3 slow and easy translocation; Level 4 medium or moderate translocation; Level 5 fast, very fast, and strenuous translocation. These levels were calibrated using mean \( VO^2 \) and heart rates (Puhl et al., 1990).

The System for Observing Fitness Instruction Time (SOFIT) is a behavioral observation instrument that has been validated using heart rate monitors (McKenzie, 1997). The intensity levels correspond to mean heart rate and energy expenditure. The mean heart rates for level 1 (lying), level 2 (sitting), level 3 (standing), level 4 (walking), and level 5 (very active) are 99, 107, 110, 130, and 153, respectively. The kcal/kg/min for levels 1, 2, 3, 4, and 5 are .029, .047, .051, .096, and .144, respectively.

Noland et al. (1990) examined the physical activity levels of 21 children age 3 to 5 years. Physical activity level was measured using teacher questionnaires, home
observations, preschool playroom observations, and child interviews. Parents were not reliable in predicting their child's physical activity level. Also, no differences were found in physical activity levels as a function of gender when measuring physical activity via systematic observation; however, teachers and parents rated boys as more physically active than girls. Finally, children did not participate in physical activity for prolonged periods of time (i.e., bouts over 20 minutes).

**Student Engagement**

For over two decades, researchers have measured the physical activity or engagement of students within their physical education classes; yet, there has been a plethora of research examining the percentage of time that students spend engaged in activity during physical education classes (Godbout et al., 1983; Metzler, 1979; Metzler, 1985; Shute, Dodds, Placek, Rife, & Silverman, 1982). For students with disabilities, a less extensive body of knowledge exists relating to how time is spent in physical education classes (Aufderheide, 1983; DePaepe, 1985; Miller, 1985; Vogler, Koranda, & Romance, 2000). All these studies used various observation instruments to gauge student engagement.

**BESTPED.**

One of the earliest observation instruments used to measure how students spend time in physical education was BESTPED (Laubach, 1975). Costello and Laubach (1978) found that elementary students from 20 elementary physical education classes spent about 37% of their physical education class time moving and about 63% of their physical education time in non-movement behaviors. Non-movement behaviors were any behaviors in which the student maintained a stationary position. In this study,
observed movement was defined as any change in space or location of a body part, one’s posture, or entire body.

ALT-PE.

The ALT-PE instrument is a valuable observation data collection instrument that can be used to assess student engagement in relevant tasks. The assumption is that the tasks that students engage in are performed correctly and in an appropriate manner during the physical education lesson (Metzler, 1985). Most investigations of how students spend their time during physical education classes have measured behaviors using the ALT-PE instrument (Siedentop, Tousignant & Parker, 1982). The findings of ALT-PE studies have revealed varied percentages of ALT-PE. Such studies have examined ALT-PE in terms of general ALT-PE and motor ALT-PE. General ALT-PE refers to both cognitive and motor engagement, while motor ALT-PE simply refers to motor engagement only (Metzler, 1979). Drawing distinctions between these two types of ALT-PE measures is extremely critical in identifying the amount of physical activity engaged in during physical education. For example, activities such as dance have been found to have high motor ALT-PE rates, whereas gymnastics activities have historically had low motor ALT-PE rates (Metzler, 1979).

According to Tousignant, Brunelle, Pieron, and Dhillon (1983), the type of activity observed during ALT-PE is the most potent variable in explaining ALT-PE differences. Anderson (1983), and Siedentop (1983), proposed that ALT-PE may need to be refined to a content-specific ALT-PE instrument in order to account for the differences
in the various activities taught during physical education classes. When conducting research it is paramount to attempt to compare ALT-PE rates of common activities (Siedentop, 1983).

**ALT-PE and Students Without Disabilities**

Metzler (1979) observed 33 classes of second through twelfth grade students and found that the average amount of motor ALT-PE was approximately 5%, 8%, and 9% for high school, junior high school, and elementary schools, respectively. Motor ALT-PE percentages for high school, junior high, and elementary were 21%, 28%, and 32%, respectively. Thus, only an average of about 2.5 minutes of the student's physical education time was spent engaged in motor ALT-PE in an appropriate manner that related to the physical education lesson. Moreover, as students increased in grade level, general and motor ALT-PE percentages decreased. Metzler also reported that motor ALT-PE was greater for individual sports than team sports.

Godbout et al. (1983) investigated the ALT-PE rates of 30 elementary and 31 high school Canadian students. These researchers found that average motor ALT-PE percentages for both elementary and high school students were 30% and 24%, respectively. The Canadian students (Godbout et al., 1983) had higher rates than the American students in Metzler's investigation (Metzler, 1979). Findings of low levels of motor ALT-PE percentages are consistent throughout the literature. Results show that motor ALT-PE percentages are usually less than 30% and sometimes as low as 5% during physical education classes, for students without mental retardation. More recently, there has been a need to investigate ALT-PE rates of students with disabilities.
ALT-PE and Students With and Without Disabilities

Vogler et al. (2000) found that when an adapted physical educator was used as a human resource for a physical education teacher that ALT-PE rates could be similar for students with and without disabilities. During an inclusive physical education class, the ALT-PE engagement was 41% for the student with severe cerebral palsy. The ALT-PE engagement for the students without disabilities ranged from 47% to 50%.

Shute et al. (1982) examined the ALT-PE of elementary students. Students were all enrolled in a movement education class. The motor ALT-PE rate for boys was 13% and for girls, 12%. The motor ALT-PE percent average for students with disabilities was 6% and for students without disabilities, 13%. Overall ALT-PE rate for students with disabilities and peers without disabilities were 35% and 45%, respectively.

Aufderheide (1983) examined the ALT-PE percentages of individuals in mainstreamed (inclusive) settings in which teachers used individualized instruction or did not use individualized instruction. The participants for her study were 60 elementary students with and without mild disabilities. The results revealed ALT-PE rates of 43.9% for students with disabilities and 47.8% for peers without disabilities; therefore, not showing obvious significant differences in ALT-PE rates for teachers who used individualized instruction and teachers who did not use individualized instruction.

DePaepe (1985) reported that of the 30 individuals with mental retardation (5-12 years of age), the ALT-PE rate of a peer-tutored classroom was higher than that of a self-contained classroom. The peer tutor classroom group averaged 17 minutes of motor ALT-PE, whereas the self-contained classroom group averaged about 10 minutes of motor ALT-PE. The typical inclusive environment resulted in the lowest amounts of
ALT-PE rates. The ALT-PE rate average was 6 minutes for the inclusive class without peer tutoring assistance.

Similarly, Miller (1985) conducted an ALT-PE study that examined behaviors of students with and without disabilities and teacher effectiveness across three educational placements. These placements included a general elementary physical education setting, a mainstreamed (inclusive) elementary physical education setting, and an adapted (segregated) physical education setting. Students in the general physical education setting had an ALT-PE average of 18.8%. An ALT-PE average of 15.5% was shown for students in the inclusive setting. The segregated setting resulted in an ALT-PE average of 11.6% for students with disabilities. None of these differences were statistically significant. Students in the segregated setting were involved in subject matter motor activities more often than the general and inclusive setting therefore resulting in fewer opportunities to be engaged in motor ALT-PE. Miller concluded that teacher behaviors play a major role in ALT-PE percentages.

Some studies have examined ALT-PE rates in general physical education settings containing students with disabilities. In this regard, Vogler, van der Mars, Darst, and Cusimano (1990) reported ALT-PE amounts for motor appropriate engagement as 21.2% or 6.4 minutes for total physical education class time for 30 elementary students with disabilities who were included in general physical education class. Vogler et al. (1990) examined several teacher/classroom behaviors, contextual variables, and teacher characteristics variables. Gagnon et al. (1989) found average motor engagement percentages of 29 students with mental retardation in segregated adapted physical education classes, in Quebec City region schools to be 16%. Lisboa et al. (1995)
measured ALT-PE of three male students with autism across a regular, reversed mainstreamed, and adapted physical education setting. Lisboa et al. reported that the ALT-PE amounts were greater for the segregated adapted physical education setting than either the regular or reversed mainstreamed settings.

The consistent results of the studies of students with and without disabilities continue to add to the notion that students have low ALT-PE percentages, particularly students with disabilities. However, the question arises, “Is the ALT-PE instrument truly measuring the activity level of students?” or “Is there another instrument that could measure only physical activity intensity” “Would the physical activity rates also be at a low level?” The following section describes the use of an instrument that responds to the preceding questions and measures physical activity levels.

The System for Observing Fitness Instruction Time

The System for Observing Fitness Instruction Time (SOFIT) was developed as an instrument to observe student physical activity opportunities to respond (McKenzie et al., 1991). SOFIT measures not only fitness instruction time (as its name implies), but any type of physical activity (T. L. McKenzie, personal communication, April 7, 1998). Rowe, Schuldheisz, and van der Mars (1997) found that the SOFIT instrument is a valid measure of physical activity level for elementary and middle school children (grades first to eighth). Heart rate monitors were used to validate the SOFIT instrument.

The SOFIT is a more plausible alternative to the ALT-PE instrument for examining physical activity for three reasons. The main reason SOFIT is a more appropriate instrument than ALT-PE is that SOFIT measures intensity of activity while ALT-PE measures the quality of the activity (T. L. McKenzie, personal communication,
October 14, 1998). Second, SOFIT has been validated using heart rate monitors (McKenzie et al., 1991; Rowe et al., 1997), whereas the validity of ALT-PE is questionable. Furthermore, Silverman, Devillier, and Ramirez (1991) found that the ALT-PE instrument was valid for only certain skills. For example, the ALT-PE instrument was valid for the volleyball serving skill but not for the volleyball passing skill. Third, SOFIT focuses on body positioning which may be more appropriate for individuals with disabilities since some more likely to be lying or sitting during physical education due to physical limitations or behavior disorders. ALT-PE does not overtly consider body positioning when determining motor engagement. Moreover, SOFIT is a viable option for students with mental retardation because they are more like their same age peers without disabilities with regard to physical and motor skills (Eichstaedt & Lavay, 1992; Winnick & Short, 1999). Faison-Hodge (1998) found the SOFIT instrument to have face validity and reliability for students with mild mental retardation. However, face validity and reliability were questionable for students with severe disabilities, as well as students with physical disabilities because these students had teachers who were physically assisting them in completing physical activities (Faison-Hodge, 1998). Hence, the resulting average interobserver agreement for students without severe disabilities and physical disabilities was 80%. The interobserver and intraobserver agreement of the physical activity level intervals was 100% for students with mild/moderate mental retardation. A review of key studies using SOFIT is discussed in the next two sections.
SOFIT and Students Without Disabilities

In a study by McKenzie et al. (1991), students in 88 third, fourth, and fifth grade physical education class sessions were recorded using the SOFIT instrument. There were a total of 24 intact classes, which were taught by 20 classroom teachers and three trained physical education specialists. Students who were taught fitness lessons were more active than students who were taught non-fitness lessons. Students in classes with fitness lessons spent about 36% of the time “walking” and 22% of the time “very active”, whereas the walking and very active categories for the non-fitness lessons were 27% and 17%, respectively. Results were not analyzed according to gender nor grade differences.

Similarly, the SOFIT instrument was used to evaluate the effects of an inservice program and health related curriculum on the quantity and quality of elementary physical education programs (McKenzie et al., 1993). For a period of eight months, students in 28 fourth grade classes in a California school district were assigned to either: a) a class taught by a trained classroom teacher who received inservice training and consultation, b) a classroom teacher and a physical education specialist, or c) a control group of classroom teachers only. Results of McKenzie et al., (1993) showed that students with the physical education specialists were categorized as “very active” for an average period of 5.4 minutes, whereas, trained classroom teachers had an average of 4.1 minutes for the “very active” category and students with the control group of classroom teachers had activity times that averaged 2.8 minutes.

Ninety-five elementary schools were observed in the Child and Adolescent Trial for Cardiovascular Health (CATCH) centers in Texas, Minnesota, Louisiana, and California using the SOFIT instrument (McKenzie et al., 1995). CATCH was an intervention
program that sought to increase physical activity levels of children and adolescents during physical education and recess settings. This three-year study revealed that the type of activity selected during physical education classes was the major determining factor of physical activity level. Another finding of this study was that students engaged in outdoor physical activity lessons were more active than those engaged in indoor lessons (42% as compared to 32%, respectively). Boys were more active during free play than girls, and fitness lessons had higher physical activity levels of students than other lesson types. Boys spent 38.5% of their class time in the moderate to vigorous category while girls spent 33.9%. Further, the average physical activity level of all students at a moderate to vigorous level was 36.2%, which is less than the standard of 50% suggested by Healthy People 2000 (USDHHS, 1990).

Van der Mars, Darst, Vogler, and Cusimano (1998) examined physical activity levels of 54 elementary students during their allotted 7 to 10 minute fitness period. Results revealed that approximately 52% of the time, students were engaged in moderate to vigorous physical activity (MVPA). Students spent 38% of the time at level 5 (very active) and 13.8% of the time at level 4 (walking). Moreover, students were standing (coded level 3) 36.4% of the time during the fitness unit.

Moreover, Ernst and Hills (2000) implemented a recess intervention for 12 fourth and fifth grade students during a four-week period. Students were coded twice during the recess intervention and twice during regular recess for 15 minutes. The recess intervention was structured physical activity and teacher led, while the regular recess activity was unstructured and student led. The results found that MVPA was 52% for the recess intervention and MVPA for students in the regular recess group was 31%.
Students during the recess intervention spent 14% of the time sitting and 34% of the time standing, while students during regular recess spent 50% of the time sitting and 19% of the time standing. The authors concluded that structured recess (the recess intervention) can increase activity levels of students.

The studies that used SOFIT to determine MVPA levels of students without disabilities revealed percentages ranging from 31% to 52%. Would these percentages be higher or lower for students with disabilities? Due to a void in the literature related to the use of SOFIT and students with disabilities a preliminary study was undertaken.

**SOFIT and Students With and Without Disabilities**

During inclusive physical education, Lieberman, Dunn, van der Mars, and McCubbin (2000) examined the effect of peer tutors on the physical activity levels of Deaf student. The results of the study revealed that MVPA for Deaf students were initially 22%, while the MVPA for the trained peer tutors was 19%. After training the peer tutors, MVPA increased to 41.5% and 37.9% for Deaf students and the peer tutors, respectively.

Stanish and Mozzochi (2000) used SOFIT to investigated the physical activity levels of 10 preschool children with developmental delay and 10 students without developmental delay. Students were observed during an inclusive gross motor activity time. MVPA averaged 33% for both students with and without developmental delay. Students without developmental delays spent more time engaged in vigorous physical activity, while the students with developmental delays spent more time engaged in moderate physical activity.
In 1998, a pilot study was conducted using SOFIT to determine the percentage of physical activity of individuals with and without disabilities who were enrolled in a 1998 summer physical activity program (Faison-Hodge, 1998). This program was part of a required practicum experience for undergraduate Sport and Leisure Studies majors at a large Midwest university. Twenty-eight observations were made over three, 2-hour sessions. Eighteen participants (11 with disabilities and seven without disabilities) were involved in the study. The participants ranged in age from 6 to 14 years. Participants with disabilities (e.g. mental retardation, orthopedic impairments, and deafness) spent more time engaged in the “very active” category than students without disabilities. The “very active” physical activity level was 50% for participants with disabilities and 34% for students without disabilities. Physical activity leaders spent more time “demonstrating fitness” for students with disabilities, whereas they spent more time “observing fitness” for individuals without disabilities. Observations showed that when physical activity leaders where demonstrating fitness participants (in this case the students with disabilities) where more attentive and able to perform the skills in a consistent manner, therefore having higher physical activity levels. However, participants without disabilities who were observed by the physical activity leaders were more likely to discontinue physical activity during the physical activity period. Students without disabilities discontinued physical activity because the physical activity leaders were not demonstrating how to do the activity and because they were not receiving feedback from the activity leaders. This study further illustrates that more research needs to be conducted to determine the physical activity levels of individuals with disabilities. It was concluded that research on physical activity should be in a setting that allows the
participants to engage in physical activity with the least amount of physical assistance possible; therefore, physical activity levels would be a true measure of the students activity level not a measure of activity levels in conjunction with physical assistance from a teacher or assistant.

**Physical Activity and Physical Education**

The school setting, particularly the physical education setting, is the ideal and most available setting for the promotion of physical activity (McKenzie et al., 1993). Physical education programs play a unique role in the promotion of physically active lifestyle for children and youth (Carroll & Hostetter, 1996; Pate et al., 1995). An examination of physical education engagement and leisure time physical activity levels showed that there is a low positive relationship between school involvement in physical education and physical activity levels of individuals (Carroll & Hostetter, 1996). Studies have shown that students who are physically active during childhood are more likely to be active outside of school and when they become adults (Sallis & McKenzie, 1991).

**Physical Activity and Recess**

Few studies have been published related to physical activity level during recess. However, Lorenzi, Horvat, and Pellegrini (1999) investigated the physical activity of 17 kindergarten through fifth grade children with and without mental retardation during inclusive recess. Data were collected using activity counts, heart rate, and an observational checklist that determined body positioning and intensity levels. All participants were observed twice for 16 minutes, during each recess period. Students with mental retardation had higher activity levels as measured by the heart rate and activity counts when compared to students without mental retardation. There were no differences in the activity levels for
children with and without mental retardation relative to the observational checklist. The researchers concluded that an inclusive, unstructured recess setting might greatly facilitate physical activity levels of students with mental retardation (Lorenzi et al., 1999).

Sarkin et al. (1997) examined gender differences in physical activity of fifth graders during physical education and recess. Physical activity engagement was determined using Caltrac accelerometers over a 3-day period. The mean Caltrac counts per minute during physical education for boys was .57 and for girls was .53. The boys were significantly more active during the unstructured recess settings than during physical education. In contrast, the girls were significantly more active during physical education than recess. The Caltrac mean for girls during recess was .46 and higher for the boys at .61. However, these differences were not statistically significant.

Sleap and Wartburon (1992) compared physical activity levels of 27 girls and 29 boys (5 to 11 years old) during recess at school, free time at home, and physical education using an observation method that used activity points to determine physical activity level. The activity point system recorded physical activity intensity of student activity each minute. Sleap and Wartburon found that preadolescent students were engaged in MVPA 48% of the time during recess. MVPA was approximately 36% of the time during the fifty-five physical education lessons. Students were most active during school recess and least active during free time at home.

Hovell, Bursick, Sharkey, and McClure (1978) assessed physical activity levels of children in grades three through six during recess. Over 300 students were observed for a total of 5 minutes each. Using a 5-second interval time-sampling recording system, physical activity levels were recorded as: no activity; moderate activity; or vigorous
activity. In addition, coding was used to distinguish upper and lower body activity. Upper body activity referred to arm movements while lower body movements referred to leg movements. Upper body activity levels were not significantly different for males and females; however, the lower body activity levels were significantly higher for males than females. Students were engaged in physical activity 60% of the time during recess. The observed physical activity rate was not at a vigorous rate of activity.

Taken collectively the aforementioned studies on physical education and recess show consistent results that students without disabilities have higher physical activity levels during recess than during physical education. Would these rates be similar for students with disabilities? How does inclusion affect the physical activity levels of students in physical education and recess settings? Passentino and Cranfield (1994) stated that recess is a great time for everyone to be physically active. Therefore, how physically active are students with disabilities during recess?

Physical Activity and Inclusion

To understand inclusive physical education, one must first understand the definition and overall principles of inclusion. Inclusion is defined in several ways. Numerous individuals use the term inclusion “as ‘including’ in or ‘integration’ into regular classrooms and physical education classes as part of the continuum of alternative placements required under Least Restrictive Environment” (Stein, 1994, p. 21). Full or total inclusion advocates state that all students with disabilities must be educated in their neighborhood school, with their same age peers, and assisted with appropriate support personnel (Block, 1994). Inclusion of students with disabilities into the general physical education setting has been examined and discussed throughout the literature (Block,
1994; 1999; Block & Zeman, 1996; Vogler et al., 2000). However, there continues to be a lack of empirical research.

Block (1994) suggests that students with disabilities can be included in the general physical education setting. There are four points offered by Block (1994). First is the principle of portability. This principle states that services can be transported from a segregated setting to an integrated setting. Transporting services means having teachers who provide services to students with disabilities provide these services within the general education setting instead of having students come to their setting. Second, inclusion is simply better than segregation. Through inclusion, students without disabilities have the opportunity to interact with students with disabilities. Third, an inclusive setting can promote better instruction and time-on-task for all students. Fourth, good physical education is good adapted physical education. Physical educators are taught to teach all students with varied needs.

Block and Zeman (1996) examined the impact of including 3 students with moderate to severe mental retardation into a general physical education setting. During a basketball unit, the three students with mental retardation were assisted by an adapted physical educator and two teacher assistants. In addition, the regular physical education teacher was the primary instructor. Results of the study showed that students with and without disabilities made gains in basketball passing, shooting, and dribbling. Further, there were no significant differences between basketball skills of the class containing students with disabilities and the class without students with disabilities. The authors concluded that students with disabilities, with proper support, can be included in regular physical education.
Vogler et al. (2000) investigated an inclusive physical education kindergarten class using a case study methodology. This class contained a child with severe cerebral palsy. An adapted physical educator was used as a resource for the regular physical educator. The authors found that with support, the inclusive class was effective in motor engagement. Further, other students accepted the student with cerebral palsy.

Inclusion and Effective Elementary Physical Education Specialists

Historically, when examining the behaviors of "effective" physical education teachers there has been little focus on inclusion of individuals with disabilities. As one exception, six effective elementary physical education specialists were studied to gain insight pertaining to their practices and perceived outcomes related to inclusion (LaMaster, Kinchin, Gall, & Siedentop, 1998). A qualitative method of data analysis was used and four distinct themes evolved from interviews and observations. These themes were teacher frustrations, student outcomes, differences in inclusion practices, and multiple teaching styles. LaMaster et al. (1998) reported that physical education programs varied in type of educational and paraprofessional support given relative to students with disabilities. This support was usually very limited. In addition, physical educators stated that they did not have sufficient teacher training preparation to teach effectively in an inclusive setting. Moreover, these teachers expressed guilt and feelings of inadequacy when teaching students with disabilities. According to one of the teachers, there appeared to be limited fitness and skill outcomes depending on the student’s disability type. There was a concern that the students with disabilities might be able to learn more in a segregated physical education setting than in an inclusive setting. The lack of assistance and time were factors that this particular teacher identified as variables affecting the student’s ability to
enhance physical skills. No empirical data were collected to determine if the teachers' perceptions of the fitness level of the students with disabilities were low. Moreover, no comparisons were made to determine if there was a difference in physical activity levels of students with and without disabilities.

Another unique feature of the LaMaster's et al. study was that all the teachers were employed in a suburban district where pupil expenditures were high. Pupil expenditures exceeded the state mean per pupil. With this fact in mind, LaMaster et al. deduced that the teachers in their study had "ample" resources and were employed in schools with strong reputations as excellent schools. The authors also stated that these schools had equipment and playing areas that were ample.

Summary

The social cognitive theory (Bandura, 1986) provides a theoretical framework for examining physical activity levels of students in various settings. The components of the social cognitive theory such as personal factors, environmental factors, self-efficacy, observational influences, and choice are vital to understanding physical activity behaviors and can shape further research in physical activity. Defining physical activity is a key aspect of understanding how to measure physical activity. Physical activity encompasses aspects related to the movement of skeletal muscles and involves intensity levels or movement. A variety of techniques are used to measure physical activity such as calorimetry, step counters, Caltrac accelerometers, and surveys (Ainsworth et al., 1994; Klesges & Klesges, 1987). Behavioral observational systems like CARS, CPAF, and SOFIT have also been used to measure physical activity (Blair, 1984; Freedson, 1991; McKenzie, 1997; O'Hara et al., 1989; Puhl et al., 1990). Historically, physical activity
intensity has not been examined in physical education settings. Instead student engagement time (irrespective of intensity) during physical education has been the focus. The BESTPED (Costello & Laubach, 1978; Laubach, 1975) and ALT-PE (Metzler, 1979; Siedentop et al., 1982) instruments have been useful observational instruments in measuring how students spend their time during physical education. And, ALT-PE instrument has been used for students with disabilities in physical education (Aufderheide, 1983; DePaepe, 1985; Godbout et al., 1983; Metzler, 1979; Miller, 1985; Vogler et al., 1990). The SOFIT instrument is now becoming popular in measuring physical activity for students (McKenzie et al., 1991, 1993, 1995; van der Mars et al., 1998). However, to this date, the use of SOFIT for students with disabilities has not been reported in the literature. SOFIT shows promise in determining the physical activity levels of students with and without disabilities in an inclusive setting. In addition, SOFIT may provide a means of establishing physical education accountability outcomes that are observable and measurable allowing teachers to determine the physical activity levels of all of students during various physical activity settings.

Few studies exist related to physical activity engagement during recess. Lorenzi et al. (1999) reported that physical activity engagement during recess for elementary students with mental retardation was higher than physical activity levels for their same age peers. Sarkin et al. (1997) found that boys were significantly more active than girls during recess. Sleap and Wartburon (1992) found that typically developing students were more active during recess than during physical education. As more and more students with disabilities are included into physical education and recess contexts (LaMaster et al.,
1998; Block & Zeman; Vogler et al., 2000), research should be conducted to determine the physical activity levels of students with and without disabilities.
Chapter three describes the procedures used in this study. Furthermore, information obtained from a pilot study was presented to further clarify procedures for the principal study. The pilot study resulted in clarifying problem areas related to coding specific activities, and allowed refinement of videotaping strategies. Initially, the chapter describes the research site and participants. Next, the SOFIT instrument is discussed; both independent and dependent variables are identified in subsequent sections. The next two sections focus on methodology and research design, respectively. The final section describes how data were analyzed.

**Research Site**

This study took place in a small rural town in eastern North Carolina with a population of approximately 2,800. A majority of the people in this town were "blue-collar" workers who were at a low to middle class socioeconomic status. Their jobs include working as unskilled or skilled manual labor workers in industries, factories, or farms.
The specific research site was one public elementary school. The student population of this school was approximately 550. The racial composition of the school was 62% African American, 20% Hispanic non-white, and 18% White American. This school serves students from preschool through 5th grade.

The school was purposively selected based on several criteria. First, the school had students with mental retardation included in general physical education classes. Second, school recess included individuals with and without mental retardation. Third, the researcher had access to and familiarity with the physical education teacher at the school, as well as the students and other teachers in the school and community. This allowed easy access to the site and the ability to examine one school in-depth. Lastly, geographic accessibility was feasible and economical.

All students in this school received physical education. All physical education classes were 30 minutes in duration. Students in kindergarten had physical education once every two weeks, while first and second grades had physical education once a week. Third, fourth, and fifth grade students had physical education twice a week. For all data collection sessions physical education occurred in the gymnasium. The total area of the gymnasium was approximately 60 feet wide and 76 feet long. There was one large storage room and one physical education office space directly adjacent to the gymnasium. The gymnasium had two mounted basketball goals with mats located on each wall under the goals. In addition, there were chin-up bars located on the east wall of the gymnasium. This gymnasium was used as a multipurpose room; therefore, there were steps that led to a carpeted stage located in the north end of the gymnasium (see Appendix A).
At this particular school, the term recess was not used. Recess was called student break. Students had a daily break lasting from 10 to 20 minutes. This recess/student break time occurred outdoors, unless it was raining, the temperature was below 20 degrees (which includes wind chill factor) or the recess area was unsafe due to weather or other conditions (Rural Elementary School Handbook, 1999-2000). The recess/student break period for third grade was at 10:00 a.m. daily and the recess/student break period for the fourth and fifth grades was at 10:15 a.m. daily. This recess/student break period occurred on a patio and grassy area. The students were allowed to have jump ropes and playground balls during this time. This area was approximately 276 feet wide and 712 feet long (see Appendix B). For validation of the SOFIT instrument for students with mental retardation, one recess session occurred indoors in the gymnasium.

Teachers occasionally allowed students to have another recess/student break in the afternoon around 1:30 p.m. or 2:00 p.m. This recess/student break was on the playground and students could only use the equipment that was on the playground. This recess/break period typically lasted from 10 to 20 minutes. The playground equipment included a slide, a swing set, climbing platforms, pull-up bars, tire swings, cargo net, fire poles, parallel bar, tire tree, wooden steps, and a large grassy playground area (see Appendix C). This area was approximately 142 feet wide by 218 feet long.

Participants

The student participants were all third, fourth, and fifth grade students ranging in age from 8 to 12 with and without mental retardation. The veteran physical education teacher taught all students. She used the same lesson plan for all classes within each grade level. It is important to note that SOFIT was first used and validated with third,
fourth, and fifth grade students without disabilities and continues to be used mainly with
elementary age students. Therefore this age group was deemed appropriate to study
using this instrument for data collection (Hovell, Bursick, Sharkey, & McClure, 1978;

At this site, there were a total of four third grade classes, four fourth grade classes
and three fifth grade classes. The number of students with mental retardation per class
was 0-3. The numbers followed the principle of natural proportions that recommends no
more than 10-15% of the total number of students in a class should be disabled (Block,
1994). Total number of students without mental retardation per class ranged from 18 to
26 (see Table 3.1). Intelligence Quotients (IQs) of the students with mental retardation
ranged from 45 to 70 (mean=58, SD=7.99). Intelligence assessment was based on the
Stanford-Binet Intelligence Test. Table 3.2 shows the group totals by grades. The total
number of students in the high cardiorespiratory fitness group was 19, the total number in
the low cardiorespiratory fitness group was 19, and the total for students with mental
retardation was 8. Third, fourth, and fifth classes without students with mental
retardation (Classes 3A, 3B, 3C, 4B, 4C, 4D, 5A, and 5B) had two students possessing
high cardiorespiratory fitness and two students possessing low cardiorespiratory fitness
chosen as participants for the study. Classes 3D, 4A, and 5C, which had students with
mental retardation in its classes, had one student possessing high cardiorespiratory fitness
and one student possessing low cardiorespiratory fitness chosen as participants from each
class, respectively.
<table>
<thead>
<tr>
<th>Class</th>
<th>Students without MR</th>
<th>Students with MR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 3A</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>Class 3B</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Class 3C</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>Class 3D</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>Class 4A</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>Class 4B</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>Class 4C</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Class 4D</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Class 5A</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>Class 5B</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>Class 5C</td>
<td>26</td>
<td>3</td>
</tr>
</tbody>
</table>

**TOTAL** 227 8

*Note.* The letters A-D denote different classes within the same grade.

Table 3.1: Class Totals by Grade for Students with and without Mental Retardation (MR)
### Table 3.2: Group Totals by Grade

<table>
<thead>
<tr>
<th></th>
<th>HCRF Group</th>
<th>LCRF Group</th>
<th>MR Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd</td>
<td>7</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>4th</td>
<td>7</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>5th</td>
<td>5</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>19</td>
<td>19</td>
<td>8</td>
</tr>
</tbody>
</table>

**Note.** HCRF = High cardiorespiratory fitness; LCRF = Low cardiorespiratory fitness; and MR = Mental retardation

Tables 3.3, 3.4, and 3.5 contain demographic information for each participant by grade. Thirty-five of the participants were black (African-American), 7 were White American, and 4 were Hispanic. There were 25 males and 21 females in this study. In addition, PACER test scores are given for each participant. Weight, height, and body mass index scores are also recorded within these tables for each participant.

The elementary physical education teacher was a veteran physical education teacher with 26 years of teaching experience. In addition, she had over 30 hours of graduate course work and continuing education classes in physical education assessment,
<table>
<thead>
<tr>
<th>Race</th>
<th>Group</th>
<th>Gender</th>
<th>PACER</th>
<th>Weight(kg)</th>
<th>Height(cm)</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>HCF</td>
<td>M</td>
<td>33</td>
<td>28.6</td>
<td>134.6</td>
<td>15.8</td>
</tr>
<tr>
<td>B</td>
<td>HCF</td>
<td>M</td>
<td>46</td>
<td>31.8</td>
<td>133.4</td>
<td>17.9</td>
</tr>
<tr>
<td>B</td>
<td>HCF</td>
<td>M</td>
<td>33</td>
<td>28.1</td>
<td>125.7</td>
<td>17.8</td>
</tr>
<tr>
<td>B</td>
<td>HCF</td>
<td>F</td>
<td>12</td>
<td>51.7</td>
<td>137.2</td>
<td>27.5</td>
</tr>
<tr>
<td>B</td>
<td>HCF</td>
<td>F</td>
<td>18</td>
<td>26.8</td>
<td>134.6</td>
<td>14.8</td>
</tr>
<tr>
<td>B</td>
<td>HCF</td>
<td>F</td>
<td>33</td>
<td>31.8</td>
<td>127.0</td>
<td>19.7</td>
</tr>
<tr>
<td>B</td>
<td>LCF</td>
<td>M</td>
<td>11</td>
<td>44.0</td>
<td>137.2</td>
<td>23.4</td>
</tr>
<tr>
<td>B</td>
<td>LCF</td>
<td>M</td>
<td>9</td>
<td>75.3</td>
<td>138.4</td>
<td>39.3</td>
</tr>
<tr>
<td>B</td>
<td>LCF</td>
<td>M</td>
<td>7</td>
<td>76.2</td>
<td>137.2</td>
<td>40.5</td>
</tr>
<tr>
<td>B</td>
<td>LCF</td>
<td>M</td>
<td>7</td>
<td>49.9</td>
<td>135.9</td>
<td>27.0</td>
</tr>
<tr>
<td>B</td>
<td>LCF</td>
<td>F</td>
<td>9</td>
<td>65.8</td>
<td>144.8</td>
<td>31.4</td>
</tr>
<tr>
<td>W</td>
<td>LCF</td>
<td>F</td>
<td>10</td>
<td>18.1</td>
<td>114.3</td>
<td>14.6</td>
</tr>
<tr>
<td>B</td>
<td>LCF</td>
<td>F</td>
<td>10</td>
<td>50.8</td>
<td>139.7</td>
<td>26.0</td>
</tr>
<tr>
<td>B</td>
<td>MR</td>
<td>M</td>
<td>6</td>
<td>38.6</td>
<td>127.0</td>
<td>23.9</td>
</tr>
<tr>
<td>W</td>
<td>MR</td>
<td>F</td>
<td>26</td>
<td>30.0</td>
<td>130.8</td>
<td>17.5</td>
</tr>
</tbody>
</table>

**Note.** B = Black; W = White American; H = Hispanic; HCRF = High cardiorespiratory fitness; LCRF = Low cardiorespiratory fitness; and MR = Mental retardation; F = Female; and M = Male.

Table 3.3: Demographic Information for Third Grade Participants
<table>
<thead>
<tr>
<th>Race</th>
<th>Group</th>
<th>Gender</th>
<th>PACER</th>
<th>Weight(kg)</th>
<th>Height(cm)</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>HCF</td>
<td>M</td>
<td>76</td>
<td>29.5</td>
<td>132.1</td>
<td>16.9</td>
</tr>
<tr>
<td>B</td>
<td>HCF</td>
<td>M</td>
<td>61</td>
<td>32.2</td>
<td>134.6</td>
<td>17.7</td>
</tr>
<tr>
<td>B</td>
<td>HCF</td>
<td>M</td>
<td>72</td>
<td>28.6</td>
<td>132.1</td>
<td>16.4</td>
</tr>
<tr>
<td>B</td>
<td>HCF</td>
<td>F</td>
<td>35</td>
<td>27.2</td>
<td>141.0</td>
<td>13.7</td>
</tr>
<tr>
<td>B</td>
<td>HCF</td>
<td>F</td>
<td>25</td>
<td>33.6</td>
<td>135.9</td>
<td>18.2</td>
</tr>
<tr>
<td>B</td>
<td>HCF</td>
<td>F</td>
<td>27</td>
<td>31.8</td>
<td>134.6</td>
<td>17.6</td>
</tr>
<tr>
<td>B</td>
<td>HCF</td>
<td>F</td>
<td>38</td>
<td>26.8</td>
<td>132.1</td>
<td>15.4</td>
</tr>
<tr>
<td>B</td>
<td>LCF</td>
<td>M</td>
<td>10</td>
<td>42.6</td>
<td>151.1</td>
<td>18.7</td>
</tr>
<tr>
<td>B</td>
<td>LCF</td>
<td>M</td>
<td>18</td>
<td>46.3</td>
<td>144.8</td>
<td>22.1</td>
</tr>
<tr>
<td>B</td>
<td>LCF</td>
<td>M</td>
<td>7</td>
<td>83.9</td>
<td>141.0</td>
<td>42.2</td>
</tr>
<tr>
<td>H</td>
<td>LCF</td>
<td>M</td>
<td>18</td>
<td>44.9</td>
<td>138.4</td>
<td>23.4</td>
</tr>
<tr>
<td>H</td>
<td>LCF</td>
<td>F</td>
<td>16</td>
<td>49.9</td>
<td>137.2</td>
<td>26.5</td>
</tr>
<tr>
<td>H</td>
<td>LCF</td>
<td>F</td>
<td>20</td>
<td>41.7</td>
<td>134.6</td>
<td>23.0</td>
</tr>
<tr>
<td>B</td>
<td>LCF</td>
<td>F</td>
<td>14</td>
<td>40.8</td>
<td>135.9</td>
<td>22.1</td>
</tr>
<tr>
<td>W</td>
<td>MR</td>
<td>M</td>
<td>10</td>
<td>29.0</td>
<td>137.2</td>
<td>15.4</td>
</tr>
<tr>
<td>B</td>
<td>MR</td>
<td>M</td>
<td>17</td>
<td>33.6</td>
<td>141.0</td>
<td>16.9</td>
</tr>
<tr>
<td>W</td>
<td>MR</td>
<td>F</td>
<td>9</td>
<td>44.5</td>
<td>141.0</td>
<td>22.4</td>
</tr>
</tbody>
</table>

Note. B = Black; W = White American; H = Hispanic; HCRF = High cardiorespiratory fitness; LCRF = Low cardiorespiratory fitness; and MR = Mental retardation; F = Female; and M = Male.

Table 3.4: Demographic Information for Fourth Grade Participants
<table>
<thead>
<tr>
<th>Race</th>
<th>Group</th>
<th>Gender</th>
<th>PACER</th>
<th>Weight(kg)</th>
<th>Height(cm)</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>HCF</td>
<td>M</td>
<td>72</td>
<td>37.2</td>
<td>149.9</td>
<td>16.6</td>
</tr>
<tr>
<td>B</td>
<td>HCF</td>
<td>M</td>
<td>41</td>
<td>41.3</td>
<td>144.8</td>
<td>19.7</td>
</tr>
<tr>
<td>B</td>
<td>HCF</td>
<td>F</td>
<td>41</td>
<td>34.0</td>
<td>139.7</td>
<td>17.4</td>
</tr>
<tr>
<td>H</td>
<td>HCF</td>
<td>F</td>
<td>45</td>
<td>41.7</td>
<td>149.9</td>
<td>18.6</td>
</tr>
<tr>
<td>B</td>
<td>HCF</td>
<td>F</td>
<td>39</td>
<td>35.4</td>
<td>143.5</td>
<td>17.2</td>
</tr>
<tr>
<td>B</td>
<td>LCF</td>
<td>M</td>
<td>14</td>
<td>76.2</td>
<td>153.7</td>
<td>32.2</td>
</tr>
<tr>
<td>W</td>
<td>LCF</td>
<td>M</td>
<td>4</td>
<td>73.5</td>
<td>154.9</td>
<td>30.6</td>
</tr>
<tr>
<td>B</td>
<td>LCF</td>
<td>M</td>
<td>17</td>
<td>43.1</td>
<td>135.9</td>
<td>23.3</td>
</tr>
<tr>
<td>W</td>
<td>LCF</td>
<td>F</td>
<td>13</td>
<td>71.2</td>
<td>148.6</td>
<td>32.2</td>
</tr>
<tr>
<td>W</td>
<td>LCF</td>
<td>F</td>
<td>16</td>
<td>49.9</td>
<td>147.3</td>
<td>23.0</td>
</tr>
<tr>
<td>B</td>
<td>MR</td>
<td>M</td>
<td>13</td>
<td>77.1</td>
<td>157.5</td>
<td>31.1</td>
</tr>
<tr>
<td>B</td>
<td>MR</td>
<td>M</td>
<td>25</td>
<td>41.3</td>
<td>139.7</td>
<td>21.2</td>
</tr>
<tr>
<td>B</td>
<td>MR</td>
<td>M</td>
<td>13</td>
<td>56.7</td>
<td>147.3</td>
<td>26.1</td>
</tr>
</tbody>
</table>

**Note.** B = Black; W = White American; H = Hispanic; HCRF = High cardiorespiratory fitness; LCRF = Low cardiorespiratory fitness; and MR = Mental retardation; F = Female; and M = Male.

Table 3.5: Demographic Information for Fifth Grade Participants
sign language, curriculum development, wellness, technology, and safety, to name a few. She had a Master's Degree in K-12 Health and Physical Education. This teacher was considered an effective elementary physical education teacher according to the county physical education director and the building principal (P. Edwards & P. Matthis, personal communication, May, 1999). She was considered an effective physical educator because of her extensive planning, professional development endeavors, and high teaching evaluations. In addition, this physical education teacher assisted classroom teachers in organizing physical activity programs for students before, during, and after school.

Specific steps were used to rate students without disabilities possessing high and low cardiorespiratory fitness. First, the cardiorespiratory fitness scores of all the third, fourth, and fifth graders were reviewed to determine the individuals who had the highest and lowest scores on the Fitnessgram PACER test item at the end of the 1998-1999 academic year (Meredith & Welk, 1999). Then the pretest scores for the PACER for the 1999-2000 academic year were reviewed. Students who had the highest and lowest cardiorespiratory fitness levels scored the highest and lowest on the PACER test.

Table 3.6 provides information on the height and weight of students by group. Students without disabilities in the low cardiorespiratory fitness group exhibited the greatest weight (54.7 kilograms). The participants possessing high cardiorespiratory fitness weighed the least (33.0 kilograms).
<table>
<thead>
<tr>
<th></th>
<th>HCRF Group (n=19)</th>
<th>LCRF Group (n=19)</th>
<th>MR Group (n=8)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>33.0</td>
<td>54.7</td>
<td>43.9</td>
</tr>
<tr>
<td>SD</td>
<td>6.4</td>
<td>17.3</td>
<td>16.1</td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>136.5</td>
<td>140.6</td>
<td>140.2</td>
</tr>
<tr>
<td>SD</td>
<td>6.8</td>
<td>9.0</td>
<td>9.4</td>
</tr>
</tbody>
</table>

**Note.** HCRF = High cardiorespiratory fitness; LCRF = Low cardiorespiratory fitness; MR = Mental retardation; and SD = Standard Deviation.

Table 3.6: Height (in centimeters) and Weight (in kilograms) by Group

**Instrumentation**

The SOFIT instrument is a direct observation instrument measuring: a) student physical activity levels; b) teacher behaviors; and c) lesson context variables (McKenzie et al., 1991). A three-phase decision system is incorporated within the SOFIT. At the end of each 20-second interval, a decision is made concerning the three phases. During phase one, the activity level of the student is determined. The level of physical activity is coded as 1, 2, 3, 4, or 5 corresponding to the student's body position: lying down, sitting,
standing, walking, or very active, respectively. Student activity level is coded using momentary time sampling; hence at the end of the 20-second interval a level is coded.

Next, a curricular lesson context is observed and a decision is made during phase two. The curricular lesson context decision consists of three parts. First, the observer determines if the class time is general content or subject matter content. An example of general content would be management and an example of subject matter content would be physical education. The second decision is made with regard to subject matter content and determines whether or not the class focus is motor content or knowledge content. Motor content includes physical activity. Knowledge content includes general or fitness knowledge. The last decision to be made during phase two is to determine and record lesson context as either fitness, skill practice, game play, or free play using a momentary time sampling technique.

The third and final phase of the SOFIT instrument involves coding teacher behaviors. There are six categories of teacher behaviors: promotes fitness, demonstrates fitness, instructs generally, manages, observes, and off-task. Teacher behavior category is coded according to a partial interval recording hierarchical system. The “promotes fitness” category refers to teacher prompts to the student concerning physical fitness activities. The “demonstrates fitness” category is coded when the teacher models physical fitness engagement. This category also includes when a teacher is participating with a student in a physical fitness related activity. “Instructs” is a teacher behavior category that pertains to lecturing, prompting, or providing feedback to students related to general physical education content such as rules, skill, technique, or strategy that is not related to physical fitness. The “manages” category is coded when the teacher takes role,
sets up equipment or performs other behaviors that manage the environment or the student that is not physical education related. The "observes" category of teacher behavior is recorded when a teacher monitors a group of students or individual students who are performing a physical education skill, game, or activity. The last category of teacher behavior, "off task", is related to behaviors such as reading the newspaper, making a phone call, or attends to events that are not related to physical education responsibilities. A copy of the SOFIT instrument can be found in Appendix D.

In this study, all three phases of the instrument were recorded. When analyzing and interpreting data from phase one (student activity level), a moderate to vigorous percentage was calculated by combining categories four and five (van der Mars, Darst, Vogler, & Cusimano, 1998). In order to contextualize the environment, both the lesson context category and teacher behavior category were also coded. These codings consisted of the physical education setting (in terms of what was being taught) and how the teacher was involved with the student and the lesson content.

Reliability, validity, and feasibility have been reported for the SOFIT instrument. Interobserver reliability for the instrument ranges from 88.3% to 91.8% (McKenzie, 1997). Concurrent validity was established for the SOFIT instrument by comparing the five-level coding system to the energy expenditure values calculated from heart rates collected from the UNIQ Heart Watch (McKenzie et al, 1991; Rowe et al., 1997). The SOFIT instrument is a practical observation instrument requiring low observer training time. Further, SOFIT is economical in terms of implementation time because observers can code students during physical activity. Finally, the financial cost of the instrument is minimal (McKenzie, 1997).
Polar Vantage XL heart rate monitors were used within this study to determine concurrent validity of the SOFIT instrument for use with students with mental retardation. The heart rate monitor has a transmitter that is attached to an elastic belt and worn around the chest. In addition, there is a receiver worn on the wrist that resembles a watch. The receiver is programmed to record heart rates at 15-second intervals. The time was synchronized on both the watch and the video camera to add to SOFIT validation data analysis for the students with mental retardation. Data from the Polar Vantage XL Heart Rate Monitors was downloaded to the Polar Interface unit and to the Polar IBM computer program.

Independent Variables

There were two main variables under study. The first independent variable was group. Group one consisted of participants (students) who had mental retardation. The second group of participants without disabilities possessed high cardiorespiratory fitness, while the third group of participants without disabilities possessed low cardiorespiratory fitness. The second independent variable was physical activity setting. The two settings in this study were physical education and recess.

Other minor independent variables (i.e., classification and contextual in nature) were examined. These were lesson context and teacher behaviors. The lesson context and teacher behavior variables provided the reader with detailed information concerning the observed physical activity session. Gender was not an independent variable because the number of males and females were disproportionate and, thus would not be appropriate for meaningful data analysis.
Dependent Variable

The dependent variables in this investigation were percentage of engagement in low physical activity (LPA) and moderate to vigorous physical activity (MVPA). The SOFIT instrument was used to determine level of physical activity engagement. Student activity levels were coded at the end of each 10-second observation intervals, thus using a momentary time sampling method of recording data. Using a 10-second observe/10-second record interval yielded three student activity codes per minute. The percentage of engagement in physical activity was computed for each activity category for each student. Categories one, two, and three were aggregated to calculate LPA, whereas categories four and five were aggregated to calculate the percent of MVPA. Physical education classes were coded for 30 minutes and recess sessions were coded for no more than 20 minutes.

Methodology

Permissions

This study was approved by The Ohio State Human Subjects Institutional Review Board (Appendix E). Further, the county board of education, for the school district in which the study was conducted, was contacted. County officials agreed to allow the research project to be conducted in their locale (Appendix F). In addition, the building principal and the physical education teacher gave their consent for the research project (Appendix G).

All parents received a letter explaining the research study and attached to the letter was a consent form (Appendices H & I). All parents signed forms allowing their
children to participate in the study. Parental consent rate for all students in grades third, fourth, and fifth was 100%.

**Observers Training**

Two doctoral students served as coders. A first year doctoral student specializing in Sport and Exercise Education with emphasis in adapted physical education served as the first trained coder. The first trained coder had education experience utilizing systematic observation tools and had completed a graduate course in teacher supervision. A third year doctoral student specializing in Sport and Exercise Education with emphasis in adapted physical education served as the second coder. The second trained coder had also completed a graduate level teacher supervision course. In addition, the latter coder was a supervisor for adapted physical education interns and used a variety of coding instruments during practicum supervision. The purpose of observer training was to collect valid and reliable data.

Several training tasks occurred prior to interobserver rating using the SOFIT instrument. First, both coders were given a SOFIT manual to study. Second, the manual was reviewed and discussed with the coders. Third, coders completed training relative to written evaluation (see Appendix J) concerning physical activity levels, provided examples of activities within each level, and information within the SOFIT manual. For the written evaluation training component, coders had to obtain a score of 100% before proceeding to the next level of training. Next, coders viewed a 5-minute segment of a videotape in the presence of the research trainer and used the coding sheet to determine student activity levels. Upon completion of this training regiment, coders and the trainer were allowed to discuss areas that required additional clarification. Lastly, coders viewed
two, 10-minute segments and code student activity levels using the SOFIT instrument. A 90% interrater agreement was obtained between the coders and the trainer during observer training. A description of how interobserver agreement for both training and actual data collection was calculated and appears in the next section. According to Cooper, Heron, and Heward (1987) a minimum of 80% is needed in order for coders to be considered competent and reliable to code research data. At the completion of the training protocol, a decision log was compiled (see Appendix K). The decision log contained information concerning activities that presented potential areas of disagreement and the way in which each activity was to be coded.

**Interobserver Agreement**

Interobserver agreement refers to the ability of two independent observers to simultaneously measure a target behavior (Cooper et al., 1987). When determining interobserver agreement, two or more independent observers observe the same event or events and record data. The objective of interobserver agreement was to obtain agreement on what was observed. Interobserver agreement was obtained by counting the number of agreements per interval, then dividing them by the total number of agreements and disagreements. This number was then multiplied by 100 to obtain a percentage. The result was the interobserver agreement for that observation (Cooper et al., 1987). For determining interobserver agreement, McKenzie (1997) suggested 10% to 15% of the SOFIT lessons should be randomly selected and coded. For this study 10% of the total observations were randomly checked for interobserver agreement, which was approximately 30 observations.
Data Collection

Data were collected from July 26, 1999 until August 20, 1999. During this period, all third, fourth, and fifth grade students were videotaped during physical education class. Classes were videotaped for a total of 30 minutes for at least 5 to 8 sessions. The physical education teacher was told to teach their class as normal without changing the unit or lesson plans. One video camera was placed in the same corner of the gymnasium throughout data collection so as not to distract students. This placement, in addition to the use of a wide-angle lens, allowed the entire gymnasium to be monitored. During the videotaping process, a microphone was used to verbally state what was happening in the gymnasium or to explain what a student was doing if he/she was out of the camera's view. The elapsed time was superimposed directly on the video camera image prior to recording. All physical education classes occurred in the gymnasium.

All students wore YAMAX step counters during physical education. When students entered the gymnasium, they immediately put on their step counter and began their exercises for the physical education session. The step counters were conveniently located on the step area and were labeled with a letter that corresponded to the student's assigned seat that was designated by a letter of the alphabet. The counters were attached to either a belt or a waistband. Students who did not have a belt or waistband to place the step counter on were not allowed to wear the step counter on that data collection day. In addition, students who were seen touching or opening the step counter during the physical education session were not allowed to wear the step counters for the remainder of the class session. During the entire study, only three students that step counters removed during their class session. At the end of the physical education class, students
would read the number of steps recorded by the counter and tell the physical education teacher the number of steps they had taken during class and the teacher would then record the number. The step counter would then be taken off.

Prior to data collection, students were told how to put on the step counters correctly and how to reset the step counters after they had been put on. The use of step counters by all students reduced the reactivity that may have occurred because some of the students wore heart rate monitors. The YAMAX step counters were all programmed for an average weight of 80 pounds and for a stride length of 2.00. At the end of data collection, all step counters were checked to ensure that the weight and stride length had not been altered.

Students without disabilities who were selected as possessing high cardiorespiratory fitness and low cardiorespiratory fitness wore Polar Vantage XL Heart Rate Monitors during physical education (Polar Electro Inc., 1997). In addition, the students with mental retardation also wore Polar Vantage XL Heart Rate Monitors. The number of students per class who wore the heart rate monitors did not exceed four.

Before class started, the four designated students entered the physical education office. Heart rate monitors were then placed on these students by the researcher. A transmitter was attached to an elastic belt that was worn around the student's chest and a receiver was worn on the wrist and resembled a regular watch (see Appendix L). The receiver was programmed to record heart rates at 15-second intervals. The time was synchronized on both the watches and the video camera to add to SOFIT validation data analysis for the students with mental retardation. Students who were seen touching or playing with the Polar Vantage XL Heart Rate Monitor watch or the transmitter during the physical
education session were not allowed to wear the heart rate monitor for the remainder of the data collection period. No students had the heart rate monitor removed for not following directions. Data from the Polar Vantage XL Heart Rate Monitors were downloaded to the Polar Interface unit at the end of each data collection day (see Appendix M).

Recess sessions were videotaped for a minimum of 10 minutes and a maximum of 20 minutes during the July 26, 1999 to August 20, 1999 data collection period. [Within the recess literature, recess observations per student have ranged from 5 minutes (Hovell et al., 1978) to 16 minutes (Lorenzi, Horvat, & Pellegrini, 1999). In addition, according to the Council for Physical Education for Children physical activity guidelines, children should engage in physical activity for periods of time 10 to 15 minutes or longer at a moderate to vigorous intensity (COPEC, 1998).] During morning and afternoon student break/recess periods, students with mental retardation and students without disabilities possessing high and low cardiorespiratory fitness were the only students videotaped. One video camera was placed in the far northwest corner of the morning recess area so as not to distract students. This placement, in addition to the use of a wide-angle lens, allowed a majority of the recess area to be captured. During the videotaping process of the recess setting, a microphone was used by the researcher to verbally state what the target students were doing if they were out of the camera's view. The elapsed time was superimposed directly on the video camera image prior to recording.

Afternoon recess sessions were the same as the morning sessions except the video camera was located on the playground recess area in the far northeast corner of the playground to capture the entire playground area. All student break/recess periods
occurred outside, except one. When indoors, the same procedures were followed for data collection as those for physical education collection within the gymnasium. Due to the large recess areas, only students with mental retardation and students selected as high and low cardiorespiratory fitness wore heart rate monitors and step counters.

**Research Design**

The design was a 3 (group) X 2 (physical activity setting) Analysis of Variance (ANOVA). Group included: a) students possessing high cardiorespiratory fitness; b) students possessing low cardiorespiratory fitness; and c) students with mental retardation. The two physical activity contexts were physical education and recess settings. The percentage of physical activity at the moderate to vigorous level was one of the dependent variables. In order to provide clarity within the results of the study, percentage of physical activity at the low level was also used as a dependent variable. In addition, an ANOVA was used to determine significant differences among the three groups during physical education. A second ANOVA was also performed on the recess data.

The purpose of a factorial design was to simultaneously determine the effects of two or more factors on a dependent variable (Vincent, 1995). This design examined the effects of group and physical activity setting on the percentage of LPA and MVPA for upper elementary age students (grades three, four, and five). Differences were determined between groups as well as across physical education and recess settings (Vincent, 1995). Determining the variability between the group means as well as the variability within each group was critical in determining significant differences for this study.

70
There are four advantages of using a factorial design instead of a simple one-way design. First, a factorial design reduces the chances of making a Type I error, inflating alpha. Second, power is increased by using a factorial design (Hopkins, Hopkins, & Glass, 1996). Factorial designs also allowed the researcher to use one analysis on several factors instead of several analyses for several factors. Third, factorial designs permitted the examination of the effects of interaction, whereas simple one-way designs would not allow such findings related to interaction. Lastly, use of a factorial design reduces the time needed to analyze data (Vincent, 1995).

**Data Analysis**

Data were analyzed using both descriptive and inferential methods. Descriptive statistics included mean percentages, standard deviations, ranges, and correlations (to determine concurrent validity using heart rates and SOFIT data). Inferential methods utilized ANOVA. SAS Statistical Software was used to analyze data (SAS, 1999). Further, an alpha level of .05 was used because according to Vincent (1995) it is standard in the behavioral sciences. Lastly, Scheffe post hoc tests were used to determine significance and omega squared was used to calculate effect sizes to determine the meaningfulness of the data (Sutlive & Ulrich, 1998; Tolson, 1980).

The Scheffe post hoc test was chosen for two reasons. One, Scheffe is highly recommended by behavioral researchers because it is conservative (Thomas & Nelson, 1996; Vincent, 1995). The conservative nature of the Scheffe post hoc test allows it to require larger mean differences before significance is found, therefore reducing the chance of finding a difference among the independent variables when there is no
difference. Two, when using Scheffe, all possible multiple comparison techniques are used, no restrictions are made on the number of comparisons used.

Omega squared was used because it is a method of comparing treatment effects independent of sample size (Thomas & Nelson, 1996). This was important in this study because of the small sample size. In addition, omega squared is more accurate in determining effect size than other effect size tools such as eta squared ($\eta^2$) because it accounts for unexplained variance and is more conservative (Vincent, 1995).

Summary

The methods identified in chapter three were used to answer the research questions for this study. The research site was an elementary school in a small rural town in eastern North Carolina. The participants for this study were students with mental retardation, students without disabilities possessing high cardiorespiratory fitness, and students without disabilities possessing low cardiorespiratory fitness. These students were observed during physical education (5-8 sessions) and recess settings (2-4 sessions), respectively. The SOFIT instrument was used to determine physical activity levels of the students. In addition, SOFIT was used to code lesson context and teacher behaviors. Students wore YAMAX step counters and Polar Vantage XL Heart Rate Monitors during the observation periods. A two-way Analysis of Variance was used to determine differences among the three groups. Specifically, a 3 (group) X 2 (physical activity setting) ANOVA was used. Data were analyzed using descriptive statistics such as means, standard deviations, and correlations.
Chapter four focuses on the results and discussion of the study. The chapter is divided into the following areas: 1) results of interobserver agreement for data collection; 2) preliminary grade and gender analyses 3) results and discussion of each research question as it relates to the findings of the study and the literature; 4) results and discussion related to lesson context and teacher behaviors; and 5) a chapter summary.

Interobserver agreement

Interobserver agreement was established for this study. Interobserver agreement was determined by finding the number of agreements divided by the number of agreements and disagreements multiplied by 100. Interobserver agreements ranged (reported in agreement percentages) between 82%-100%. The mean interobserver agreement was 94.4%.

No information was provided to the interobserver coders concerning participants who were in the high fitness, low fitness, or mental retardation groups. In addition, the interobserver coders did not know the research questions related to the study.
Preliminary grade and gender analyses

To rule out grade level and gender differences, preliminary data analyses were conducted for low physical activity (LPA) and moderate to vigorous physical activity (MVPA). The ANOVA results indicated that there were no significant differences across grade according to physical activity level (F (2, 43) = .95, p = .39 for LPA and F (2, 43) = .95, p = .39 for MVPA.) The gender ANOVA results were not significant either. LPA results were F (1, 43) = .68, p = .42, while MVPA results were F (1, 43) = .78, p = .38. As a result, these variables were not used in subsequent analyses.

Research Question 1: Is the SOFIT instrument a valid instrument for measuring physical activity engagement for students with mental retardation?

Concurrent validity results.

Concurrent validity of SOFIT for measuring physical activity of children with mental retardation was established during physical education and recess settings using multiple time interval measures. Concurrent validity results can be found in Table 4.1. Concurrent validity of SOFIT for measuring physical activity of children with mental retardation was also established during the physical education setting. There was an average of seven (range 5 to 8) physical education observations (30-minute duration) that occurred in the gymnasium. Observations resulted in 90 time interval measures within each 30-minute observation period. Heart rate measures and SOFIT physical activity levels were determined in the same manner as stated in the previous section (by participants wearing heart rate monitors and by participants being videotaped, respectively). Concurrent validity was established by correlating heart rates with physical activity levels for all participants with mental retardation (n = 8). The results of
the physical education data revealed correlations ranging from $r = .72$ to $r = .86$ (see Table 4.1). The mean correlation for all participants in physical education was $r = .81$. All participants in physical education had correlations that were significant ($p = .01$).

Heart rates and activity levels for both recess and physical education were then combined to determine overall correlations. Resulting overall correlations were significant ($p = .01$) for all participants.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Physical Education</th>
<th>Recess</th>
<th>Combined PE &amp; Recess</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.86</td>
<td>.78</td>
<td>.86</td>
</tr>
<tr>
<td>B</td>
<td>.78</td>
<td>.58</td>
<td>.83</td>
</tr>
<tr>
<td>C</td>
<td>.79</td>
<td>.90</td>
<td>.79</td>
</tr>
<tr>
<td>D</td>
<td>.86</td>
<td>.61</td>
<td>.86</td>
</tr>
<tr>
<td>E</td>
<td>.86</td>
<td>.59</td>
<td>.89</td>
</tr>
<tr>
<td>F</td>
<td>.75</td>
<td>.06*</td>
<td>.72</td>
</tr>
<tr>
<td>G</td>
<td>.72</td>
<td>.73</td>
<td>.79</td>
</tr>
<tr>
<td>H</td>
<td>.85</td>
<td>.64</td>
<td>.86</td>
</tr>
</tbody>
</table>

*Note. Participant F did not have a significant correlation ($r = .06$); all other correlations were found to be significant at the $p = .01$ level.

Table 4.1: Physical education, recess, and combined physical education and recess correlations for heart rate and physical activity
There were two 15-minute recess observations that occurred on the playground specifically for students with mental retardation during the validation of the SOFIT instrument. Observations resulted in 45 time interval measures within each 15-minute observation period. Concurrent validity was established by correlating heart rates with activity levels for all participants with mental retardation (n = 8). Participants with mental retardation wore Polar Vantage XL Heart Rate Monitors during the recess period. Heart rate readings were recorded every 15 seconds from the transmitter that was attached to an elastic belt worn around the participant's chest. These heart rate readings were downloaded to the Polar Interface unit from the watch. SOFIT physical activity levels were coded every 20 seconds during the observation period from the videotape analysis. These data were then correlated. The results of the recess data revealed Pearson's product moment correlation coefficients ranging from \( r = .06 \) to \( r = .90 \) (see Table 4.1). The mean correlation for all participants was \( r = .69 \). Seven of the eight participants were significant at the .01 level. The participant with a correlation of \( r = .06 \) had an irregular heartbeat; therefore, the resulting correlation was considered an outlier.

**Discussion of concurrent validity results for research question 1.**

The results of this study showed that the SOFIT instrument is a valid instrument for measuring physical activity levels of participants with mental retardation. These findings are consistent with those found by Rowe, Schuldheisz, and van der Mars (1997) for elementary children without disabilities. Similarly, McKenzie et al. (1991) had found that the SOFIT instrument was valid for elementary age students.

The finding that the SOFIT instrument is valid for participants with disabilities is not surprising. Participants with mental retardation, particularly participants with mild...
mental retardation are typically similar in physical and motor skills to their same age peers without disabilities (Eichstaedt & Lavay, 1992; Winnick & Short, 1999). When no physical deformities are present that would limit movement capacities (e.g. running, hopping, walking, standing) differences in physical and motor skills are even more similar.

Also, it was found that heart rate monitors for participants with mild mental retardation can be used in subsequent research studies. The participants for this study did not appear to be uncomfortable when wearing monitors. While participants looked at the watch that was attached to their arms, they did not try to adjust the watch or the chest band. Further, the monitor did not interfere with the participants' physical activity movements. This finding is in agreement with a study by Bar-Or, Bar-Or, Waters, Hirji, and Russell (1996) who found that heart rate monitors were suitable and appropriate for young children.

Research Question 2: Does the percentage of time engaged in physical activity intensity differ during physical education as opposed to recess for elementary students without disabilities who possess high cardiorespiratory fitness, students without disabilities who possess low cardiorespiratory fitness, and students with mental retardation?

ANOVA results for research question 2.

Tables 4.2 and 4.3 show ANOVA results for LPA and MVPA, respectively, by group and setting. There was a statistically significant difference across settings for LPA, $F(1, 70) = 299.28$, $p = .0001$, and MVPA, $F(1, 70) = 296.52$, $p = .0001$. Scheffe post hoc test revealed that participants within the physical education setting had higher LPA.
than during the recess setting (34%). However, for MVPA, the participants within the recess setting had higher MVPA (66%) than the physical education setting (24%).

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group (A)</td>
<td>2</td>
<td>541.01</td>
<td>270.51</td>
<td>2.74</td>
<td>.07</td>
</tr>
<tr>
<td>Setting (B)</td>
<td>1</td>
<td>29494.23</td>
<td>29494.23</td>
<td>299.28</td>
<td>.0001</td>
</tr>
<tr>
<td>A X B</td>
<td>2</td>
<td>26.60</td>
<td>13.30</td>
<td>.13</td>
<td>.87</td>
</tr>
<tr>
<td>Error</td>
<td>70</td>
<td>6898.62</td>
<td>98.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>39299.06</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.2: Factorial (two-way) ANOVA for LPA by Group and Setting

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group (A)</td>
<td>2</td>
<td>594.55</td>
<td>297.27</td>
<td>2.96</td>
<td>.06</td>
</tr>
<tr>
<td>Setting (B)</td>
<td>1</td>
<td>29755.98</td>
<td>29755.98</td>
<td>296.52</td>
<td>.0001</td>
</tr>
<tr>
<td>A X B</td>
<td>2</td>
<td>18.33</td>
<td>9.16</td>
<td>.09</td>
<td>.91</td>
</tr>
<tr>
<td>Error</td>
<td>70</td>
<td>7024.59</td>
<td>100.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>39771.02</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.3: Factorial (two-way) ANOVA for MVPA by Group and Setting
The omega-squared value was .74 for LPA and MVPA, revealing an extremely large main effect size (Cohen, 1988; Thomas & Nelson, 1996). Approximately 74% of the physical activity levels variance can be accounted for by setting. There was not a main effect for group [LPA, F (2, 70) = 2.74, p = .07, and MVPA, F (2, 70) = 2.96, p = .06] across settings. No significant interaction effects across group and setting were revealed for LPA (F (2, 70) = .13, p = .87) and MVPA (F (2, 70) = .09, p = .91.)

Discussion of results for research question 2 for participants with high cardiorespiratory fitness across settings.

The percentage of time engaged in physical activity is different during physical education and recess for participants with high cardiorespiratory fitness. Participants with high cardiorespiratory fitness were at a LPA intensity level 71% of the time during physical education and 28% of the time during recess, as opposed to a MVPA intensity level 28% of the time during physical education and 72% of the time during recess (see Table 4.4). Simply stated, these participants spent most of their time being inactive or at a low intensity of physical activity during physical education and more active at a higher intensity during recess. Despite the low MVPA of participants possessing high cardiorespiratory fitness, their percentages were higher than the percentages for participants possessing low cardiorespiratory fitness and participants with mental retardation (see raw data in Appendix N).

These data strongly confirm that cardiorespiratory fitness and physical activity levels are positively related (Leon, Connett, Jacobs, & Raurama, 1987; Sallis, Haskell, Fortmann, Wood, and Vranizan, 1986). Individuals who have high cardiorespiratory fitness levels are more likely to engage in activities that are moderate to vigorous. The
difference found in physical activity intensity across settings also supports the theoretical underpinnings (social cognitive theory) embedded within this study (Bandura, 1986). Participants possessing high cardiorespiratory fitness had higher physical activity levels during physical education that could be attributed to their ability to sustain high levels of activity due to their fitness status. This would also explain their high physical activity levels during recess.

<table>
<thead>
<tr>
<th></th>
<th>HCRF Group n=19</th>
<th>LCRF Group n=19</th>
<th>MR Group n=8</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPA</td>
<td>Mean  SD</td>
<td>Mean  SD</td>
<td>Mean  SD</td>
</tr>
<tr>
<td>PE</td>
<td>72  15.1</td>
<td>79  12.3</td>
<td>77  16.4</td>
</tr>
<tr>
<td>Recess</td>
<td>28  18.8</td>
<td>35  12.6</td>
<td>35  25.5</td>
</tr>
<tr>
<td>MVPA</td>
<td>Mean  SD</td>
<td>Mean  SD</td>
<td>Mean  SD</td>
</tr>
<tr>
<td>PE</td>
<td>28  15.1</td>
<td>21  12.3</td>
<td>23  16.4</td>
</tr>
<tr>
<td>Recess</td>
<td>72  18.8</td>
<td>65  12.6</td>
<td>65  25.5</td>
</tr>
</tbody>
</table>

Note. HCRF=High Cardiorespiratory Fitness; LCRF=Low Cardiorespiratory Fitness; MR =Mental Retardation; and SD=Standard Deviation.

Table 4.4: Mean Percentage for LPA and MVPA by Group and Setting
Discussion of results for research question 2 for participants with low cardiorespiratory fitness across settings.

Physical activity percentages were also different during physical education and recess for participants with low cardiorespiratory fitness. Participants with low cardiorespiratory fitness were at a LPA intensity level 79% of the time and 35% of the time for physical education and recess, respectively. MVPA intensity was documented 21% of the time during physical education and 65% of the time during recess. Participants spent most of their time being inactive or at a low intensity of physical activity during physical education as opposed to being more active and at a higher intensity during recess. These findings are consistent with the results of physical activity levels of the participants with high cardiorespiratory fitness and the participants with mental retardation.

These results also supports several aspects of the social cognitive theory that relate to the effect of environmental and personal factors on an individual's behavior (Bandura, 1997). The nature of the differences within a physical education class and a recess setting could account for the differences across settings. Self-efficacy may also play an important role in the LPA of these individuals because they do have low cardiorespiratory levels. Therefore, these participants may have felt that they would not be successful when it came to participating in activities. However, it is important to note that participants possessing low cardiorespiratory fitness may not have been able to sustain high levels of physical activity during physical education because of the length of the session but could sustain high levels of physical activity during recess because of the shorten sessions. A review of the literature fount no studies related to the self-efficacy of
students with low cardiorespiratory fitness level and physical activity engagement within
the social cognitive theory framework.

Body mass index is a possible personal factor that could have affected the percent of physical activity of participants possessing low cardiorespiratory fitness. These participants had an average body mass index of 27.46. Body mass index scores greater than 26 are considered overweight according to federal guidelines (USDHHS, 1990). According to Blair, Jacobs, and Powell (1985) when a person is overweight, physical activity levels are reduced. The students possessing high cardiorespiratory fitness and the students with mental retardation had body mass indexes of 17.67 and 21.81, respectively. Therefore, they were not at the overweight level.

Discussion of results for research question 2 for participants with mental retardation across settings.

Physical activity percentages were also different during physical education and recess for participants with mental retardation. These participants were at LPA intensity levels 79% and 35% of the time during physical education and recess, respectively. Participants exhibiting MVPA intensity 21% of the time during physical education and 65% of the time during recess.

During physical education, participants with mental retardation were active 77% of the time, while during recess participants were active 35% of the time in LPA. However, MVPA levels were exhibited 23% of the time in physical education and 65% of the time in recess. The physical activity intensity levels for these participants were higher during recess than during physical education.
The difference found in physical activity intensity across settings supports the theoretical underpinnings (social cognitive theory) embedded within this study (Bandura, 1986). There are several differences within the two settings. Within the physical education setting, participants were not allowed to choose the type of activities to engage in, while in the recess setting, participants were allowed to choose their activities. A majority of the participants during recess chose high intensity activities like jumping rope and running and chasing other students. It is unclear as to why the participants chose these activities. However, it is speculated that these students enjoyed these activities because most students were laughing and smiling while doing them. Evans (1989), stated that choice is an integral aspect of the social cognitive theoretical framework. Moreover, within the physical education setting participants with mental retardation had limited space. However, in the recess setting these participants had ample space within which to move. The more open space that an individual has, the more likely that individual is able to engage in large sport activities such as touch football or soccer. The physical education setting was more conducive to sitting. Physical education consisted of a physical fitness unit where students sat listening to instructions, performing warm-up exercises, and recording partner PACER test scores. However, during the recess setting, students were more likely to stand than sit because they were not given instructions by their teacher that required that they be seated.

All physical education sessions occurred indoors while all recess sessions except one occurred outdoors. McKenzie et al. (1995) found that students engaged in outdoor physical activities were more active than those engaged in indoor lessons (42% as compared to 32%, respectively). Additionally, Pellegrini, Horvat, and Huberty (1998)
found that outdoor (unstructured) play activity resulted in more energy cost than indoor (unstructured) play activity. Self-efficacy, a major tenet within social cognitive theory may also have played a major role in the difference between the physical education and recess settings. Participants with mental retardation appeared more "confident" and "free" during the recess setting than in the physical education setting. This confidence or freedom could have been due to the fact that the participants with mental retardation did not wait for instructions as to what activities to do during recess, whereas during physical education these participants appeared to wait for the teacher's instructions or verbal encouragement to start or continue an activity.

Similarly to participants possessing low cardiorespiratory fitness, participants with mental retardation scored low on their PACER test indicating that they had similar cardiorespiratory fitness levels to participants with low cardiorespiratory fitness. Participants possessing low cardiorespiratory fitness and participants with mental retardation had average PACER test scores of 12.1 laps and 14.9 laps, respectively. These low levels of cardiorespiratory fitness could explain why participants with mental retardation were able to sustain higher intensity levels during recess (a shorter time period; 10-15 minutes) than during physical education (a longer time period; 20-30 minutes).

When comparing students with mental retardation during classroom, and both segregated and inclusive recess settings Horvat, Richards, and Franklin (2000) found significant differences. Segregated and inclusive recess settings when compared to the classroom setting resulted in higher activity counts and heart rates when using an unspecified observational instrument and heart rate monitoring. It is unclear if the
classroom setting for the students of the Horvat, et al. (2000) was a physical education setting or a regular classroom setting. However, overall findings of the Horvat et al. study are consistent with the findings of this study; that is, students with mental retardation were more active during recess than during a structured setting.

Research Question 3: Does the percentage of time engaged in physical activity intensity differ among elementary grade students with mental retardation as opposed to students without disabilities (possessing either high cardiorespiratory fitness or low cardiorespiratory fitness) during physical education?

ANOVA results for research question 3.

ANOVA results showed that groups were statistically significant on LPA, F (2, 43) = 12.85, p = .0001, and MVPA, F (2, 43) = 12.81, p = .0001 during physical education (see Tables 4.5 and 4.6, respectively). The value of omega squared was .34 for LPA and MVPA, revealing a moderate main effect size (Thomas & Nelson, 1996). Approximately 34% of the physical activity level variance can be attributed to the group variable.

Further analysis, using the Scheffe post hoc test revealed that participants possessing high cardiorespiratory fitness were engaged in LPA 71% of the time while participants possessing low cardiorespiratory fitness were engaged in LPA 79% of the time while participants with mental retardation were engaged 77% of the time. In addition, participants possessing high cardiorespiratory fitness had higher physical activity levels (28%) in MVPA than the participants possessing low cardiorespiratory fitness (21%) and participants with mental retardation (23%).

85
Table 4.5: ANOVA for LPA during Physical Education by Group

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>2</td>
<td>519.37</td>
<td>259.69</td>
<td>12.85</td>
<td>.0001</td>
</tr>
<tr>
<td>Error</td>
<td>43</td>
<td>869.03</td>
<td>20.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>1388.40</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.6: ANOVA for MVPA during Physical Education by Group

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>2</td>
<td>518.86</td>
<td>259.43</td>
<td>12.81</td>
<td>.0001</td>
</tr>
<tr>
<td>Error</td>
<td>43</td>
<td>871.13</td>
<td>20.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>1389.99</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discussion of results for research question 3.

The percentage of time engaged in physical activity according to intensity level differs among the three groups (high cardiorespiratory fitness group, low cardiorespiratory fitness group and mental retardation group) during physical education. This finding supports the assumption by Rimmer (1996) that individuals with mental
retardation are most similar to participants who are sedentary and have low
cardiorespiratory endurance levels.

Descriptive statistics show that for LPA (level 1: lying; level 2: sitting; and level
3: standing) participants in the low cardiorespiratory fitness group spent 79% of their
time exhibiting LPA, while participants with mental retardation spent 77% of their time
exhibiting LPA. Participants with high cardiorespiratory fitness spent 71% of their time
exhibiting LPA.

All participants spent less than 30% of their time exhibiting MVPA (level 4:
walking, level 5: very active). Participants in the high cardiorespiratory fitness group had
the highest MVPA (28%), while participants in the low cardiorespiratory fitness group
had the lowest MVPA (21%). Participants with mental retardation exhibited an average
of 23% of their time in MVPA. These percentages suggest that when participating in the
physical education setting, participants did not meet the Healthy People 2000 objective
that states students should be physically active at least 50% of the time during physical
education. Stanish and Mozzochi (2000) found similar physical activity levels for
children with and without developmental delays. Using the SOFIT instrument, Stanish
and Mozzochi found that during structured gross motor activity sessions MVPA was 33%
and LPA was 67% for both students with and without developmental delays. Lieberman,
Dunn, van der Mars, and McCubbin (2000) found that MVPA for Deaf students was 22%
prior to peer tutor intervention and 41.5% after trained peer tutor intervention. For the
trained peer tutors within the inclusive physical education setting, pre-intervention
MVPA was 19%, while post-intervention MVPA was 37.9%. 
MVPA percentages during physical education are also similar to the percentages found for academic learning time in physical education (ALT-PE) for students without disabilities 30% (Godbout, Brunelle, & Tousignant, 1983) and 32% (Metzler, 1979). ALT-PE rates for students with mental retardation in previous studies were calculated at 15.5% (Miller, 1985), 21.2% (Vogler, van der Mars, Darst, & Cusimano, 1990), and 43.9% (Aufderheide, 1983), respectively. Vogler, Koranda, and Romance (2000) found that ALT-PE rates were 41% for a kindergarten student with cerebral palsy, while the ALT-PE rates of students without disabilities ranged from 47% to 50%. Siedentop (1998) reported that overall, students spend approximately 27% of their physical education class time being physically active. It is important to note that ALT-PE measures in these studies related only to activity related to the subject matter content and did not consider physical activity intensity.

McKenzie, Sallis, and Nader (1991) found that students without disabilities in grades 3-5 spent 58% of their time engaged in MVPA during fitness lessons and 44% of their time engaged in MVPA during non-fitness lessons (e.g. game play, skill drills). Van der Mars, Darst, Vogler, Cusimano (1998) found that students spent 52% of their time engaged in MVPA during physical education. Percentages from these studies (58%, 44%, and 52%) are all higher than the ones reported in this study for participants without disabilities (28% for participants possessing high cardiorespiratory levels and 21% for participants possessing low cardiorespiratory levels). A majority of the lessons during this study were fitness oriented. According to van der Mars et al. (1998) and McKenzie et al. 1991, physical education fitness oriented lessons result in higher MVPA than other lessons that focus on skill or knowledge content. Fitness lessons resulted in higher
MVPA levels because students are more active and on-task due to the nature of the activity (i.e. jogging, jumping rope, walking), whereas during non-fitness lessons, students are more likely to be off task, standing, or waiting for a turn (i.e. relays, volleyball drills, game play). It is speculated that the participants in this study did not have higher physical activity levels during fitness lessons because these lessons related to fitness testing not simply fitness activities. During physical fitness testing, the students would complete sit-ups, pull-ups, and PACER tests while the other students would watch and record their scores. Therefore, the amount of time the students were active was reduced.

Research Question 4: Does the percentage of time engaged in physical activity intensity differ among elementary grade students with mental retardation as opposed to students without disabilities (possessing either high cardiorespiratory fitness or low cardiorespiratory fitness) during recess?

ANOVA results for research question 4.

ANOVA results revealed that these groups were not statistically significant for LPA, F (2, 27) = .33, p = .72 and MVPA, F (2, 27) = .41, p = .67 (see table 4.7 and 4.8). Descriptive statistics (see Table 4.3) showed that participants without disabilities possessing high cardiorespiratory fitness exhibited lower physical activity (28%) than participants without disabilities possessing low cardiorespiratory fitness and participants with mental retardation (35% and 35%, respectively). Participants possessing high cardiorespiratory fitness had a higher MVPA mean (72%) than the other two groups (participants possessing low cardiorespiratory fitness (65%) and participants with mental retardation (65%).

89
Table 4.7: ANOVA for LPA during Recess by Group

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>2</td>
<td>149.36</td>
<td>74.68</td>
<td>.33</td>
<td>.72</td>
</tr>
<tr>
<td>Error</td>
<td>27</td>
<td>6029.59</td>
<td>223.32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>6178.95</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.8: ANOVA for MVPA during Recess by Group

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>2</td>
<td>186.78</td>
<td>93.39</td>
<td>.41</td>
<td>.67</td>
</tr>
<tr>
<td>Error</td>
<td>27</td>
<td>6153.46</td>
<td>227.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>6340.24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discussion of results for research question 4.

According to the results of this study, the percentage of time engaged in physical activity according to intensity differs among the three groups of participants (high cardiorespiratory fitness, low cardiorespiratory fitness and mental retardation) during recess. Participants possessing low cardiorespiratory fitness and participants with mental retardation spent the same percentage of time engaged in LPA (35%) and MVPA (65%).
Participants possessing high cardiorespiratory fitness spent 28% of their time in LPA and 72% of their time in MVPA during recess. Identical physical activity intensities for participants with mental retardation and participants possessing low cardiorespiratory fitness supports the notion that individuals with mental retardation are most similar to participants who do not have disabilities and who are sedentary or have low cardiorespiratory endurance levels (Eichstaedt & Lavay, 1992; Rimmer, 1996; Winnick & Short, 1999). In addition, participants possessing low cardiorespiratory fitness had an average PACER test score of 12.1 laps while students with mental retardation had an average PACER test score of 14.9 laps. As a result, participants with mental retardation are similar to students possessing low cardiorespiratory fitness. (The students possessing high cardiorespiratory fitness had an average PACER test score of 40.0 laps.)

Lorenzi, Horvat, and Pellegrini (1999) found no differences in activity levels of elementary children with and without mental retardation during recess when physical activity was measured using an observational checklist. This finding is consistent with findings of this study (LPA, F (2, 27) = .33, p = .72 and MVPA, F (2, 27) = .41, p = .67) related to the three groups of participants (high cardiorespiratory fitness, low cardiorespiratory fitness and mental retardation).

Physical activity levels during recess of approximately 50% and higher, have been found within the literature. Ernst and Hill (2000) found MVPA to range from 31% (for students during regular unstructured recess) to 52% (for students during structured recess). Sleap and Wartburon (1992) found that students were engaged in MVPA 48% of the time during recess. Also during recess, Hovell, Bursick, Sharkey, and McClure (1978) found moderate physical activity intensity to be 60% for elementary students. All
the participants for these studies have been individuals without disabilities. Moreover, none of these studies identified the cardiorespiratory level of their participants.

A review of the literature revealed only one study that observed students with disabilities during recess (Horvat et al. 2000). These authors did not report the physical activity level percentages during recess but simply stated that “...we were able to quantify activity levels for children with mental retardation during play and recess” (Horvat et al. 2000, A-108).

Lesson context results and discussion

In order to provide a more meaningful description relative to the results of this study, descriptive data were used for lesson context within physical education. Based on videotape analysis of all teaching episodes using the SOFIT instrument, lesson context for all participants (high cardiorespiratory fitness, low cardiorespiratory fitness, and mental retardation) was similar. As seen in Table 4.9, a majority of the lesson context was fitness (46.4%, 41.2%, and 43.8%) and physical fitness knowledge (31.7%, 37.1%, and 41.1%), for the participants possessing high cardiorespiratory fitness, low cardiorespiratory fitness, and mental retardation, respectively. The fitness category refers to lesson context that is related to activities with the purpose of improving an individual's cardiovascular endurance, muscular strength, or flexibility. In this study, the main fitness activities seen during videotaped analysis were warm-up exercises, fitness testing, and jogging. The physical fitness knowledge that occurred during the lessons related to pacing strategies and knowledge related to fitness concepts. It is vital to note that a majority of the lessons during this study were related to physical fitness testing. During physical fitness testing, the students completed sit-ups, pull-ups, skinfold measurements,
<table>
<thead>
<tr>
<th>Category</th>
<th>HCRF Group n=19</th>
<th>LCRF Group n=19</th>
<th>MR Group n=8</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Content</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>17.9</td>
<td>17.8</td>
<td>14.8</td>
</tr>
<tr>
<td>SD</td>
<td>22.1</td>
<td>21.5</td>
<td>18.6</td>
</tr>
<tr>
<td>Physical Fitness Knowledge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>31.7</td>
<td>37.1</td>
<td>41.1</td>
</tr>
<tr>
<td>SD</td>
<td>22.5</td>
<td>24.1</td>
<td>23.7</td>
</tr>
<tr>
<td>General Knowledge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.4</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>SD</td>
<td>3.3</td>
<td>0.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Fitness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>46.4</td>
<td>41.2</td>
<td>43.8</td>
</tr>
<tr>
<td>SD</td>
<td>19.3</td>
<td>16.5</td>
<td>21.4</td>
</tr>
<tr>
<td>Skill Practice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>SD</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Game Play</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>2.8</td>
<td>3.8</td>
<td>1.3</td>
</tr>
<tr>
<td>SD</td>
<td>9.4</td>
<td>11.8</td>
<td>8.3</td>
</tr>
</tbody>
</table>

**Note.** HCRF=High Cardiorespiratory Fitness; LCRF=Low Cardiorespiratory Fitness; MR =Mental Retardation, and SD=Standard Deviation.

Table 4.9: Mean Percentage of Lesson Context Categories
and PACER testing. While students participated in PACER testing, other students would sit, watch, and record the scores of their partners. Therefore, there was a great deal of sitting when the students were not being tested. In addition, prior to beginning physical fitness testing for each class session, students would sit on the floor and complete stretching exercises and listen to instructions for the day's lesson.

The least amount of lesson context knowledge was spent in skill practice (all percentages were 0), game play (mean percentages less than 3.8), and general knowledge (mean percentages less than 1) for all participant groups. Skill practice relates to activities that develop skill in a particular sport or activity. Game play involves activities used for the application of skills in a competitive or game-like situation. The low levels of skill practice, game play, and general knowledge are not surprising because during physical fitness testing there is usually not a skill or game component meaning taught. General knowledge relates to information that pertains to history, rules, or techniques that are not related to fitness. The formerly mentioned categories (skill practice, game play, and general knowledge) had very low percentages or in the case of skill practice was nonexistent.

Teacher behaviors results and discussion

Descriptive interpretation of teacher behaviors for all grades was determined during physical education. Teachers spent a majority of their time promoting fitness (72.6%, 73.4%, and 82.2%) for participants with high cardiorespiratory fitness, low cardiorespiratory fitness, and mental retardation, respectively. Within the promoting fitness category, the teacher encouraged or prompted participants to complete fitness related skills or activities. The high percentages in the promoting fitness category are
appropriate because teachers were prompting students who were completing their physical fitness testing. These prompts included feedback while completing sit-ups, pull-ups, and the PACER test. As revealed in Table 4.10, demonstrating fitness and providing instructions resulted in percentages less than 1 for both categories. Within the demonstrating fitness category, the teacher normally modeled fitness participation behaviors prior to or during a fitness activity. The providing instructions category refers to feedback, descriptions, lectures, or prompts provided by the teacher related to general physical education content not related to fitness engagement. Since the teacher was performing physical fitness testing, there was limited opportunity to demonstrate fitness or discuss instructions related to non-fitness content.

Summary

This chapter focused on the results and discussion of the study. Interobserver agreement for this study ranged between 82%-100% with a mean of 94.4%. Preliminary grade and gender analyses ruled out grade level and gender differences. As a result, these variables were not included in subsequent analyses. The results of each research questions was addressed and then discussed.

Research question 1 answered the following question: Is the SOFIT instrument a valid instrument for measuring physical activity engagement for students with mental retardation? The SOFIT instrument was found to be a valid instrument for measuring physical activity engagement for participants with mental retardation. Combined recess and physical education heart rate and SOFIT data revealed significant correlations (ranging from $r = .72$ to $r = .89$) for all 8 participants with mental retardation.
<table>
<thead>
<tr>
<th></th>
<th>HCRF Group n=19</th>
<th>LCRF Group n=19</th>
<th>MR Group n=8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Promotes Fitness</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>72.6</td>
<td>73.4</td>
<td>82.2</td>
</tr>
<tr>
<td>SD</td>
<td>29.2</td>
<td>28.5</td>
<td>23.7</td>
</tr>
<tr>
<td><strong>Demonstrates Fitness</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0</td>
<td>.1</td>
<td>.1</td>
</tr>
<tr>
<td>SD</td>
<td>.5</td>
<td>.7</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Instructs Generally</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>.1</td>
<td>.1</td>
<td>0</td>
</tr>
<tr>
<td>SD</td>
<td>.5</td>
<td>.5</td>
<td>0</td>
</tr>
<tr>
<td><strong>Manages</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>18.0</td>
<td>17.6</td>
<td>12.7</td>
</tr>
<tr>
<td>SD</td>
<td>22.3</td>
<td>21.5</td>
<td>16.6</td>
</tr>
<tr>
<td><strong>Observes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>9.3</td>
<td>8.9</td>
<td>3.8</td>
</tr>
<tr>
<td>SD</td>
<td>15.7</td>
<td>15.8</td>
<td>13.8</td>
</tr>
</tbody>
</table>

Note. HCRF=High Cardiorespiratory Fitness; LCRF=Low Cardiorespiratory Fitness; MR =Mental Retardation, and SD=Standard Deviation.

Table 4.10: Mean Percentage of Teacher Behaviors

96
Research question 2 answered the following question: Does the percentage of time engaged in physical activity intensity differ during physical education as opposed to recess for elementary students without disabilities who possess high cardiorespiratory fitness, students without disabilities who possess low cardiorespiratory fitness, and students with mental retardation? The percentage of time engaged in physical activity is different during physical education and recess for participants possessing high cardiorespiratory fitness, participants possessing low cardiorespiratory fitness, and participants with mental retardation. There was a significant difference in physical activity across physical education and recess settings. Participants were more active during recess than physical education. For all three groups, their MVPA during recess ranged from 65% to 72%, while their MVPA during physical education ranged from 21% to 28%.

Research question 3 answered the following question: Does the percentage of time engaged in physical activity intensity differ among elementary grade students with mental retardation as opposed to students without disabilities (possessing either high cardiorespiratory fitness or low cardiorespiratory fitness) during physical education? There was a significant difference in physical activity intensity during physical education across groups. The percentage of time engaged in physical activity does differ among the three participant groups (high cardiorespiratory fitness, low cardiorespiratory fitness, and mental retardation) during physical education. During physical education the participants possessing high cardiorespiratory fitness were more active (28%) at the MVPA intensity during physical education than either the participants possessing low cardiorespiratory fitness (21%) or participants with mental retardation (23%).
Research question 4 answered the following question: Does the percentage of time engaged in physical activity intensity differ among elementary grade students with mental retardation as opposed to students without disabilities (possessing either high cardiorespiratory fitness or low cardiorespiratory fitness) during recess? During recess the participants possessing high cardiorespiratory fitness were more active at the MVPA intensity (72%) during recess than participants in the other two groups [low cardiorespiratory (65%) and mental retardation (65%)]. However, these differences were not significant.

The last section discussed in this chapter related to lesson context and teacher behavior data. A majority of the time spent during the physical education lessons were fitness and physical fitness knowledge related, while the least amount of time spent was related to skill practice and game play. Teacher behavior data revealed that teachers spent most of their time promoting fitness and the least amount of their time demonstrating fitness.
SUMMARY/CONCLUSIONS/RECOMMENDATIONS

Chapter five is comprised of three main sections. First, a summary of the study is provided. Second, conclusions related to the findings of this research are presented. Finally, recommendations for future research studies are given.

Summary

The release of the document Physical Activity and Health: A Report of the Surgeon General, (USDHHS, 1996) stated the importance of daily, moderate physical activity. It stated that moderate and short periods of physical activity (e.g. school recess) can produce substantial health benefits. The school setting is a key location for providing opportunities for students to engage in physical activity (COPEC, 1998). Students with and without disabilities can benefit from physical activity within the school setting (USDHHS, 1996). Historically, when examining physical activity within a physical education setting, Academic Learning Time in Physical Education (ALT-PE) has been used (McKenzie, Sallis, & Nader, 1991). ALT-PE relates to the amount of time during physical education that a student spends actively engaged in relevant motor tasks and responding at a high rate of success (Metzler, 1983). ALT-PE does not measure the intensity level of activity it measures the quality of the activity. Therefore, ALT-PE
would not be appropriate for measuring physical activity intensities of students with and without disabilities.

Several methods have been used to measure physical activity within the literature (Klesges & Klesges, 1987). Calorimetry (measuring body heat to determine physical activity), pedometers (measuring vertical movement to determine physical activity), electronic monitors (measuring body movement to determine physical activity), and accelerometers (measuring body acceleration and energy expenditure to determine physical activity) are all methods used to determine physical activity (Ainsworth, Montoye & Leon, 1994; Blair, 1984; Freedson, 1991; Hatano, 1993; and Hensley, Ainsworth, & Ansorge, 1993). The SOFIT instrument is a behavioral instrument that is currently being widely used to determine physical activity levels of students within the school context (McKenzie, 1991, 1997). This instrument was chosen as the most appropriate instrument to determine the physical activity levels of participants within this study.

The purpose of this study was to compare low physical activity (LPA) and moderate to vigorous physical activity (MVPA) of elementary students possessing high cardiorespiratory fitness, students possessing low cardiorespiratory fitness, and students with mental retardation during physical education and recess. The System for Observing Fitness Instruction Time (SOFIT) instrument was used to determine physical activity level. In addition to determining physical activity intensity levels, the SOFIT instrument was also used to ascertain lesson context and teacher behaviors during physical education. The SOFIT instrument has been validated on students without disabilities. This study validated the instrument for use with students possessing mental retardation.
The theoretical framework for this study was based on social cognitive theory (Bandura, 1986). The underlying premise of this theory is that behavior is affected by both environment and personal factors. Within this study, the two environments examined were physical education and recess. Further, personal factors such as cardiorespiratory fitness level and body composition were used in this study.

Participants for this study were from an eastern North Carolina rural elementary school in grades third, fourth, and fifth. There were 19 students possessing high cardiorespiratory fitness, 19 students possessing low cardiorespiratory fitness, and 8 students with mental retardation. Participants with mental retardation had IQs ranging from 45 to 70 (mean = 58, SD = 7.99). Each participant was observed and videotaped during physical education for 5 to 8 sessions for a duration of at least 30 minutes and during recess for at 2 to 5 sessions for a duration of at least 10 minutes. A 3 (group) X 2 (physical activity setting) ANOVA was employed. In addition, ANOVAs was used to determine significant differences among the three groups during physical education and a second ANOVA was also performed on the recess data. In order to enhance physical activity data and provide a contextual picture of the physical education environment, lesson context and teacher behaviors were also coded. The dependent variables were percentage of engagement in LPA and MVPA. Categories one (lying), two (sitting), and three (standing) were aggregated to calculate LPA. To determine MVPA, categories four (walking) and five (very active) were summed.

Data were analyzed using both descriptive and inferential methods. Descriptive statistics included mean percentages, standard deviations, ranges, and correlations. The correlational analyses were used to determine concurrent validity using heart rates and
SOFIT data of the participants with mental retardation. A significance level of .05 was set for statistical purposes and Scheffe post hoc tests were used as a follow-up to significant main effects. Effect sizes were calculated to determine additional meaningfulness of the data relative to the amount of variance attributed to the independent variable disregarding sample size. Interobserver agreement for this study ranged between 82%-100% with a mean of 94.4%. Preliminary grade level and gender analyses were not significant and therefore these variables were not used in subsequent analysis.

Research question 1 answered the following question: Is the SOFIT instrument a valid instrument for measuring physical activity engagement for students with mental retardation? The SOFIT instrument was found to be a valid instrument for measuring physical activity engagement for participants with mental retardation. Concurrent validity was established by correlating heart rates with SOFIT activity levels. Combined recess and physical education data revealed significant correlations (ranging from $r = .72$ to $r = .89$) for all eight participants with mental retardation. SOFIT has found to be valid for students without disabilities (McKenzie et al., 1991; Rowe, Schuldheisz, & van der Mars, 1991); therefore, it is not surprising that it is also valid for students with mental retardation, since all participants with mental retardation had no physical disabilities preventing them from performing the activities specified on the SOFIT instrument.

Research question 2 answered the following question: Does the percentage of time engaged in physical activity intensity differ during physical education as opposed to recess for elementary students without disabilities who possess high cardiorespiratory fitness, students without disabilities who possess low cardiorespiratory fitness, and
students with mental retardation? ANOVA results revealed a significant difference
across settings for LPA, $F(1, 70) = 299.28, p = .0001$, and MVPA, $F(1, 70) = 296.52,$
$p = .0001$; therefore showing that the percentage of time engaged in physical activity is
different during physical education as opposed to recess for participants possessing high
cardiorespiratory fitness, participants possessing low cardiorespiratory fitness, and
participants with mental retardation. Scheffe post hoc test results further showed that
participants were more active during recess than in physical education. For all three
participant groups, MVPA during recess ranged from 65% to 72%, while MVPA during
physical education ranged from 21% to 28%. According to the omega squared results,
74% of the variance can be explained for physical activity levels as being attributed to the
setting. There was not a main effect for LPA and MVPA for groups, nor were there
significant interaction effects across group and setting. These findings support other
studies showing that students are more active during recess than during physical
education (Horvat, Richards, & Franklin, 2000; Sarkin, McKenzie, & Sallis, 1997).

Research question 3 answered the following question: Does the percentage of
time engaged in physical activity intensity differ among elementary grade students with
mental retardation as opposed to students without disabilities (possessing either high
cardiorespiratory fitness or low cardiorespiratory fitness) during physical education?
Groups were significantly different on LPA, $F(2, 43) = 12.85, p = .0001$, and MVPA, $F$
$(2, 43) = 12.81, p = .0001$ during physical education. The percentage of time engaged in
physical activity differs among the three participant groups (high cardiorespiratory fitness
group, low cardiorespiratory fitness group, and mental retardation group) during physical
education. During physical education the participants possessing high cardiorespiratory
fitness were more active (28%) at the MVPA intensity level during physical education than the participants possessing low cardiorespiratory fitness (21%), as well as the participants with mental retardation (23%). The value of omega squared was .34 for LPA and MVPA, which revealed a moderate main effect (Thomas & Nelson, 1996). The MVPA amounts for this study are somewhat lower than percentages found within other studies. For example, McKenzie, Sallis, and Nader (1991) found that students without disabilities spent 58% of their time engaged in MVPA. Stanish and Mozzochi (2000) found MVPA percentages to average 33% during structured physical activity sessions.

Research question 4 answered the following question: Does the percentage of time engaged in physical activity intensity differ among elementary grade students with mental retardation as opposed to students without disabilities (possessing either high cardiorespiratory fitness or low cardiorespiratory fitness) during recess? There was not a statistically significant difference across groups during recess sessions; however, the participants possessing high cardiorespiratory fitness were more active at the MVPA intensity level (72%) during recess than participants of the other two groups (low cardiorespiratory group - 65% and mental retardation - 65%). Lorenzi, Horvat, and Pellegrini (1999) also found no difference in the MVPA intensity levels of elementary children with and without mental retardation during recess. The MVPA intensity level of elementary students during a study by Hovell, Bursick, Sharkey, and McClure (1978) was 60%; also revealing high levels of physical activity with the recess setting at the MVPA intensity.

A majority of the time spent during the physical education lessons were fitness and physical fitness knowledge, while the least amount of time spent was related to skill
practice and game play. McKenzie et al. (1991) found that lessons that spend a majority of time on fitness usually result in participants exhibiting higher levels of MVPA. These authors found MVPA to be 36% during fitness lessons and 22% during non-fitness lessons in a physical education setting. Teacher behavior data revealed that teachers spent most of their time promoting fitness and the least amount of their time demonstrating fitness. Faison-Hodge (1998) found that when teachers demonstrated fitness, the MVPA level was greater than 50%.

Conclusions

Based on the findings of this study, six conclusions are presented. These conclusions are applicable for physical education teachers who teach students with mental retardation in inclusive physical education and recess settings:

1. The SOFIT instrument can be used to measure physical activity levels of students with mild mental retardation, since it possesses concurrent validity for these students.

2. When measuring physical activity at a moderate to vigorous level, students with mild mental retardation are more like their same age peers with low cardiorespiratory fitness.

3. Students with mental retardation are more active during recess than during physical education.

4. Students who have a high body mass index (i.e. are overweight) are more likely to exhibit low physical activity levels during moderate to vigorous physical activity. These students are also more likely to have low cardiorespiratory levels.

5. During physical education lessons, despite the fact that students spent most of the time doing fitness related activities and teachers spent most of their time promoting fitness, physical activity levels of students were not moderate to vigorous a majority of the time.
6. The social cognitive theory is an appropriate theoretical framework for this study and other studies related to physical activity for students with varying cardiorespiratory fitness levels and students with mental retardation.

**Recommendations**

Recommendations for further research are as follows:

1. The methodology of this study should be replicated using participants from other geographic locations and in urban and suburban settings.

2. Research combining qualitative and quantitative methodology should be conducted by incorporating the self-efficacy component of the social cognitive theory for various populations.

3. A follow-up study should be conducted using the same participants during their secondary physical education experiences.

4. The SOFIT instrument should be validated for use with other populations with disabilities such as individuals with severe mental retardation, deafness, visual impairments, and orthopedic impairments.

5. More research is needed to determine the relationship among cardiorespiratory fitness levels, body mass index values (overweight or obesity) and physical activity levels.

6. More in-depth examination of context setting as it relates to physical activity should be completed.

7. When using SOFIT to determine physical activity levels, the five levels of student activity should be analyzed as independent levels not combined levels (moderate to vigorous physical activity levels and low physical activity levels).
References


110


112


APPENDIX A

GYMNASIUM AREA
APPENDIX B

PATIO RECESS AREA
APPENDIX C

PLAYGROUND RECESS AREA
APPENDIX D

SYSTEM FOR OBSERVING FITNESS INSTRUCTION TIME
(SOFIT)
APPENDIX E

HUMAN SUBJECTS INSTITUTIONAL REVIEW BOARD APPROVAL
Research Involving Human Subjects

ACTION OF THE INSTITUTIONAL REVIEW BOARD

With regard to the employment of human subjects in the proposed research protocol:

99B0253  PHYSICAL ACTIVITY LEVELS OF ELEMENTARY STUDENTS DURING PHYSICAL
EDUCATION AND RECESS. David Porretta, Jennifer F. Hodge, Physical Activity & Educational
Services

THE BEHAVIORAL AND SOCIAL SCIENCES HUMAN SUBJECTS IRB HAS TAKEN THE FOLLOWING ACTION:

X APPROVED  DISAPPROVED

APPROVED WITH CONDITIONS  WAIVER OF WRITTEN CONSENT GRANTED

It is the responsibility of the principal investigator to retain a copy of each signed consent form for at least three (3) years beyond the termination of the subject's participation in the proposed activity. Should the principal investigator leave the University, signed consent forms are to be transferred to the Human Subjects IRB for the required retention period. This application has been approved for the period of one year. You are reminded that you must promptly report any problems to the IRB, and that no procedural changes may be made without prior review and approval. You are also reminded that the identity of the research participants must be kept confidential.

Date: April 14, 2000

Signed: [Signature]

(Chairperson)
APPENDIX F

BOARD OF EDUCATION APPROVAL LETTER
Mrs. Jennifer Faison Hodge  
2495 West NC 44  
Warsaw, NC 28398

Dear Jennifer:

The Duplin County Board of Education approved your request to conduct a research project at Warsaw Elementary School. Please communicate with Pat Mathis, Principal, your goals and objectives for this project. The Board understands that no videotaping of students would be done without prior approval of the parents.

Good luck and best wishes in this part of your doctoral work.

Sincerely,

Tommy Benson, Ed. D
Assistant Superintendent

Cc: Mr. Pat Mathis, Principal
APPENDIX G

PRINCIPAL LETTER OF SUPPORT

AND

TEACHER LETTER OF SUPPORT
June 09, 1999

Dr. Paul Jansma
The Ohio State University
215 Pomerene Hall
Columbus, OH 43210

Dear Dr. Jansma:

It is with pleasure that I write this letter of support for the dissertation research entitled, "A comparison of physical activity levels of third grade students with and without mild mental retardation across inclusive physical education and recess settings". The principal, Pat Mathis has given me the responsibility of reviewing the aspects related to the research which Jennifer Hodge will be conducting in our school. After talking with Mrs. Hodge and carefully reviewing her research prospectus I am very proud to be a part of this research.

Your research related to physical activity comes at a crucial time in our physical education profession. I know that the findings of your research will be beneficial to my programming as the physical education teacher here at Warsaw Elementary.

The principal and I are in support of your research and we look forward to working with Mrs. Hodge during the data collection period when she will be at Warsaw Elementary. If you need further assistance, please feel free to contact me.

Sincerely,

Connie Mathis
Physical Education Teacher
Dear Jennifer,

I am grateful that you have always managed to keep in touch with your home-town schools since you have married and moved to Ohio to continue your education. I am so happy for you that you are now ready to do your research for your dissertation. As the principal, Pat Mathis, affirmed, we are delighted to be a part of your data collection for your dissertation. As Mr. Mathis told you, the only requirement we have is for all of your research to be shared with us in order for us to evaluate our program. We are always anxious to learn and find ways to improve and feel your research will be an opportunity for us to find ways to help the children that we teach.

As you prepare to come to Warsaw, please let me know if there is anything I need to do in advance so that you will be successful in collecting the data that you need. I am excited about your work and appreciate the opportunity to participate with my students.

Sincerely,

Connie Mathis
APPENDIX H

PARENTAL CONSENT LETTER
Dear Parent,

I am Jennifer Faison-Hodge, a doctoral student in adapted physical education at The Ohio State University (OSU). Dr. Paul Jansma is my advisor. The purpose of this letter is to seek consent to have your child participate in a research study entitled “Physical activity levels of elementary students during physical education and recess.” The purpose of the study is to determine how physically active your child is during physical education and recess.

Your child will be videotaped during physical education and recess and the amount of physical activity engagement will be determined by using an observational instrument called the System for Observing Fitness Instruction Time (SOFIT). From the videotape, your child will be observed and their physical activity level will be recorded as 1, 2, 3, 4, or 5. One means that your child was lying, 2 that your child was sitting, 3 that your child was standing, 4 that your child was walking, and 5 that your child was very active during the observation period (see attached SOFIT instrument). Two other graduate students from OSU will assist with analysis of the data after the videotaping has been done. Pedometers or step counters will also be used to determine the number of steps taken by your child during physical education and recess (see attached picture of step counter). In addition, heart rate monitors will also be used to determine your child’s heart rate during PE and recess (see attached picture of heart monitor).

Your child will NOT be asked to do any additional activity during physical education class or recess. Your child will be videotaped during physical education and recess beginning on July 26, 1999 and ending August 20, 1999. In addition, your child will wear a step counter so that they can record the number of steps taken during physical education and recess. The step counter is an instrument that is worn like a beeper. Your child will only wear the step counter during physical education for no longer than 10 minutes and during recess for no longer than 10 minutes per day. During this timeframe, your child will also wear a heart rate monitor so that his/her heartbeats can be counted while being active. Also a watch that is a data receiver that receives information from the heart rate monitor will be worn. The videotapes will be secured and maintained confidentially. At the completion of the dissertation, which is no more than 2 years, the tapes will be destroyed by extracting the internal tape. Further, your child’s name will not be associated with the research.

Jennifer Faison-Hodge
Your permission will assist in obtaining information that will allow physical educators to evaluate their instruction, improve their teaching, and will help assess physical activity levels of students in different settings that will help to program for your child’s physical activity needs. After reading this letter, if you consent to have your child participate in this research study, please complete the Consent Form for permission to include your child in this research study and return it to your child’s teacher. Also please know that your child can withdraw from this project at any time without penalty. If you have questions or concerns please feel free to contact me by telephone or in person!

Sincerely yours,

Jennifer Faison Hodge
Dr. Paul Jansma, advisor
2495 West NC 24
Wonsaw, NC 28398
(910) 293-7494 (home)

(614) 292-3854
jansma.2@osu.edu
APPENDIX I

CONSENT FORM
CONSENT FORM

I consent to allowing my child, ____________________________________________

to participate in the research entitled: "Physical activity levels of elementary students
during physical education and recess" by Jennifer Faison-Hodge and Dr. Paul Jansma.

I have read the attached letter and understand the purpose of the research. I
further understand the procedures to be followed and the expected duration of my child's
participation. The importance of the study for my child and others like my child has been
explained. The benefits of this study have been satisfactorily described to me as well.

I acknowledge that I have had the opportunity to obtain additional information
regarding the study and that any questions I may have raised were answered to my full
satisfaction. Furthermore, I understand that my child and I are free to withdraw consent
at any time and to discontinue participation in the study without prejudice to my child.

Finally, my signature acknowledges that I have read and fully understand the
consent form. I sign it freely and voluntarily. A copy of this form as well as results of
the research study will be given to me if requested.

Signed: _________________________________________________________________
(Parent or Guardian)  Date: __________________

Reviewed:

(Parent or Guardian)

(People's Investigator)

(Doctoral Student Investigator)
APPENDIX J

SOFIT CODER TRAINING EVALUATION

AND

ANSWER KEY
Section I: Answer the following questions.

1. List the 5 categories of student activity engagement levels according to the SOFIT manual.
   
   Level 1: _______________
   
   Level 2: _______________
   
   Level 3: _______________
   
   Level 4: _______________
   
   Level 5: _______________

2. The _________ the code or level of the student, the higher the student's rate of energy expenditure or activity level. (lower, higher)

3. The standard recording format used for SOFIT coding is _____-second observe/ _____-second record.

4. When coding the activity level/body position and lesson context of a target student a _______________ is used. (partial interval recording format/ momentary time sampling format/ placecheck recording format)

5. True or False. Student activity level is coded at the end of the observe interval.

6. True or False. The highest activity level code is recorded for any activity in which the student is expending more energy than he/she would during ordinary walking and does not consider body position only.

7. True or False. When a student is transitioning from one activity to another, the code that should be entered is the lower category code.
Section II: Read each example and determine the activity level. Write the activity level code number in the space provided. (Please note that #15 refers to unit taught!).

ACTIVITY CODE (1, 2, 3, 4, or 5)

8. _____ student is running
9. _____ student is skipping
10._____ student is sitting on a mat
11._____ student is kneeling on a mat
12._____ student is sitting on bleachers
13._____ student is going to get a drink of water
14._____ student is changing from sitting on mat to walking to next station
15._____ student is wrestling with a classmate and is lying on back
16._____ student is pedaling a stationary bicycle
17._____ student is in a standing in circle during flexibility exercises
18._____ student is sitting on the floor during relay activities
19._____ student is goalie and is standing in front of the goal
20._____ student is jumping rope
21._____ student is partially lying down and partially sitting up
22._____ student is jumping on a trampoline
23._____ student is in outfield waiting for the softball to be hit
24._____ student is sitting on a scooter and moving during a relay
25._____ student is fast walking around the gym

Number Correct: _____/25         Total score: ________%

141
Answer Key

(1) Level 1: lying down  Level 2: sitting
     Level 3: standing  Level 4: walking
     Level 5: very active
(2) higher
(3) 10/10
(4) momentary time sampling format
(5) True
(6) True
(7) False
(8) 5
(9) 5
(10) 2
(11) 2
(12) 2
(13) 4
(14) 4
(15) 5
(16) 5
(17) 3
(18) 2
(19) 3
(20) 5
(21) 2
(22) 5
(23) 3
(24) 5
(25) 5
APPENDIX K

DECISION LOG
Decision Log

1. Record the activity level at the end of each 10-second interval.

2. If the activity level is the same in the next interval, still code that activity level.

3. If a student is out of the camera's view during an interval, do not code that interval, unless a verbal statement is given when the student is not seen.

4. If a student is in transition from one activity to another, that is coded as activity.

5. If the student is between categories, code the higher category (e.g., student is going from lying down to sitting).

6. Code students who are standing and doing stretching or flexibility exercises as standing (code 3) because the energy expenditure is within the standing category range.

7. Code students who are sitting and doing stretching exercises or arm circles as a sitting (code 2) because the energy expenditure is within the sitting category range.

8. Sit-ups and pushups should be coded as walking (code 4) because the energy expenditure is within the walking category range.

9. Stationary inverted isometric exercises should be coded as standing (code 3) because the energy expenditure is within the standing category range.

Note: The decision log will be in the coders' possession while he or she is coding from the videotape.
APPENDIX L

TRANSMITTER, ELASTIC BELT, AND

POLAR VANTAGE XL HEART RATE MONITOR
APPENDIX M

POLAR DOWNLOADING INTERFACE
APPENDIX N

RAW PHYSICAL ACTIVITY DATA
<table>
<thead>
<tr>
<th>ID</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Session 5</th>
<th>Session 6</th>
<th>Session 7</th>
<th>Session 8</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45.5</td>
<td>13.3</td>
<td>15.6</td>
<td>22.3</td>
<td>22.6</td>
<td>23.9</td>
<td>12.8</td>
<td>23.9</td>
<td>12.8</td>
<td>150</td>
</tr>
<tr>
<td>2</td>
<td>32.2</td>
<td>25.6</td>
<td>26.6</td>
<td>23.4</td>
<td>36.7</td>
<td>28.9</td>
<td>5.4</td>
<td>28.9</td>
<td>5.4</td>
<td>16.2</td>
</tr>
<tr>
<td>3</td>
<td>38.1</td>
<td>24.4</td>
<td>28.9</td>
<td>31.2</td>
<td>34.4</td>
<td>30.4</td>
<td>5.2</td>
<td>30.4</td>
<td>5.2</td>
<td>16.2</td>
</tr>
<tr>
<td>4</td>
<td>34.6</td>
<td>25.5</td>
<td>31.1</td>
<td>22.3</td>
<td>16.6</td>
<td>26.0</td>
<td>7.1</td>
<td>26.0</td>
<td>7.1</td>
<td>15.4</td>
</tr>
<tr>
<td>5</td>
<td>42.3</td>
<td>31.1</td>
<td>4.0</td>
<td>25.3</td>
<td>16.7</td>
<td>22.5</td>
<td>13.4</td>
<td>22.5</td>
<td>13.4</td>
<td>15.4</td>
</tr>
<tr>
<td>6</td>
<td>44.4</td>
<td>25.6</td>
<td>13.3</td>
<td>25.6</td>
<td>22.6</td>
<td>26.3</td>
<td>11.3</td>
<td>26.3</td>
<td>11.3</td>
<td>15.4</td>
</tr>
<tr>
<td>7</td>
<td>38.1</td>
<td>26.7</td>
<td>33.3</td>
<td>14.5</td>
<td>18.9</td>
<td>24.5</td>
<td>8.8</td>
<td>24.5</td>
<td>8.8</td>
<td>16.2</td>
</tr>
<tr>
<td>17</td>
<td>30.1</td>
<td>56.2</td>
<td>0.0</td>
<td>33.3</td>
<td>30.0</td>
<td>17.3</td>
<td>18.6</td>
<td>17.3</td>
<td>18.6</td>
<td>10.9</td>
</tr>
<tr>
<td>18</td>
<td>32.3</td>
<td>52.1</td>
<td>20.0</td>
<td>18.9</td>
<td>23.3</td>
<td>28.9</td>
<td>15.4</td>
<td>28.9</td>
<td>15.4</td>
<td>11.3</td>
</tr>
<tr>
<td>19</td>
<td>37.5</td>
<td>58.3</td>
<td>23.3</td>
<td>5.7</td>
<td>30.0</td>
<td>57.3</td>
<td>33.4</td>
<td>57.3</td>
<td>33.4</td>
<td>16.2</td>
</tr>
<tr>
<td>20</td>
<td>20.0</td>
<td>15.6</td>
<td>24.5</td>
<td>1.1</td>
<td>50.0</td>
<td>19.4</td>
<td>16.0</td>
<td>19.4</td>
<td>16.0</td>
<td>10.9</td>
</tr>
<tr>
<td>21</td>
<td>21.4</td>
<td>62.7</td>
<td>36.7</td>
<td>17.8</td>
<td>12.0</td>
<td>0.0</td>
<td>24.7</td>
<td>0.0</td>
<td>24.7</td>
<td>15.4</td>
</tr>
<tr>
<td>22</td>
<td>49.0</td>
<td>61.5</td>
<td>2.2</td>
<td>9.1</td>
<td>23.4</td>
<td>12.2</td>
<td>23.6</td>
<td>12.2</td>
<td>23.6</td>
<td>10.9</td>
</tr>
<tr>
<td>23</td>
<td>46.7</td>
<td>40.0</td>
<td>46.7</td>
<td>40.0</td>
<td>10.3</td>
<td>21.3</td>
<td>34.6</td>
<td>21.3</td>
<td>34.6</td>
<td>16.2</td>
</tr>
<tr>
<td>34</td>
<td>20.9</td>
<td>42.7</td>
<td>0.0</td>
<td>62.7</td>
<td>17.2</td>
<td>40.0</td>
<td>34.0</td>
<td>40.0</td>
<td>34.0</td>
<td>15.4</td>
</tr>
<tr>
<td>35</td>
<td>50.0</td>
<td>36.0</td>
<td>6.7</td>
<td>41.1</td>
<td>50.7</td>
<td>28.9</td>
<td>34.4</td>
<td>50.7</td>
<td>34.4</td>
<td>16.2</td>
</tr>
<tr>
<td>36</td>
<td>12.5</td>
<td>43.8</td>
<td>35.6</td>
<td>21.3</td>
<td>24.1</td>
<td>35.6</td>
<td>11.4</td>
<td>35.6</td>
<td>11.4</td>
<td>15.4</td>
</tr>
<tr>
<td>37</td>
<td>46.9</td>
<td>29.3</td>
<td>34.5</td>
<td>2.2</td>
<td>40.5</td>
<td>50.7</td>
<td>14.8</td>
<td>50.7</td>
<td>14.8</td>
<td>15.4</td>
</tr>
<tr>
<td>38</td>
<td>65.6</td>
<td>5.3</td>
<td>32.2</td>
<td>25.6</td>
<td>30.9</td>
<td>37.7</td>
<td>19.6</td>
<td>37.7</td>
<td>19.6</td>
<td>150</td>
</tr>
<tr>
<td>ID</td>
<td>Session 1</td>
<td>Session 2</td>
<td>Session 3</td>
<td>Session 4</td>
<td>Session 5</td>
<td>Session 6</td>
<td>Session 7</td>
<td>Session 8</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>----</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>------</td>
<td>----</td>
</tr>
<tr>
<td>8</td>
<td>40.0</td>
<td>33.3</td>
<td>1.3</td>
<td>32.0</td>
<td>8.96</td>
<td>9.6</td>
<td>1.3</td>
<td>32.0</td>
<td>20.9</td>
<td>16.1</td>
</tr>
<tr>
<td>10</td>
<td>26.2</td>
<td>30.0</td>
<td>40.0</td>
<td>10.0</td>
<td>11.1</td>
<td>23.5</td>
<td>16.1</td>
<td>23.5</td>
<td>12.8</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>28.9</td>
<td>16.7</td>
<td>14.4</td>
<td>23.3</td>
<td>22.6</td>
<td>21.2</td>
<td>22.6</td>
<td>21.2</td>
<td>5.8</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>23.6</td>
<td>17.8</td>
<td>22.2</td>
<td>6.6</td>
<td>11.1</td>
<td>20.0</td>
<td>16.9</td>
<td>20.0</td>
<td>16.9</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>19.0</td>
<td>24.4</td>
<td>42.2</td>
<td>22.3</td>
<td>24.4</td>
<td>26.5</td>
<td>24.4</td>
<td>26.5</td>
<td>9.1</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>14.5</td>
<td>18.9</td>
<td>8.9</td>
<td>24.5</td>
<td>22.6</td>
<td>17.9</td>
<td>22.6</td>
<td>17.9</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>17.2</td>
<td>31.2</td>
<td>8.9</td>
<td>17.7</td>
<td>13.3</td>
<td>17.3</td>
<td>17.3</td>
<td>17.3</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>24.4</td>
<td>32.3</td>
<td>16.0</td>
<td>16.7</td>
<td>15.5</td>
<td>48.7</td>
<td>48.7</td>
<td>48.7</td>
<td>13.2</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>58.3</td>
<td>34.5</td>
<td>40.0</td>
<td>58.8</td>
<td>10.3</td>
<td>20.0</td>
<td>20.0</td>
<td>20.0</td>
<td>13.2</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>25.0</td>
<td>37.5</td>
<td>1.1</td>
<td>10.3</td>
<td>12.2</td>
<td>12.3</td>
<td>2.2</td>
<td>12.3</td>
<td>14.8</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>19.3</td>
<td>43.7</td>
<td>2.2</td>
<td>13.3</td>
<td>16.7</td>
<td>26.7</td>
<td>26.7</td>
<td>26.7</td>
<td>14.0</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>24.5</td>
<td>25.0</td>
<td>0.0</td>
<td>15.6</td>
<td>21.1</td>
<td>13.1</td>
<td>13.1</td>
<td>13.1</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>25.0</td>
<td>41.7</td>
<td>16.7</td>
<td>2.2</td>
<td>4.6</td>
<td>7.8</td>
<td>8.9</td>
<td>13.6</td>
<td>13.8</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>22.9</td>
<td>24.0</td>
<td>10.0</td>
<td>16.0</td>
<td>3.3</td>
<td>24.1</td>
<td>10.0</td>
<td>10.0</td>
<td>17.4</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>42.7</td>
<td>33.4</td>
<td>18.9</td>
<td>5.6</td>
<td>17.9</td>
<td>21.2</td>
<td>4.0</td>
<td>17.9</td>
<td>8.9</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>40.7</td>
<td>2.7</td>
<td>7.8</td>
<td>31.1</td>
<td>27.4</td>
<td>45.5</td>
<td>25.9</td>
<td>25.9</td>
<td>17.3</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>22.9</td>
<td>34.4</td>
<td>26.7</td>
<td>17.8</td>
<td>19.5</td>
<td>23.8</td>
<td>22.6</td>
<td>22.6</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>46.9</td>
<td>30.7</td>
<td>25.6</td>
<td>1.1</td>
<td>25.0</td>
<td>18.9</td>
<td>22.6</td>
<td>22.6</td>
<td>12.7</td>
<td></td>
</tr>
</tbody>
</table>

151
<table>
<thead>
<tr>
<th>ID</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Session 5</th>
<th>Session 6</th>
<th>Session 7</th>
<th>Session 8</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>10.7</td>
<td>16.6</td>
<td>30.0</td>
<td>10.7</td>
<td>21.1</td>
<td></td>
<td></td>
<td></td>
<td>17.8</td>
<td>8.1</td>
</tr>
<tr>
<td>16</td>
<td>15.5</td>
<td>13.4</td>
<td>25.0</td>
<td>0.0</td>
<td>24.4</td>
<td>35.5</td>
<td></td>
<td></td>
<td>19.0</td>
<td>12.2</td>
</tr>
<tr>
<td>31</td>
<td>37.7</td>
<td>23.4</td>
<td>36.0</td>
<td>13.8</td>
<td>18.7</td>
<td>17.3</td>
<td>17.9</td>
<td></td>
<td>23.5</td>
<td>9.5</td>
</tr>
<tr>
<td>32</td>
<td>26.1</td>
<td>62.2</td>
<td>36.6</td>
<td>37.4</td>
<td>16.1</td>
<td>34.7</td>
<td>24.0</td>
<td></td>
<td>33.9</td>
<td>14.7</td>
</tr>
<tr>
<td>33</td>
<td>55.5</td>
<td>13.7</td>
<td>17.3</td>
<td>18.7</td>
<td>26.2</td>
<td></td>
<td></td>
<td></td>
<td>26.3</td>
<td>17.0</td>
</tr>
<tr>
<td>44</td>
<td>68.8</td>
<td>0.0</td>
<td>4.4</td>
<td>14.5</td>
<td>6.0</td>
<td>40.0</td>
<td></td>
<td></td>
<td>22.3</td>
<td>26.9</td>
</tr>
<tr>
<td>45</td>
<td>39.6</td>
<td>2.7</td>
<td>7.7</td>
<td>15.5</td>
<td>6.0</td>
<td></td>
<td>40.0</td>
<td></td>
<td>18.6</td>
<td>17.0</td>
</tr>
<tr>
<td>46</td>
<td>47.9</td>
<td>2.7</td>
<td>4.1</td>
<td>6.0</td>
<td>42.2</td>
<td></td>
<td></td>
<td></td>
<td>20.6</td>
<td>22.5</td>
</tr>
</tbody>
</table>

MVPA Physical Education Raw Data of Participants with Mental Retardation Across Sessions

152
<table>
<thead>
<tr>
<th>ID</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Session 5</th>
<th>Session 6</th>
<th>Session 7</th>
<th>Session 8</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>54.4</td>
<td>85.7</td>
<td>84.5</td>
<td>77.8</td>
<td>77.3</td>
<td></td>
<td></td>
<td></td>
<td>76.0</td>
<td>12.6</td>
</tr>
<tr>
<td>2</td>
<td>67.9</td>
<td>74.5</td>
<td>73.4</td>
<td>76.7</td>
<td>63.3</td>
<td></td>
<td></td>
<td></td>
<td>71.2</td>
<td>5.5</td>
</tr>
<tr>
<td>3</td>
<td>61.9</td>
<td>75.6</td>
<td>71.2</td>
<td>68.8</td>
<td>65.5</td>
<td>74.5</td>
<td></td>
<td></td>
<td>69.6</td>
<td>5.3</td>
</tr>
<tr>
<td>4</td>
<td>65.5</td>
<td>74.4</td>
<td>68.9</td>
<td>77.8</td>
<td>83.3</td>
<td></td>
<td></td>
<td></td>
<td>74.0</td>
<td>7.1</td>
</tr>
<tr>
<td>5</td>
<td>57.8</td>
<td>68.8</td>
<td>96.0</td>
<td>74.7</td>
<td>83.3</td>
<td>84.5</td>
<td></td>
<td></td>
<td>77.5</td>
<td>13.4</td>
</tr>
<tr>
<td>6</td>
<td>55.6</td>
<td>74.5</td>
<td>86.7</td>
<td>74.4</td>
<td>77.3</td>
<td></td>
<td></td>
<td></td>
<td>73.7</td>
<td>11.3</td>
</tr>
<tr>
<td>7</td>
<td>61.9</td>
<td>73.4</td>
<td>66.6</td>
<td>85.6</td>
<td>81.2</td>
<td>75.6</td>
<td></td>
<td></td>
<td>74.1</td>
<td>8.8</td>
</tr>
<tr>
<td>17</td>
<td>69.9</td>
<td>43.8</td>
<td>100.0</td>
<td>66.7</td>
<td>70.0</td>
<td>82.7</td>
<td></td>
<td></td>
<td>72.2</td>
<td>18.6</td>
</tr>
<tr>
<td>18</td>
<td>67.7</td>
<td>47.9</td>
<td>80.0</td>
<td>81.1</td>
<td>76.7</td>
<td>70.2</td>
<td>42.7</td>
<td></td>
<td>66.6</td>
<td>15.4</td>
</tr>
<tr>
<td>19</td>
<td>62.5</td>
<td>41.7</td>
<td>76.7</td>
<td>94.3</td>
<td>70.0</td>
<td>64.4</td>
<td>97.8</td>
<td></td>
<td>72.5</td>
<td>19.4</td>
</tr>
<tr>
<td>20</td>
<td>80.0</td>
<td>84.4</td>
<td>75.5</td>
<td>98.9</td>
<td>50.0</td>
<td>80.6</td>
<td></td>
<td></td>
<td>78.2</td>
<td>16.0</td>
</tr>
<tr>
<td>21</td>
<td>78.6</td>
<td>37.3</td>
<td>63.3</td>
<td>82.2</td>
<td>88.0</td>
<td>100.0</td>
<td>77.8</td>
<td></td>
<td>75.3</td>
<td>20.1</td>
</tr>
<tr>
<td>22</td>
<td>51.0</td>
<td>38.5</td>
<td>97.8</td>
<td>90.9</td>
<td>76.6</td>
<td>97.8</td>
<td>87.8</td>
<td></td>
<td>77.2</td>
<td>23.6</td>
</tr>
<tr>
<td>23</td>
<td>53.3</td>
<td>60.0</td>
<td>53.3</td>
<td>60.0</td>
<td>89.7</td>
<td>78.7</td>
<td>72.6</td>
<td>65.4</td>
<td>66.6</td>
<td>12.9</td>
</tr>
<tr>
<td>34</td>
<td>79.1</td>
<td>57.3</td>
<td>100.0</td>
<td>37.3</td>
<td>82.8</td>
<td>60.0</td>
<td>45.3</td>
<td></td>
<td>66.0</td>
<td>22.3</td>
</tr>
<tr>
<td>35</td>
<td>50.0</td>
<td>64.0</td>
<td>93.3</td>
<td>58.9</td>
<td>49.3</td>
<td>74.1</td>
<td>71.1</td>
<td>64.2</td>
<td>65.6</td>
<td>14.3</td>
</tr>
<tr>
<td>36</td>
<td>87.5</td>
<td>56.2</td>
<td>64.4</td>
<td>78.7</td>
<td>75.9</td>
<td>64.4</td>
<td>59.5</td>
<td></td>
<td>69.5</td>
<td>11.4</td>
</tr>
<tr>
<td>37</td>
<td>53.1</td>
<td>70.7</td>
<td>65.5</td>
<td>97.8</td>
<td>59.5</td>
<td>65.6</td>
<td>49.3</td>
<td>85.2</td>
<td>68.3</td>
<td>16.2</td>
</tr>
<tr>
<td>38</td>
<td>34.4</td>
<td>94.7</td>
<td>67.8</td>
<td>74.4</td>
<td>69.1</td>
<td>62.3</td>
<td></td>
<td></td>
<td>67.1</td>
<td>19.6</td>
</tr>
<tr>
<td>ID</td>
<td>Session 1</td>
<td>Session 2</td>
<td>Session 3</td>
<td>Session 4</td>
<td>Session 5</td>
<td>Session 6</td>
<td>Session 7</td>
<td>Session 8</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>----</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>------</td>
<td>----</td>
</tr>
<tr>
<td>8</td>
<td>60.0</td>
<td>66.7</td>
<td>98.7</td>
<td>68.0</td>
<td>91.1</td>
<td>90.4</td>
<td></td>
<td></td>
<td>79.2</td>
<td>16.1</td>
</tr>
<tr>
<td>9</td>
<td>75.0</td>
<td>62.2</td>
<td>78.9</td>
<td>88.8</td>
<td>87.8</td>
<td>78.9</td>
<td></td>
<td></td>
<td>78.6</td>
<td>9.7</td>
</tr>
<tr>
<td>10</td>
<td>73.8</td>
<td>70.0</td>
<td>60.0</td>
<td>90.0</td>
<td>88.9</td>
<td></td>
<td></td>
<td></td>
<td>76.5</td>
<td>12.8</td>
</tr>
<tr>
<td>11</td>
<td>71.1</td>
<td>83.3</td>
<td>85.6</td>
<td>76.7</td>
<td>77.4</td>
<td></td>
<td></td>
<td></td>
<td>78.8</td>
<td>5.8</td>
</tr>
<tr>
<td>12</td>
<td>76.4</td>
<td>82.2</td>
<td>77.8</td>
<td>93.4</td>
<td>88.9</td>
<td>80.0</td>
<td></td>
<td></td>
<td>83.1</td>
<td>6.7</td>
</tr>
<tr>
<td>13</td>
<td>81.0</td>
<td>75.6</td>
<td>57.8</td>
<td>77.7</td>
<td>75.6</td>
<td></td>
<td></td>
<td></td>
<td>73.5</td>
<td>9.1</td>
</tr>
<tr>
<td>14</td>
<td>85.5</td>
<td>81.1</td>
<td>91.1</td>
<td>75.5</td>
<td>77.4</td>
<td></td>
<td></td>
<td></td>
<td>82.1</td>
<td>6.3</td>
</tr>
<tr>
<td>24</td>
<td>82.8</td>
<td>68.8</td>
<td>91.1</td>
<td>82.3</td>
<td>86.7</td>
<td>82.7</td>
<td></td>
<td></td>
<td>82.4</td>
<td>7.5</td>
</tr>
<tr>
<td>25</td>
<td>75.6</td>
<td>67.7</td>
<td>84.0</td>
<td>83.3</td>
<td>84.5</td>
<td>89.2</td>
<td>51.3</td>
<td></td>
<td>76.5</td>
<td>13.2</td>
</tr>
<tr>
<td>26</td>
<td>41.7</td>
<td>65.5</td>
<td>60.0</td>
<td>41.2</td>
<td>89.7</td>
<td>80.0</td>
<td>79.7</td>
<td>85.4</td>
<td>67.9</td>
<td>19.0</td>
</tr>
<tr>
<td>27</td>
<td>75.0</td>
<td>62.5</td>
<td>98.9</td>
<td>89.7</td>
<td>87.8</td>
<td>87.7</td>
<td>97.8</td>
<td></td>
<td>85.6</td>
<td>12.9</td>
</tr>
<tr>
<td>28</td>
<td>80.7</td>
<td>56.3</td>
<td>97.8</td>
<td>86.7</td>
<td>83.3</td>
<td>73.3</td>
<td></td>
<td></td>
<td>79.7</td>
<td>14.0</td>
</tr>
<tr>
<td>29</td>
<td>75.5</td>
<td>75.0</td>
<td>100.0</td>
<td>84.4</td>
<td>78.9</td>
<td>86.9</td>
<td>56.0</td>
<td></td>
<td>79.5</td>
<td>13.5</td>
</tr>
<tr>
<td>30</td>
<td>75.0</td>
<td>58.3</td>
<td>83.3</td>
<td>97.8</td>
<td>95.4</td>
<td>92.2</td>
<td>91.1</td>
<td>97.8</td>
<td>86.4</td>
<td>13.8</td>
</tr>
<tr>
<td>39</td>
<td>77.1</td>
<td>76.0</td>
<td>90.0</td>
<td>84.0</td>
<td>96.7</td>
<td>75.9</td>
<td>90.0</td>
<td>71.5</td>
<td>82.7</td>
<td>8.9</td>
</tr>
<tr>
<td>40</td>
<td>57.3</td>
<td>66.6</td>
<td>81.1</td>
<td>94.4</td>
<td>82.1</td>
<td>78.8</td>
<td>96.0</td>
<td>71.7</td>
<td>78.5</td>
<td>13.2</td>
</tr>
<tr>
<td>41</td>
<td>59.3</td>
<td>97.3</td>
<td>92.2</td>
<td>68.9</td>
<td>72.6</td>
<td>54.5</td>
<td></td>
<td></td>
<td>74.1</td>
<td>17.3</td>
</tr>
<tr>
<td>42</td>
<td>77.1</td>
<td>65.6</td>
<td>73.3</td>
<td>82.2</td>
<td>80.5</td>
<td>86.6</td>
<td>76.2</td>
<td></td>
<td>77.4</td>
<td>6.8</td>
</tr>
<tr>
<td>43</td>
<td>53.1</td>
<td>69.3</td>
<td>74.4</td>
<td>98.9</td>
<td>75.0</td>
<td>81.1</td>
<td>77.4</td>
<td>74.1</td>
<td>75.4</td>
<td>12.7</td>
</tr>
</tbody>
</table>

LPA Physical Education Raw Data of Participants Possessing Low Cardiorespiratory Fitness Across Sessions
<table>
<thead>
<tr>
<th>ID</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Session 5</th>
<th>Session 6</th>
<th>Session 7</th>
<th>Session 8</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>89.3</td>
<td>83.4</td>
<td>70.0</td>
<td>89.3</td>
<td>78.9</td>
<td></td>
<td></td>
<td></td>
<td>82.2</td>
<td>8.1</td>
</tr>
<tr>
<td>16</td>
<td>84.5</td>
<td>86.6</td>
<td>75.0</td>
<td>100.0</td>
<td>75.6</td>
<td>64.5</td>
<td></td>
<td></td>
<td>81.0</td>
<td>12.2</td>
</tr>
<tr>
<td>31</td>
<td>62.3</td>
<td>76.6</td>
<td>64.0</td>
<td>86.2</td>
<td>81.3</td>
<td>82.7</td>
<td>82.1</td>
<td></td>
<td>76.5</td>
<td>9.5</td>
</tr>
<tr>
<td>32</td>
<td>73.9</td>
<td>73.8</td>
<td>63.4</td>
<td>62.6</td>
<td>83.9</td>
<td>65.3</td>
<td>76.0</td>
<td></td>
<td>66.1</td>
<td>14.7</td>
</tr>
<tr>
<td>33</td>
<td>44.5</td>
<td>86.3</td>
<td>82.7</td>
<td>81.3</td>
<td>73.8</td>
<td></td>
<td></td>
<td></td>
<td>73.7</td>
<td>17.0</td>
</tr>
<tr>
<td>44</td>
<td>31.2</td>
<td>100.0</td>
<td>95.6</td>
<td>85.5</td>
<td>94.0</td>
<td>60.0</td>
<td></td>
<td></td>
<td>77.7</td>
<td>26.9</td>
</tr>
<tr>
<td>45</td>
<td>60.4</td>
<td>97.3</td>
<td>92.3</td>
<td>84.5</td>
<td>94.0</td>
<td>60.0</td>
<td></td>
<td></td>
<td>81.4</td>
<td>17.0</td>
</tr>
<tr>
<td>46</td>
<td>52.1</td>
<td>97.3</td>
<td>95.6</td>
<td>94.0</td>
<td>57.8</td>
<td></td>
<td></td>
<td></td>
<td>79.4</td>
<td>22.4</td>
</tr>
<tr>
<td>ID</td>
<td>Session 1</td>
<td>Session 2</td>
<td>Session 3</td>
<td>Session 4</td>
<td>Session 5</td>
<td>Mean</td>
<td>SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------</td>
<td>------</td>
<td>-----</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>86.7</td>
<td>84.4</td>
<td>83.4</td>
<td></td>
<td></td>
<td>84.8</td>
<td>1.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>62.3</td>
<td>80.0</td>
<td>91.2</td>
<td>80.0</td>
<td>100</td>
<td>82.7</td>
<td>14.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>75.5</td>
<td>83.3</td>
<td></td>
<td></td>
<td></td>
<td>79.4</td>
<td>5.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>86.7</td>
<td>60.0</td>
<td></td>
<td></td>
<td></td>
<td>73.4</td>
<td>18.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>80.0</td>
<td>82.3</td>
<td>80.0</td>
<td>96.6</td>
<td></td>
<td>84.7</td>
<td>8.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>75.6</td>
<td>53.3</td>
<td></td>
<td></td>
<td></td>
<td>64.4</td>
<td>15.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>80.0</td>
<td>66.7</td>
<td>68.9</td>
<td>100</td>
<td></td>
<td>78.9</td>
<td>15.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>75.6</td>
<td>86.7</td>
<td>51.2</td>
<td>93.4</td>
<td></td>
<td>76.7</td>
<td>18.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>37.8</td>
<td>55.6</td>
<td>71.1</td>
<td>36.7</td>
<td></td>
<td>50.3</td>
<td>16.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>26.7</td>
<td>44.5</td>
<td></td>
<td></td>
<td></td>
<td>35.6</td>
<td>12.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>55.6</td>
<td>55.6</td>
<td></td>
<td></td>
<td></td>
<td>55.6</td>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## MVPA Recess Raw Data of Participants Possessing Low Cardiorespiratory Fitness Across Sessions

<table>
<thead>
<tr>
<th>ID</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>36.6</td>
<td>66.6</td>
<td>82.2</td>
<td>60</td>
<td>61.4</td>
<td>18.9</td>
</tr>
<tr>
<td>26</td>
<td>68.9</td>
<td>50.0</td>
<td>59.9</td>
<td>n/a</td>
<td>59.6</td>
<td>9.5</td>
</tr>
<tr>
<td>27</td>
<td>60.0</td>
<td>77.8</td>
<td>80.0</td>
<td>n/a</td>
<td>72.6</td>
<td>11.0</td>
</tr>
<tr>
<td>28</td>
<td>66.7</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>66.7</td>
<td>n/a</td>
</tr>
<tr>
<td>29</td>
<td>75.5</td>
<td>83.3</td>
<td>n/a</td>
<td>n/a</td>
<td>79.4</td>
<td>5.5</td>
</tr>
<tr>
<td>30</td>
<td>62.2</td>
<td>68.9</td>
<td>60.0</td>
<td>n/a</td>
<td>63.7</td>
<td>4.6</td>
</tr>
<tr>
<td>39</td>
<td>53.3</td>
<td>68.9</td>
<td>77.8</td>
<td>83.3</td>
<td>70.8</td>
<td>13.1</td>
</tr>
<tr>
<td>40</td>
<td>51.1</td>
<td>40.0</td>
<td>62.2</td>
<td>n/a</td>
<td>51.1</td>
<td>11.1</td>
</tr>
<tr>
<td>41</td>
<td>51.1</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>51.1</td>
<td>n/a</td>
</tr>
<tr>
<td>42</td>
<td>53.3</td>
<td>66.7</td>
<td>73.3</td>
<td>n/a</td>
<td>64.4</td>
<td>10.2</td>
</tr>
<tr>
<td>43</td>
<td>60.0</td>
<td>84.4</td>
<td>66.7</td>
<td>n/a</td>
<td>70.4</td>
<td>12.6</td>
</tr>
</tbody>
</table>

157
## MVPA Recess Raw Data of Participants with Mental Retardation Across Sessions

<table>
<thead>
<tr>
<th>ID</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>63.9</td>
<td>87.5</td>
<td>-----------</td>
<td>-----------</td>
<td>75.7</td>
<td>16.7</td>
</tr>
<tr>
<td>16</td>
<td>42.2</td>
<td>52.8</td>
<td>7.5</td>
<td>47.5</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>88.9</td>
<td>69.5</td>
<td>87.5</td>
<td>-----------</td>
<td>82.0</td>
<td>10.8</td>
</tr>
<tr>
<td>32</td>
<td>31.1</td>
<td>94.4</td>
<td>-----------</td>
<td>-----------</td>
<td>62.8</td>
<td>44.8</td>
</tr>
<tr>
<td>33</td>
<td>77.8</td>
<td>38.9</td>
<td>-----------</td>
<td>-----------</td>
<td>58.4</td>
<td>27.5</td>
</tr>
<tr>
<td>44</td>
<td>97.8</td>
<td>87.5</td>
<td>-----------</td>
<td>-----------</td>
<td>92.7</td>
<td>7.3</td>
</tr>
<tr>
<td>45</td>
<td>17.8</td>
<td>41.7</td>
<td>-----------</td>
<td>-----------</td>
<td>29.8</td>
<td>16.9</td>
</tr>
<tr>
<td>46</td>
<td>44.5</td>
<td>87.5</td>
<td>-----------</td>
<td>-----------</td>
<td>66.0</td>
<td>30.4</td>
</tr>
</tbody>
</table>
LPA Recess Raw Data of Participants Possessing High Cardiorespiratory Fitness Across Sessions

<table>
<thead>
<tr>
<th>ID</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Session 5</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>13.3</td>
<td>15.6</td>
<td>16.6</td>
<td></td>
<td></td>
<td>15.2</td>
<td>1.7</td>
</tr>
<tr>
<td>19</td>
<td>37.8</td>
<td>20.0</td>
<td>8.8</td>
<td>20.0</td>
<td>0</td>
<td>17.3</td>
<td>14.2</td>
</tr>
<tr>
<td>20</td>
<td>24.5</td>
<td>16.7</td>
<td></td>
<td></td>
<td></td>
<td>20.6</td>
<td>5.5</td>
</tr>
<tr>
<td>21</td>
<td>13.3</td>
<td>40.0</td>
<td></td>
<td></td>
<td></td>
<td>26.7</td>
<td>44.8</td>
</tr>
<tr>
<td>22</td>
<td>20.0</td>
<td>17.7</td>
<td>20.0</td>
<td>3.4</td>
<td></td>
<td>15.3</td>
<td>8.0</td>
</tr>
<tr>
<td>23</td>
<td>24.4</td>
<td>46.7</td>
<td></td>
<td></td>
<td></td>
<td>35.6</td>
<td>15.8</td>
</tr>
<tr>
<td>34</td>
<td>20.0</td>
<td>33.3</td>
<td>31.1</td>
<td>0</td>
<td></td>
<td>21.1</td>
<td>15.2</td>
</tr>
<tr>
<td>35</td>
<td>24.4</td>
<td>13.3</td>
<td>48.8</td>
<td>6.6</td>
<td></td>
<td>23.3</td>
<td>18.5</td>
</tr>
<tr>
<td>36</td>
<td>62.2</td>
<td>44.4</td>
<td>28.9</td>
<td>63.3</td>
<td></td>
<td>49.7</td>
<td>16.4</td>
</tr>
<tr>
<td>37</td>
<td>73.3</td>
<td>55.5</td>
<td></td>
<td></td>
<td></td>
<td>64.4</td>
<td>12.6</td>
</tr>
<tr>
<td>38</td>
<td>44.4</td>
<td>44.4</td>
<td></td>
<td></td>
<td></td>
<td>44.4</td>
<td>0.0</td>
</tr>
</tbody>
</table>

159
### LPA Recess Raw Data of Participants Possessing Low Cardiorespiratory Fitness Across Sessions

<table>
<thead>
<tr>
<th>ID</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>63.4</td>
<td>33.3</td>
<td>17.8</td>
<td>40</td>
<td>38.6</td>
<td>19.0</td>
</tr>
<tr>
<td>26</td>
<td>31.1</td>
<td>50.0</td>
<td>40.1</td>
<td>---------</td>
<td>40.4</td>
<td>9.5</td>
</tr>
<tr>
<td>27</td>
<td>40.0</td>
<td>22.2</td>
<td>20.0</td>
<td>---------</td>
<td>27.4</td>
<td>11.0</td>
</tr>
<tr>
<td>28</td>
<td>33.3</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>33.3</td>
<td>n/a</td>
</tr>
<tr>
<td>29</td>
<td>24.5</td>
<td>16.7</td>
<td>---------</td>
<td>---------</td>
<td>20.6</td>
<td>5.5</td>
</tr>
<tr>
<td>30</td>
<td>37.8</td>
<td>31.1</td>
<td>40.0</td>
<td>---------</td>
<td>36.3</td>
<td>4.6</td>
</tr>
<tr>
<td>39</td>
<td>46.7</td>
<td>31.1</td>
<td>22.2</td>
<td>16.7</td>
<td>29.2</td>
<td>13.1</td>
</tr>
<tr>
<td>40</td>
<td>48.9</td>
<td>60.0</td>
<td>37.8</td>
<td>---------</td>
<td>48.9</td>
<td>11.1</td>
</tr>
<tr>
<td>41</td>
<td>48.9</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>48.9</td>
<td>n/a</td>
</tr>
<tr>
<td>42</td>
<td>46.7</td>
<td>33.3</td>
<td>26.7</td>
<td>---------</td>
<td>35.6</td>
<td>10.2</td>
</tr>
<tr>
<td>43</td>
<td>40.0</td>
<td>15.6</td>
<td>33.3</td>
<td>---------</td>
<td>29.6</td>
<td>12.6</td>
</tr>
</tbody>
</table>
LPA Recess Raw Data of Participants with Mental Retardation Across Sessions

<table>
<thead>
<tr>
<th>ID</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>36.1</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>16</td>
<td>57.8</td>
<td>47.2</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>31</td>
<td>11.1</td>
<td>30.5</td>
<td>12.5</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>32</td>
<td>68.9</td>
<td>5.6</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>33</td>
<td>22.2</td>
<td>61.1</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>44</td>
<td>2.2</td>
<td>12.5</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>45</td>
<td>82.2</td>
<td>58.3</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>46</td>
<td>55.5</td>
<td>12.5</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
</tbody>
</table>