

## ABSTRACT

**GROTENHUIS, J. A. Comparison of effort levels of middle school male basketball players in physical education classes and athletic team practices. MS in Exercise and Sport Science-Physical Education Teaching, August 2001, 45 pp. (J. Steffen)**

Heart rates were recorded on a sample of 37 middle school male athletes, ranging in age from 12-14, during physical education classes and basketball team practices. Each subject was measured during three physical education classes and three basketball practices. Each lesson and practice session lasted 45 minutes. The physical education class consisted of 10-12 minutes of warm up followed by 30-35 minutes of instruction and skill development. The basketball team practice consisted of 12-15 minutes of warm up followed by 30-35 minutes of drill and practice. Using Polar Vantage XL and Accurex IIa heart rate monitors (HRM) the subject's heart rate was measured for the duration of each session. A paired t-test was used to determine if significant differences existed between the two activities. No significant difference was found between the physical education class and the basketball team practice. The data indicate that there is no difference in effort levels of middle school male athletes in athletic team practices compared to physical education classes. Further investigations on different populations are needed to broaden the scope of this study. The primary goal of physical education is to establish an understanding of the body and develop an appreciation for exercise.

**COMPARISON OF EFFORT LEVELS OF MIDDLE SCHOOL MALE  
BASKETBALL PLAYERS IN PHYSICAL EDUCATION  
CLASSES AND ATHLETIC TEAM PRACTICES**

**A THESIS PRESENTED  
TO  
THE GRADUATE FACULTY  
UNIVERSITY OF WISCONSIN-LA CROSSE**

**IN PARTIAL FULFILLMENT  
OF THE REQUIREMENTS FOR THE  
MASTER OF SCIENCE DEGREE**

**BY  
JEFF A. GROTENHUIS  
AUGUST 2001**

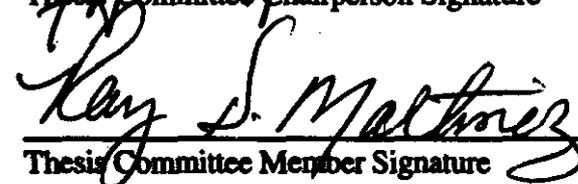
COLLEGE OF HEALTH, PHYSICAL EDUCATION,  
RECREATION, AND TEACHER EDUCATION  
UNIVERSITY OF WISCONSIN-LA CROSSE  
THESIS FINAL ORAL DEFENSE FORM

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We recommend acceptance of this thesis in partial fulfillment of this candidate's requirements for the degree:

Master of Science in Exercise and Sport Science-Physical Education Teaching

The candidate has successfully completed the thesis final oral defense.

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## ACKNOWLEDGEMENTS

I would like to express my appreciation to the following individuals for their intuition and encouragement during this process. First, I want to thank Jeff Steffen for chairing my thesis committee and calming my nerves when I was stressed. I would also like to thank my other committee members, Ray Martinez and Abdulaziz Elfessi. Their insight and encouragement was much appreciated.

I would also like to thank the young men at Kewaskum Middle School for participating in the study. Without your cooperation and support this thesis would not have been possible. To the fine people at Polar Electro, your dedication to research and physical education programs is exemplary. To my friend and colleague, Cherith, thanks for loaning me your heart rate monitors.

Next, I would like to thank my girlfriend, Amy. Without you pushing me along and keeping me on track, this thesis would not have been a reality. I am proud of you and all your achievements, and thank you.

Finally, I would like to thank my family, Grandma, Mom, Dad, Jenny, and Jon. There are not too many people fortunate enough to grow up in a family as wonderful as ours. I am truly blessed. Thanks for always being there for me.

I would like to dedicate this thesis to my Grandpa Grotenhuis, who taught me that the most important things in life are not learned from a text book but learned from the people who inspire you. Thank you for showing me the value of hard work and being good to other people.

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## CHAPTER I

### INTRODUCTION

The fitness levels of America's youth are in jeopardy. According to the Surgeon General's Report (U.S. Department of Health and Human Services, 1996), three-fourths of school age children fail to engage in some type of light to moderate activity on a daily basis. "Researchers in physical education and exercise science have suggested that all Americans, regardless of age, should be involved in physical activity at various levels of intensity on a regular basis" (Keating, Kulinna, & Silverman, 1999, p. 208). Wright, Patterson, and Cardinal (2000) report that, "the prevalence of overweight children is at an all-time high" (p. 26). Research such as this show that there has never been more of a need for quality physical education programs than there is now. It is important that physical education teachers are given the tools necessary to construct quality programs that encourage students to become lifelong movers.

Many opportunities exist for children to participate in athletics. Athletics provide students with positive after school activities that help build important teamwork and problem solving skills. For various reasons, physical education and athletics have gone hand in hand. Many studies have compared the two disciplines, but few have looked at where middle students place more efforts.

It is unclear at this time if children put forth more effort in physical education classes or in athletic team practices. This study will determine if effort levels are higher in physical education classes or athletic team practices or if effort levels are the same in both settings. A quantitative assessment of effort will be obtained through the use of heart rate monitors

(HRM). According to Laukkanen and Virtanen (1998), heart rate is a useful indicator of intensity of effort in children. The rate at which the heart is pumping is a direct reflection of the stress level placed on the heart.

A key component of any physical education class is physical fitness (Ernst, Pangrazzi, & Corbin, 1998). Physical education teachers struggle to find activities that motivate students to put forth effort. During non-physical education time at school, children's heart rates rarely enter the target heart rate zone (Jun Li & Dunham, 1993). A physical education class should be a place where the heart rates of students are increased on a regular basis. Teachers need to strive to find activities that stimulate students to increase their heart rate to a target zone for twenty minutes three times per week. However, many physical education programs are not placing their focus on meeting this goal (Strand and Reeder, 1993). Stratton (1997) suggests students are not receiving enough moderate to vigorous physical activity in physical education classes. Another goal of physical education is to increase fitness levels of students. Recent research has shown that many school districts are reducing the time allotment for physical education. Therefore, it is difficult for physical education teachers to find time to increase student heart rates.

According to Cowden and Plowman (1999), there are several methods used to measure effort and intensity during exercise. These methods include rates of perceived exertion (RPE), percentage of maximum oxygen consumption, and percentage of reserve heart rate. One of the best methods of measuring effort levels of students is through the use of HRMs. Heart rate monitors have been used in physical education classes for several years. Heart rate monitoring is one of the best ways to measure intensity in exercise (Vuori, 1998). According to Armstrong (1998), heart rate monitoring is a reliable and valid method of measurement in school age children. According to Jeukendrup and Van Diemen (1998) HRMs are used to motivate athletes to work at high intensities. "Heart rate is not a direct

measure of physical activity, but a measure of the relative stress being placed on the (heart)" (Armstrong, 1998, p. S10).

The purpose of this study is to compare effort levels of middle school male basketball players in basketball team practices to their effort levels in physical education classes.

### Significance of Thesis

The significance of this study is that through its findings, one should have an understanding of where middle school students put forth more effort, or if they put forth the same effort in both situations. Once we determine where students put forth more effort, we can begin to examine reasons as to why they put forth more effort in one area.

Increasing intensity of exercise in physical education classes should be emphasized by all physical education teachers. One goal of this study is to provide physical education teachers with another resource for planning their lessons. This study will also determine if students are provided with moderate to vigorous physical activity in their physical education classes. According to Armstrong (1998), heart rate monitoring can provide an illustration as to the activity level of children.

Regularly increasing heart rates in children is a key component of physical education. Finding methods, techniques, or lessons that increase heart rate will help the physical educator develop appropriate lessons. For example, if effort levels are higher in athletic team practices, physical education teachers may need to look at ways in which the coach motivates his/her athletes. This study will not only benefit physical education teachers and basketball coaches, but it also benefits the subjects in the study. The subjects participating in this study will gain exposure to cutting edge technology in the fitness industry.

This study will provide the subjects with knowledge of the use of heart rate monitors as a fitness assessment tool. According to Hinson (1994), "Teaching children about the heart is the first step in helping to combat cardiovascular disease" (p. 62). These students will

better understand the capabilities of their bodies and the effects of intensity levels on their heart rates.

### **Purpose of the Study**

The purpose of this study was to compare effort levels of middle school male basketball players in physical education classes to their effort levels in athletic team practice. Thirty-seven male seventh and eighth grade students from Kewaskum Middle School were used for the study. Each athlete who was a member of either the seventh or eighth grade basketball team was recruited to participate in the study.

### **Hypothesis**

There will be no difference in effort levels of middle school basketball players in athletic team practices compared to physical education classes.

### **Assumptions**

The following assumptions can be made regarding this study:

1. All subjects were of good health.
2. All subjects passed a physical examination by a medical doctor prior to the study.
3. All subjects placed the HRM on correctly.
4. The researcher started and stopped the HRM correctly.
5. All subjects were members of the boys basketball team.

### **Delimitations**

The following delimitations must be recognized regarding this study:

1. Subjects were in either seventh or eighth grade at Kewaskum Middle School.
2. Subjects were tested over three consecutive physical education classes.
3. Subjects participated in physical education classes on an every other day basis.

4. Subjects were tested during skill development portions of the physical education unit plan.
5. Subjects were tested over three consecutive basketball practices.
6. Subjects were not tested on a day prior to a basketball contest or a day immediately following a contest.
7. Subjects were tested for a forty-five minute physical education class and for a forty-five minute period during basketball practice.

#### Limitations

The following limitations must be recognized for this study:

1. The researcher may not start or stop the HRM correctly.
2. The HRM may malfunction or break during use.
3. Subjects may exercise or train outside of the physical education class or basketball practice.
4. Teachers and/or coaches may use varying motivational techniques to elicit effort from the subjects.
5. The subject may not put forth his best effort.
6. The subject may not be motivated to put forth effort by the teacher or coach.

#### Definition of Terms

**Heart Rate** - A measure of the relative stress being placed on the cardiopulmonary system by an activity (Armstrong, 1998).

**Intensity** - The degree of energy that is required to perform a given task (Jun Li and Dunham, Jr., 1993).

**Moderate Physical Activity** - Generating a heart rate of greater than or equal to 140 beats per minute (Armstrong, 1998).

**Target Heart Rate** - Maximum heart rate multiplied by .60 to find the lower limit and maximum heart rate multiplied by .80 to find the upper limit (Cowden and Plowman, 1999).

**Vigorous Physical Activity** - Generating a heart rate of greater than or equal to 160 beats per minute (Armstrong, 1998).

## CHAPTER II

### REVIEW OF RELATED LITERATURE

#### Introduction

It seems as though children are not receiving the proper amount of physical exercise on a daily basis. Often the only time they receive exercise is during physical education class. Today, there are opportunities for boys and girls to be involved in numerous extra-curricular activities. The benefits of participation in such activities has been well documented. Yet, in order for children to be receiving full physical benefit from these activities, it is important that their heart rates are being increased. It is recommended that children participate in daily physical activity and receive moderate to vigorous physical activity three times a week for thirty minutes (Stratton, 1997). No matter where children receive their physical activity, it is important that it is a positive experience. Adults who do not exercise regularly often link that choice to a negative experience as a child (Ferguson, Yesalis, Pomrehn, & Kirkpatrick, 1989). Physical education and athletic programs provide opportunities for children to develop an appreciation for exercise.

The following review of literature will discuss comparative aspects of physical education and athletics, heart rate, heart rate monitoring, and effort levels.

#### Physical Education Versus Athletics

Although many studies have compared the dual role of teaching and coaching, (Bain & Wendt, 1983; Rupert & Buschner, 1989; and Smith, Steffen, & Aicinena, 1994) few studies have probed into the comparison of effort levels of students in physical education and athletics.

For various reasons, teacher/coaches often place more emphasis on coaching. Rupert and Buschner (1989), report that "The teacher/coaches displayed significantly more praise in coaching when compared to the physical education class" (p. 54). In addition, coaches tended to be more efficient in their management duties. This study will examine the aspect of student/athlete effort levels in physical education classes compared with their effort in athletic team practices. The best way to compare athletics and physical education is to first focus on the two separate topics of athletics and physical education and then discuss the shared characteristics of the activities.

Promoting life-long fitness needs is the backbone of a quality physical education program. It is essential for physical education teachers to increase heart rates of students during classes. Physical education is one area in which the promotion of healthy behaviors takes place (Keating, et al., 1999). The role of the physical education teacher is to motivate children to exercise. Praise and performance go hand in hand, and children constantly seek out praise from their teachers and other adults.

Cousineau and Luke (1990) report that teacher expectations have a direct link to student outcomes and students often adjust their performances to meet teacher expectations. Ernst, Pangrazzi, and Corbin (1998) suggest that physical education teachers tend to focus on encouraging an active lifestyle rather than test physical capabilities through skill or fitness testing.

Motivation comes from many places, including the individual. Gifted athletes may be motivating themselves at a young age. Anderson and Pease (1981) propose that even as early as fourth or fifth grade, highly skilled student-athletes are motivated intrinsically. Although children may indeed be able to motivate themselves, teachers and coaches are usually the driving force behind motivation.

Oman and McAuley (1993) suggest that intrinsic motivation is a predictor of exercise program adherence. According to Young (1985) secondary school students lack the motivation necessary for physical education classes. Motivation usually increases in athletics due to the fact that the student/athlete has a strong interest in that particular activity. "While evidence supporting the health benefits of exercise increases, researchers need to discover ways to motivate children to develop life-long exercise habits" (Ferguson, et al., 1989, p. 112).

Despite the fact that there are many excellent physical education programs out there, Strand and Reeder (1993) point out that middle school students are not receiving adequate aerobic activity in physical education classes.

Educators continue to debate appropriate methods of assessment in physical education classes. This debate and controversy typically leads teachers to improve their programs. There are some conflicting beliefs as to the objectives of physical education. Matanin & Tannehill (1994) found that "Teacher responses indicated that keeping students active was more important than assessing student progress" (p. 399). However, Desrosiers, Genet-Volet, & Godbout (1997) point out that if used correctly, assessment practices allow teachers to examine weaknesses of students and develop lessons that are in accordance with the students skill levels. What teachers learn in college and university courses may not necessarily be applied to their classroom.

Even though teachers are trained to assess, they do not necessarily apply those techniques in their physical education classes (Veal 1992). Veal (1992) calls for improvements in assessment education in undergraduate teacher preparation programs. It is more likely for a student to become involved in an activity if they are competent at performing that activity, and the only way they improve their skills is through practice and assessments. Objective grading is likely to increase student understanding, performance,

and motivation (Matanin & Tannehill, 1994).

For many reasons, physical education and athletics are linked. Common goals of both activities include increased fitness levels, skill performance, and enjoyment. Physical education is required by many school districts, athletics are not. Therefore, the participation in athletics is one of choice. More students are participating in extra-curricular activities (Anderson & Pease, 1981). "Some twenty million boys and girls participate in school-based and community sport programs in the United States each year" (Jones, Housner, & Kornspan, 1997, p. 454). Determining ways to motivate children to become active may be the key to reducing childhood obesity and cardiovascular disease.

Athletics are an important cog in the framework of a school and community. Athletics focus students and keep them out of trouble. Athletics provide children with opportunities to socialize with peers in a positive manner. Studies indicate that if it were not for athletics, drop-out rates and delinquency would be higher in schools (Buhrman, 1977). Many middle schools recognize the importance of athletics and require teams to make sure that all athletes play (Riemcke, 1988).

The preparation of the athlete is usually controlled by the coach, and the behavior of the coach during practices dictates the success of that practice session (Claxton & Lacy, 1986). The attitude and personality of the coach can either leave the child with positive athletic experience or a negative one. Jones, Housner, and Kornspan (1997) suggest that very successful coaches such as John Wooden and Frank Kush used some criticism, but followed that criticism with corrective feedback.

Behaviors of successful coaches mirror the behaviors of successful physical education teachers. Just as the experience of the teacher enhances the success of the class, the experience of the coach can also have an impact on the success of the team and the athlete. Jones, Housner, and Kornspan (1997), found that experienced teachers and coaches were

more adept at knowing when to introduce new skills and were more detailed in their lesson planning.

Whether in physical education or sport, increasing the heart rate of the student/athlete is important. Increasing heart rate improves the function of the heart and lungs.

### Heart Rate

Heart rate measurements are relatively new in the field of exercise and sport research. However, heart rate measurements can provide athletes and non-athletes with an accurate reflection of their exercise intensity. According to Jeukendrup and Van Diemen (1998), "Heart rate can be used to determine exercise intensity during a training session or to evaluate the intensity after the session" (p. S96). Other research has compared heart rate in competitive and non-competitive situations. Noakes, Lambert, and Gleeson (1998) found that heart rates were higher than expected during competition. They also found that if the athlete is in a non-competitive atmosphere, his/her heart rate will tend to be lower. The best way to measure heart rate is through the use of HRMs.

### Heart Rate Monitors

Using HRMs is an excellent method of assessing student performance, physical fitness, and energy expenditure without being overly cumbersome or bothersome (Bar-Or, Bar-Or, Waters, Hirji, & Russell, 1996). An early concern of HRMs was the validity and reliability of them (Treiber, et al., 1989). Armstrong (1998) discovered that "Continuous heart rate monitoring. . . is both reliable and valid in children and adults (p. S9). Bar-Or, et al. (1996) support the notion that HRMs are valid and reliable in children as young as three years of age. According to Vuori (1998), the use of HRMs to monitor heart rate has grown tremendously in recent years.

Monitoring heart rate began in the 1970s and often involved cumbersome equipment that

provided discomfort for the individuals being tested (Armstrong, 1998). Electro Cardiograph machines were made portable, but were still an awkward means of monitoring heart rate, especially in field settings (Bar-Or, et al., 1996). A more sophisticated approach was necessary and with the development of the Polar Sport Tester PE 2000, such a product was available. According to Laukkanen and Virtanen (1998), "The first wireless heart rate monitor, the portable Polar PE 2000, was introduced in 1983" (p. S3). This HRM was soon found to be an accurate method of monitoring heart rate. Since then, HRMs have surged into the consumer market. Various models are available for anyone interested in personal fitness and wellness (Laukkanen & Virtanen, 1998). In research, HRMs have been used in a wide variety of settings, including the testing of athletes.

HRMs have been used to measure intensity of athletes in skiing, orienteering, tennis, soccer, running (Lambert, Mbambo, and St. Clair Gibson, 1998), rhythmic gymnastics (Alexander, Boreskie, & Law, 1987), dance (Dahlstrom, 1997), and rowing (Hartmann, Mader, & Hollmann, 1990). "Heart rate is one useful indicator of the intensity of physical activity because of its known, predictable, and reproducible relationships, within certain limits, to energy expenditure and cardiac load or strain" (Vuori, 1998, p. S25-S30). Jeukendrup and Van Diemen (1998) suggest that heart rate monitors assist athletes in their effort to train at proper intensities. Dahlstrom (1997) used heart rate as an indication of effort in a study involving dance students. Strand and Reeder (1993) used heart rate monitors to examine the intensity levels of middle school students in physical education classes. Heart rate monitors, while quite popular in research, have some drawbacks.

Drawbacks of the HRM include that it can be uncomfortable at times (Bar-Or, et al., 1996). It is important that the researcher makes sure the HRM fits properly on each subject prior to testing. Due to the placement of the transmitter belt, the belt can often slip down. To combat this Polar manufactures a sport bra for women where the monitor is placed in

the lining of the bra (Weller, 1997). Finally, it is not uncommon for the transmitters to pick up electrical interference from other monitors, computers, or other electrical equipment (Weller, 1997).

It is evident that Polar HRMs are the best HRMs on the market. Polar participates in an extensive research and development program and continues to be a leader in the field of heart rate monitoring (Laukkanen and Virtanen, 1998).

### Effort Levels

One of the most challenging aspects of teaching physical education is determining the proper way to evaluate students performance. Teachers grade students on such things as attitude, behavior, skill, and effort. Assigning a letter grade to a student's effort level is a daunting task. Teachers rely mainly on their subjective evaluation of student effort levels. Increased effort levels have a positive impact on the class. According to Veal and Compagnone (1995) "effort (as a tool for motivation) is a critical component on which teachers should focus if enhanced skill is the desired outcome" (p. 432).

It can be difficult to get a handle on the physical activity of young people (Armstrong, 1998). The teacher may have a difficult time explaining clearly to the students what their expectation of effort is. Since children often find it difficult to determine their own effort levels (Cowden & Plowman, 1999), teachers must devise a method of assessing effort which is understood easily by the student. Heart rate monitors make it easy for both students and teachers to understand effort levels.

Another problem, self-esteem issues, results from assessment. Students tend to compare themselves to other students when they are formally assessed and lesser skilled students can develop negative attitudes toward physical education (Veal and Compagnone, 1995). Therefore, there has been somewhat of a paradigm shift in thoughts regarding

assessment by physical education teachers in recent years.

Teachers are becoming less concerned with ability and more concerned with students doing their best (Veal and Compagnone, 1995). Ability or skill is easier to objectively grade than effort, which tends to make some teachers stick with traditional styles of assessment through skill testing.

### Effort

Perceptions by students often effect the way in which teachers assess. "More successful students generally perceived themselves as . . . putting forth more effort" (Oman & McAuley, 1993, p. 232). When students have more success, they are likely to produce more effort and as a result have continued success (Veal and Compagnone, 1995). It often takes time before children are able to differentiate between effort and skill (Veal & Compagnone, 1995; Whitehead and Smith 1996). Veal and Compagnone (1995) stress the importance of praising and rewarding good effort. Heart rate monitors provide constant feedback to the student. Sometimes this feedback comes in the form of praise and other times criticism. The recognition of effort can be instrumental in improving skill performance.

## **CHAPTER III**

### **METHODS**

#### **Introduction**

**This study was conducted to compare the effort levels of athletes in physical education classes with their effort levels in athletic team practices. The methods and procedures of this study are outlined in this chapter under the following headings: subject characteristics, pilot study, study design, instrumentation, and statistical analysis.**

#### **Subject Characteristics**

**The subjects (n = 37) used for this study were male basketball players who were in seventh or eighth grade at Kewaskum Middle School. Subjects were selected based on their voluntary participation in the school's extra-curricular basketball program. Prior to participation in the study, each subject was required to obtain permission from a parent or guardian. Upon approval, each subject and his parent or guardian signed an informed consent form (see Appendix A) which described the conditions involved with the study. Permission from the Institutional Review Board for the Protection of Human Subjects at the University of Wisconsin-La Crosse was granted prior to commencement of the study. Permission was also granted by the principal of Kewaskum Middle School, the school where the study was conducted (see Appendix B). Each student also passed a physical examination by a medical doctor, a practice required by the school district.**

**Most potential subjects agreed to participate in the study. Those who declined gave reasons such as uncomfortableness with the HRM, or fear of loss of privacy.**

### Pilot Study

Prior to data collection, subjects took part in a pilot study. This pilot study provided the subjects with the opportunity to learn how to use the HRMs. Subjects were instructed on the proper methods of placing the HRM on and preparing and securing the chest strap. This pilot study allowed the researcher to troubleshoot potential problems and to adjust any deficiencies in the test instruments. Subjects were given the opportunity to try on the heart rate monitors. This pilot study adequately prepared both the researcher and subjects for the data collection process.

### Study Design

Data were collected over three forty-five minute physical education class periods and three forty-five minute sessions of a basketball team practice. The physical education classes were early- to mid-unit basketball lessons. Data were gathered on skill development days. Data were collected from approximately one-half of the subjects in physical education class first and basketball team practice second. The other half of the subject group was tested in basketball team practice first and physical education class second. To help ensure accurate readings, the subject wore the same HRM during physical education class and athletic team practice (Appendix C).

The basketball athletes were measured during three early-season practices. No data were collected on the day prior to a contest or on the day immediately following a contest. Subjects were measured on three consecutive days of practice. Data were not collected during basketball practice on a day when a subject had physical education class. The physical education lesson plans and basketball team practice plans can be found in Appendix D.

Upon completion of each data collection session, data from the Polar Vantage XL HRMs were downloaded onto a computer through the Polar Computer Interface. Polar

Heart Rate Analysis Software was used to determine the average heart rate of the subject. Data from the Polar Accurex IIa models were recorded onto data collection sheets. Files were assigned with a student code and saved onto the computer's hard drive. A back-up copy was made on a floppy disk. Files were kept with the researcher or locked up at all times.

### Instrumentation

The Polar Vantage XL and Polar Accurex IIa heart rate monitoring systems were used for this study. Polar HRMs have been the most accurate models in the field of heart rate monitoring for several years (Laukkanen and Virtanen, 1998). According to Armstrong (1998), heart rate monitoring in children is both reliable and valid. Required for proper monitoring are a Polar Electro transmitter belt, receiver watch, downloading interface, and computer software.

The transmitter belt is secured with an elastic strap. Straps come in four sizes; small, medium, large, and extra-large and can be adjusted to fit properly. The transmitter belt is placed just below the nipples and the electrodes must be moistened prior to use.

Also necessary is the receiver watch. An active display shows time, current heart rate, and duration of monitoring. A signal is also programmable if the exerciser is out of a target zone. For this study the signal was not utilized. The Polar Vantage XL HRM can be programmed to record a signal every 5, 15, or 60 seconds. For the purpose of this study, the watches were programmed to record a signal every 15 seconds. Since the Polar Vantage XL monitors can store up to 8 hours of data, the watches were downloaded at the end of each school day.

Finally, a downloading interface and software are necessary for the analysis of the data. To find the average heart rate of each subject, the watches were placed on the interface and

downloaded onto the computer by pressing a prescribed series of buttons on the receiver watch.

### Statistical Analysis

Descriptive statistics were applied to the data that were gathered, and were used to compare the mean heart rates of physical education classes compared to basketball team practices. A level of significance of 0.05 was assigned to the paired t-test to determine statistical significance.

## CHAPTER IV

### RESULTS AND DISCUSSION

#### Introduction

The purpose of this study was to compare the effort levels of middle school male basketball players in physical education classes to their effort levels in athletic team practice. Thirty-seven subjects, all in good health, from Kewaskum Middle School in Kewaskum, Wisconsin participated in this study. This chapter contains descriptive statistics, tests of hypothesis, and a discussion of the results.

#### Subject Descriptive Statistics

Table 1 contains descriptive statistics related to heart rates in basketball team practice and physical education classes. All of the subjects were in either seventh or eighth grade at Kewaskum Middle School in Kewaskum, Wisconsin. The subjects were measured for three physical education classes and three athletic team practices. Physical education classes were forty-five minutes in duration. Subjects were tested during a forty-minute session of a basketball team practice which was two hours in length.

During the physical education classes the subjects had a mean heart rate of 147.77 beats per minute (bpm). During the basketball team practice, the subjects had a mean heart rate of 146.80 bpm. The standard deviation for physical education class was 10.12 and the standard deviation for the basketball team practice was 7.29. A complete breakdown of the raw data recorded from each individual can be found in Appendix E.

**Table 1. Mean Heart Rates and Standard Deviations of Physical Education Classes and Basketball Team Practices**

Group	N	Mean	Standard Deviation
Physical Education	37	147.77	10.12
Basketball Practice	37	146.80	7.29

A paired t-test was used to determine if significant differences existed between the mean heart rate of the physical education class and the basketball team practice. The results are presented in Table 2. No significant difference was found between the physical education class and the basketball team practice. The degrees of freedom represented by these units is 36, the t-value is  $-.524$  and the p-value is  $.603$ .

**Table 2. Paired T-test Results for Physical Education Classes and Basketball Team Practices**

Group	df	t-Value	p-Value
Physical Education vs. Basketball Practice	36	$-.524$	$.603$

Upon analysis of the results of this study, there was no difference in effort levels of male middle school basketball athletes in athletic team practices compared to physical education classes.

### Discussion

The purpose of this study was to compare the effort levels of middle school male basketball players in physical education classes to their effort levels in athletic team practice. Heart rate was used as the indicator of effort. Heart rate monitors were used to record the heart rate of the subject. The results of the study indicate that physical education

classes and basketball team practices are equally good at eliciting a heart rate which is in the recommended target heart rate zone. While studying the heart rates of schoolchildren, Stratton (1997) found that exercise bouts where the average heart rate was above 140 beats per minute (bpm) proved to reduce submaximal heart rates. Armstrong (1998) also stated that moderate physical activity included a heart rate above 140 bpm and vigorous physical activity included a heart rate above 160 bpm.

The notion that students are not receiving enough moderate to vigorous physical activity in physical education classes does not hold up in this instance. Students were clearly exercising in a moderate to vigorous heart rate zone in both the physical education class and the basketball practice.

The basketball practice was conducted differently from the physical education class. Different individuals designed the lessons and the lessons were taught with different approaches.

Although the subjects were only tested for a 45 minute session of the basketball team practice, the practice lasted two hours. This shows that the students who participate in the sport of basketball are receiving well beyond the recommended dose of daily exercise. Increased promotion of extra-curricular and intramural sport activities would most likely have a positive impact on the fitness levels of youth.

In each instance, the subject was provided with several factors that could have served as motivation. In the basketball practices, the subjects were possibly motivated to perform at a high level so that they would make the starting team. Another reason they may have been motivated was because they wanted to be better than their teammates. The praise and criticism from the coach could have also played a role in their motivation. Other factors for motivation may have been pressure from parents to perform or recognition or acceptance from peers. Still other students may have been intrinsically motivated.

In physical education classes, the subjects were possibly motivated to perform at a high level so that they could earn a high grade in the class. The subjects also could have been motivated by the fear of criticism from the physical education teacher, or by the fear of criticism from his parents. Again, students may have been self-motivated.

In either instance, the subject may have had a personal fitness goal to improve his fitness level, lose weight, or get in shape for another upcoming sport. There are countless reasons as to why the effort levels of the subjects were at the levels they were.

Although few studies have compared physical education and athletics, other research has examined heart rates in different settings. The findings of other research coincides with the findings of this study. Vuori (1998) measured heart rate while individuals participated in cycling, rowing, jogging, or skiing. Average heart rates were recorded as follows: cycling, 153 bpm; rowing, 137 bpm; jogging, 159 bpm; and skiing, 145 bpm. Lambert, Mbambo, and St. Clair Gibson, 1998 found similar heart rates when they measured distance runners in training. They determined that runners who were training for 10 kilometer races had an average heart rate of 143 bpm while they were training. However, this study does not support all of the research in the field.

Strand and Reeder (1993) examined academic learning time in physical education, commonly referred to as engaged time. They found that students spent far more time in physical education classes below their target heart rate zone than they did in their target heart rate zone. Results from this study contradict what Strand and Reeder found to be true of physical education classes. One possible reason for this contradiction was the fact that Strand and Reeder were measuring all students, whereas this study only measured athletes.

One of the best ways to slow the aging process is through regular exercise. Schools provide opportunities for students to exercise. However, physical education teachers are the ones who must motivate the students to exercise. Simply making the class or practice

fun can be motivation enough for students to exercise. Teaching with enthusiasm can instill excitement for exercise in students as well. Teachers and coaches have a tremendous influence on students. It is essential that the teachers and coaches attempt to influence all children positively. Teachers and coaches need to be careful not to use exercise as a punishment or something with which the students have a negative association. Teachers and coaches must also be good role models for the students. Teachers must provide lessons that increase students heart rate for the majority of the lesson. If teachers and coaches can meet these goals, the nation will become healthier.

The information contained in this study provides teachers and coaches with lesson plans that have increased the heart rate in middle school athletes. These lesson plans, found in Appendix D, can be used as a teaching or coaching tool.

Using heart rate monitors can improve a physical education program. Students learn valuable information about their heart. They can see a clear illustration of their heart patterns during exercise. They also become exposed to new trends in the fitness industry at a young age. Students also gain valuable experience working with computers. Heart rate monitors also provide the physical education program with a public relations tool. The home-to-school contact with the physical education teachers is increased. Parents are more likely to view physical education as an important class. The major drawback of heart rate monitors is the cost. Fortunately, the cost of heart rate monitors is dropping. Some models now cost less than one hundred dollars. Grants are available for the purchase of such items. Polar Electro also sponsors a loaner program for teachers and researchers to loan the monitors for a period of time. This provides benefits for the students, yet keeps the cost of the monitors to a minimum.

**CHAPTER V**  
**SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS**

**Summary**

The purpose of this study was to compare effort levels of middle school male basketball players during athletic team practices and physical education activity classes. Thirty-seven healthy male seventh and eighth grade students from Kewaskum Middle School participated the study. Heart rate was measured through the use of Polar Vantage XL and Accurex IIa HRM. The average heart rate for each individual was recorded during three basketball practice sessions and three physical education classes. There was no significant difference found between the physical education class and the basketball team practice. There are be many possible reasons why this occurred.

First, and most simply, the subjects gave equal effort in both basketball and physical education class because they perceived both activities as equally important. The physical education teacher and the basketball coaches may have each had high expectations.

A second factor may be motivation. The subjects may have been motivated in the physical education class by such things as earning a good grade, teacher approval, peer approval, or competition. The subjects may have been motivated in the basketball team practice by such things as earning a starting position, coach approval, peer approval, or competition.

Third, the design of the physical education lesson plan and the basketball practice plan may have been similar, therefore they both elicited a high average heart rate.

Finally, it is possible that athletes tend to enjoy physical activity by nature. Athletes

may put forth more effort in physical education compared to non-athletes. Further studies could compare effort levels of athletes and non-athletes in physical education settings.

### Conclusions

After statistical analysis of the data from this study, the following conclusions were reached:

1. The three basketball team practices resulted in a statistically similar heart rate to the three physical education classes. The basketball team practice was perceived as equally as important to the physical education class to the middle school boys.
2. The three basketball team practices resulted in a statistically similar heart rate to the three physical education classes. This suggests that the design of the basketball practice was similar to the design of the physical education class, thus both resulting in eliciting a high heart rate.
3. The expectations of the basketball coaches was similar to the expectations of the physical education instructor.
4. The basketball team practice provided the subjects with the recommended vigorous physical activity. This suggests that students involved in the extra-curricular activity of basketball are receiving more structured physical activity time than their non-participating peers.

### Recommendations

Additional research is necessary to provide support for the hypothesis and to obtain more information as it relates to effort levels in physical education classes. The following recommendations were made:

1. Measure effort levels in other extra-curricular activities such as volleyball, track and field, wrestling, tennis, cross country, swimming, baseball, softball, or golf to determine if effort levels are similar in other sports.

2. Measure different populations including high school and college athletes. Look for similarities and differences between the different age groups.
3. Measure effort levels in different activities during physical education classes such as softball, team handball, lacrosse, badminton, tennis, or pickleball.
4. Conduct the physical education class and athletic team practice in an identical manner.
5. Measure the effort levels of non-athletes in the physical education setting.
6. Use a larger sample size.
7. Conduct a similar study with females as the subjects.
8. Conduct a similar study in a different geographical location (i.e. Midwest versus West, or urban versus rural).

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**APPENDIX A**  
**INFORMED CONSENT**

**INFORMED CONSENT FORM****COMPARISON OF EFFORT LEVELS OF MIDDLE SCHOOL MALE BASKETBALL PLAYERS DURING PHYSICAL EDUCATION CLASSES AND ATHLETIC TEAM PRACTICES**

I provide my informed consent to have my son take part in the comparative study of effort levels of middle school male basketball players during physical education classes and athletic team practices. Effort levels will be obtained through the use of wireless heart rate monitors. Physical education classes and basketball practices will be conducted as usual. I consent to having data from this study presented such that my child's identity is not revealed. As a result of this study your child will have knowledge related to technology in the field of physical education, and will be provided knowledge of the effects of various levels of exercise on heart rate. I further understand that my son's data will never be given to anyone under any circumstances. I understand that computer files will be stored under a code number and not the name of my child.

- 1) I have been informed that this study will be comparing effort levels of middle school male middle school basketball players during physical education classes and athletic team practices.
- 2) I have been informed that my child's participation in this study will involve regular physical education class and basketball practice and the inherent risks contained in those particular activities.
- 3) I have been informed that there are no known discomforts associated with this study.
- 4) I have been informed that the researcher (Mr. Jeff Grotenhuis) will answer any questions regarding the study, provided the questions do not breach the confidentiality of any student involved in the study.
- 5) I have been informed that my child's participation in this study is strictly voluntary, and I am free to remove my child from this study at any time, with the understanding that no consequences will be administered whatsoever.

Questions or concerns of any nature regarding this study may be addressed to the principal researcher (Mr. Jeff Grotenhuis (262) 626-8427) or thesis advisor (Dr. Jeff Steffen (608) 785-6535). Questions regarding the protection of human subjects may be addressed to Dr. Garth Tymeson, Chair, University of Wisconsin La Crosse Institutional Review Board (IRB) for the Protection of Human Subjects at (608) 785-8155.

In the unlikely event that any injury or illness occurs as a result of this research, the Board of Regents of the University of Wisconsin System, and the University of Wisconsin La Crosse, their officers, agents, and employees do not automatically provide reimbursement for medical care or other compensation. Payment for treatment of any injury or illness must be provided by you or your third-party payor, such as your health insurer or Medicare. If any injury or illness occurs in the course of research, or for more information, please notify the investigator in charge (Mr. Jeff Grotenhuis).

**I have been informed that I am not waiving any rights that I may have for injury resulting from negligence of any person or the institution.**

\_\_\_\_\_  
**Parent/Guardian**

\_\_\_\_\_  
**Date**

\_\_\_\_\_  
**Participant**

\_\_\_\_\_  
**Date**

\_\_\_\_\_  
**Researcher**

\_\_\_\_\_  
**Date**

**APPENDIX B**  
**LETTER FROM PRINCIPAL**

## KEWASKUM MIDDLE SCHOOL

October 22, 2000

Dr. Garth Tymeson  
Institutional Review Board  
University of Wisconsin LaCrosse  
LaCrosse, WI 54601

Dear Dr. Tymeson,

The School District of Kewaskum has no formal protocol for internal review of research involving students in the district. The authority to make decisions based on research and the use of students as subjects is delegated to the building principals. The decision to allow individual students to participate in research is ultimately determined by the parent or legal guardian of the student.

Mr. Jeff Grotenhuis has discussed his research proposal with me and he clearly outlined the procedures of his study to me. I understand that Mr. Grotenhuis will be comparing effort levels of male basketball players in physical education classes and athletic team practices. I understand that Mr. Grotenhuis will be providing parents/legal guardians with informed consent forms. Mr. Grotenhuis will also answer any questions that parents/legal guardians have related to the research.

Mr. Grotenhuis has my permission and full cooperation to conduct a comparative study of effort levels of middle school male basketball players during athletic team practices and physical education classes. I am looking forward to seeing the results of the study.

Sincerely,



Mr. Ken Soerens, Principal,  
Kewaskum Middle School

**APPENDIX C**  
**HEART RATE MONITOR NUMBERS**

## HEART RATE MONITOR NUMBERS

## Grade 8

#	Code
B	CAJO
AA	CLCO
3	FIDA
4	FOAB
15	FRBR
5	HITY
6	JOCR
7	KNJA
14	KOLU
A	KRJJ
17	KUBI
26	LAJI
10	MEJO
23	PECH
4	SEMA
11	SHSA
12	STNA
15X	TOBR
26	VOAD
15	ZIAD

## Grade 7

#	Code
3	BENA
4	BEMA
5	BRRY
6	COFR
7	COBR
27	DABR
9	DOGA
26	EGJA
10	GUJE
28	HAJO
29	JAJA
11	JUJA
20	KENA
12	PAMI
4X	SCAD
14	SHAU
15	VAZA

**APPENDIX D**  
**LESSON PLANS**

**Physical Education Lesson Plan  
Day One-Basketball Unit**

**Equipment:**

- 1 basketball per student and one heart rate monitor per subject.

**Dress for Class (4 minutes)**

- Change clothes.
- Put on heart rate monitor.

**Warm Up (9 minutes)**

- Researcher starts heart rate monitor.
- 12 push ups
- 40 sit ups
- 7 minutes of jogging
- Take attendance

**Warm Up and Ball Handling Drills (15 minutes)**

- **Ball slaps:** Players slap the ball as hard as they can 25 times.
- **Ball tips:** Players pass the ball from hand to hand using only their finger tips.
- **Around the waist:** Player circle the ball around their waist as fast as they can.
- **Figure eights:** Players dribble the basketball through their legs in a figure eight pattern as quickly as they can.
- **Dribbling in motion:** Players dribble down the length of the court and back with their dominant hand, then non-dominant hand, then alternating hands.

**Individual Shooting Drills (10 minutes)**

- Discuss BEEF principle. Balance, Eyes, Elbow, Follow through. Demonstrate proper technique. Discuss the importance of shooting with one hand.
- **Twenty One:** Players work in groups of four and in teams of two. The first shooters on each team take a shot from the elbow of the free throw line. If they make the shot, they earn two points for their team, and they are allowed to take a lay-up shot. If they make the lay-up shot, they earn one point for their team and they pass the ball to their partner. If they miss the first shot, they rebound the ball and pass to their partner who attempts to complete the same task. The first team to earn 21 points is the winner.
- **Mikan Drill:** Players stand with a ball as close to the hoop as they can. In rapid succession, players alternate shooting a left handed shot and a right handed shot for one minute.

**Review, preview, and closure (2 minutes)**

- Review techniques of dribbling and shooting. Who remembers what BEEF stands for? When is it advisable to dribble the ball.
- Next time, we will cover passing and more shooting.

**Dismissal (5 minutes)**

- Researcher will stop watches, record data, and subjects will remove transmitter belt.
- Students are dismissed to change clothes.

**Physical Education Lesson Plan  
Day Two-Basketball Unit**

**Equipment:**

- 1 basketball per student and one heart rate monitor per subject.

**Dress for Class (4 minutes)**

- Change clothes.
- Put on heart rate monitor.

**Warm Up (9 minutes)**

- Researcher starts heart rate monitor.
- 12 push ups
- 40 sit ups
- 7 minutes of jogging
- Take attendance

**Warm Up and Ball Handling Drills (5 minutes)**

- Ball slaps: Players slap the ball as hard as they can 25 times.
- Ball tips: Players pass the ball from hand to hand using only their finger tips.
- Around the waist: Player circle the ball around their waist as fast as they can.
- Dribble relay: Partners take turns dribbling the length of the court.

**Passing Drills (10 minutes)**

- Discuss the different passing techniques for the chest and bounce pass. Two handed passing is performed using equal pressure from both hands and the one handed push pass is performed by using primarily the dominant hand to push the ball to your teammate.
- Partner passing: Partners pass back and forth using bounce pass and chest pass.
- Passing and moving: Partners pass back and forth as they move down court.

**Individual Shooting Drills (10 minutes)**

- Review BEEF principle. Balance, Eyes, Elbow, Follow through. Demonstrate proper technique. Discuss the importance of shooting with one hand.
- Seven spot shooting: Players work with a partner. The object is to make as many shots as possible out of seven attempts from seven identified spots on the floor (right block, right wing, right elbow, free throw, left elbow, left wing, and left block). While one player shoots, the other rebounds. After seven shots the players change roles.
- Hot spot shooting: Players work with a partner to make as many shots as possible.

**Review, preview, and closure (2 minutes)**

- Review techniques of passing and shooting. Who remembers the two different types of passes?
- Next time, we will begin our three on three tournament.

**Dismissal (5 minutes)**

- Researcher will stop watches, record data and subjects will remove transmitter belt.
- Students are dismissed to change clothes.

**Physical Education Lesson Plan  
Day Three-Basketball Unit**

**Equipment:**

- Three basketballs, nine mesh jerseys, and one heart rate monitor per subject.

**Dress for Class (4 minutes)**

- Change clothes.
- Put on heart rate monitor.

**Warm Up (9 minutes)**

- Researcher starts heart rate monitor.
- 12 push ups
- 40 sit ups
- 7 minutes of jogging
- Take attendance.

**Warm Up Drills (5 minutes)**

- Full court lay-ups: Students will perform full court lay-ups. Students will form a continuously moving single file line. Players take turns shooting lay-ups at each basket.

**Three on Three Tournament (20 minutes)**

- Explain tournament: Discuss rules, and answer questions that students have.
- Divide the students into preselected teams.
- Begin tournament.
- All students play half court basketball. Games last 6 minutes. After each game, all teams wearing jersey's rotate and play against a different team. This continues until all teams with jersey's have played all of the teams without jersey's.

**Review, preview, and closure (2 minutes)**

- Record results of tournament on standings chart in gym.
- Next time, we will work on skills and continue our three on three tournament.

**Dismissal (5 minutes)**

- Researcher will stop watches, record data and subjects will remove transmitter belt.
- Students are dismissed to change clothes.

## Basketball Practice Plan Day One

### Equipment:

- 1 basketball per athlete and one heart rate monitor per subject.

### Introduction (3 minutes):

- Subjects put on heart rate monitors and start watches.

### Warm Up (15 minutes)

- **Calisthenics:** Players perform calisthenics (push ups, sit-ups, jumping jacks) in an organized pattern led by team captains.
- **Sprints:** Players run full court sprints up and down the length of the basketball court.
- **Line Drills:** Players enhance agility through short sprinting and cutting.
- **Quick feet:** Players run with short quick steps for one length of the court.
- **Defensive slide:** Players shuffle from left to right for one length of the court.
- **Defensive slide:** Players shuffle from right to left for one length of the court.

### Individual Defensive Drills (5 minutes)

- **Zig-zag drill:** Players work in two. One player has the ball, the other player is the defender. The offensive player dribbles a ball down the court in a zig-zag pattern while the defensive player guards him/her. Players switch roles.
- **Toughness drill:** Players work in groups of three. One player is in the middle as the defender, and the two offensive players are about 15 feet apart. The two offensive players pass the basketball back and forth using a series of chest, bounce, and baseball passes. The defensive player attempts to guard the passer. The defender should work on ball tracing and quick recovery to the ball.

### Team Offensive Drills (10 minutes)

- **Set Plays:** Players work in groups of five and in teams of two. One team is on offense and the other is on defense. The coaches direct their respective teams through offensive set plays. Teaching and instruction is followed by the players performing the plays at game speed.
- **Out of Bounds Plays:** Players work in groups of five. The coaches direct their teams through the out of bounds plays.

### Transition Drills (10 minutes):

- **Three on Two/Two on One:** Three players are on offense and they attempt to dribble down court and score against two defenders. After a basket or rebound, the two defenders return to the opposite court and attempt to score against one defender. The drill continues in this manner for several minutes.
- **Three man weave:** Players will line up in three lanes. The player in the center lane will start with the ball. He/she passes to the right wing, and runs behind the right wing. The right wing passes to the left wing and runs behind the left wing. Play continues in this manner until a player shoots a lay-up. The team gets the rebound and performs the same drill on the way back down the length of the court.

### Closure (2 minutes):

- Researcher will stop watches, record data and subjects will remove transmitter belt.

## Basketball Practice Plan Day Two

### Equipment:

- 1 basketball per athlete and one heart rate monitor per subject.

### Introduction (3 minutes):

- Subjects put on heart rate monitors and start the monitors.

### Warm Up (15 minutes)

- **Calisthenics:** Players perform calisthenics (push ups, sit-ups, jumping jacks) in an organized pattern led by team captains.
- **Sprints:** Players run full court sprints up and down the length of the basketball court. Sprints are performed utilizing two groups, one sprinting group and one recovery group.
- **Line Drills:** Players enhance agility through short sprinting and cutting.
- **Quick feet:** Players run with short quick steps for one length of the court.
- **Defensive slide:** Players shuffle from left to right for one length of the court.
- **Defensive slide:** Players shuffle from right to left for one length of the court.

### Shooting Drills (15 minutes)

- **Seven spot shooting:** Players work with a partner. The object is to make as many shots as possible out of seven attempts from seven identified spots on the floor (right block, right wing, right elbow, free throw, left elbow, left wing, and left block). While one player shoots, the other rebounds. After seven shots the players change roles.
- **Hot spot shooting:** Players work with a partner. The object is find a spot on the floor, shoot in rapid succession, and make as many shots as possible.
- **Team Free Throws:** All members of the team take turns shooting two free throws each. The goal of the team is to make sixty percent of the free throws.

### Team Offensive Drills (10 minutes)

- **Team Offense:** Players work in groups of five and in teams of two. One team is on offense and the other is on defense. The coaches direct players through team offensive concepts. Teaching and instruction is followed by the players rehearsing the offense.
- **Out of Bounds Plays:** Players work in groups of five. The coaches direct their teams through the out of bounds plays. Players work on the plays until all of the players know the plays.

### Closure (2 minutes):

- Researcher will stop watches, record data and subjects will remove transmitter belt.

## Basketball Practice Plan Day Three

### Equipment:

- 1 basketball per athlete and one heart rate monitor per subject.

### Introduction (3 minutes):

- Subjects put on heart rate monitors and start the monitors.

### Warm Up (15 minutes)

- **Calisthenics:** Players perform calisthenics (push ups, sit-ups, jumping jacks) in an organized pattern led by team captains.
- **Sprints:** Players run full court sprints up and down the length of the basketball court. Sprints are performed utilizing two groups, one sprinting group and one recovery group.
- **Line Drills:** Players enhance agility through short sprinting and cutting.
- **Quick feet:** Players run with short quick steps for one length of the court.
- **Defensive slide:** Players shuffle from left to right for one length of the court.

### Rebounding (10 minutes):

- **Triangle rebounding:** Players will form teams of three offensive players and three defensive players. The three offensive players line up on the three point arc, and the three defensive players line up in a triangle pattern in the lane. On each pass by the offense, the three defensive players rotate clockwise one position. Upon the shot, the defensive players seek out an offensive player and box him/her out.
- **All for one rebounding:** All the players find a space in the lane. The coach shoots and all the players attempt to go for the rebound. If a player gets a rebound, he/she is out of the drill. Play continues until there is one player remaining in the drill. The last player to get a rebound must perform 15 push ups.

### Post Drills (10 minutes):

- **Mikan Drill:** Players stand with a ball as close to the hoop as they can. In rapid succession, players alternate shooting a left and right handed shots for one minute.
- **Superman Drill:** Players work in groups of three. Two players are rebounders, and a third is the shooter. The shooter begins by picking up a ball from the right block, he/she shoot the ball off the backboard as quickly as possible and moves to the left block where he/she picks up another ball and shoots that ball. The drill continues in this manner for one minute. The rebounders are responsible for returning the ball to the block after each shot.
- **Feed the Post Drill:** Players form groups of two. Play starts with the ball in the post, the post player passes the ball out to his teammate on the wing. The post player cuts and the wing player feed the post the ball. The post player takes a drop step and shoots.

### Press Defense (10 minutes):

- **Press Defense:** The coaches direct players through press defense assignments. Coaches position players on the court according to the design of the press defense.

### Closure (2 minutes):

- **Researcher will stop monitors and record data and subjects will remove transmitter belt.**

**APPENDIX E**  
**RAW DATA**

CODE	HRM #	HR BB 1	HR BB 2	HR BB 3	BB AVG	ST DEV BB	HR PE 1	HR PE 2	HR PE 3	PE AVG	ST DEV PE
CAJO	B XL	146	161	164	157	9.64365076	164	165	160	163	2.6457513
CLOO	AA	157	126	156	146.333	17.6162803	158	162	150	156.667	6.1101008
FIDA	3A	169	127	146	147.333	21.0317221	150	143	150	147.667	4.0414519
FOAB	4A	154	134	130	139.333	12.868201	142	140	141	141	1
FRBR	15 XL	146	140	146	144	3.46410162	178	169	160	169	9
HITY	5A	148	138	121	136.667	13.6503968	145	153	144	147.333	4.9328829
JOCR	6A	165	147	137	149.667	14.1891978	162	147	167	158.667	10.40633
KNUA	7XL	168	148	150	155.333	11.0151411	160	160	153	157.667	4.0414519
KOLU	14XL	145	145	151	147	3.45410162	169	153	139	153.667	15.011107
KRUJ	AXL	167	164	156	162.333	5.6962407	156	153	160	156.333	3.5116946
KUBI	17ST	156	148	153	152.333	4.04145188	160	151	148	153	6.244898
LAJI	26A	155	145	145	148.333	5.77350289	149	149	154	150.667	2.8867513
MEJO	10XL	164	145	147	152	10.4403085	152	142	130	141.333	11.015141
PECH	23ST	153	137	137	142.333	9.23760431	148	160	160	156	6.9282032
SEMA	4A	151	147	151	149.667	2.30940108	140	153	156	149.667	8.5049005
SFSA	11XL	151	142	147	146.667	4.50824975	150	148	157	151.667	4.7258156
STNA	12XL	154	165	135	151.333	15.1767366	154	150	139	147.667	7.7674535
TOBR	15XL	145	118	148	137	16.5227116	127	137	131	131.667	5.033223
VOAD	20XL	164	121	134	139.667	22.0529665	149	158	157	154.667	4.9328829
ZIAD	15A2	153	135	148	145.333	9.29157324	138	106	150	131.333	22.744963
BENA	3A	154	136	164	152	13.114877	146	144	157	149	7
BEMA	4A	143	136	135	138.667	4.04145188	165	151	156	157.333	7.0945969
BFRY	5A	145	152	125	140.667	14.0118997	120	138	140	132.667	11.015141
COFR	6A	137	142	122	133.667	10.40833	128	163	165	152	20.806652
COBR	7XL	147	146	131	141.333	8.96288644	145	153	155	151	5.2915026
DABR	27ST	134	150	152	145.333	9.86576572	141	136	124	133.667	8.7369949
DOGA	9XL	158	145	152	151.667	6.5064071	146	149	136	143.333	7.3711148
EGJA	28A	150	144	140	144.667	5.03322296	143	141	160	148	10.440307
GULE	10XL	158	150	149	152.333	4.93288286	144	141	159	148	9.6436508
HAIJO	26ST	149	146	145	146.667	2.0816666	143	140	146	143	3
JAJA	28ST	157	153	133	147.667	12.858201	142	130	153	141.667	11.503623
JULIA	11XL	169	163	147	159.667	11.3724614	152	124	108	127.333	23.180452
KENA	30ST	141	125	142	136	9.59839201	147	131	133	137	8.7177979
PAMI	12XL	160	152	165	159	6.55743852	144	132	153	143	10.536654
SCAD	4XL	128	147	124	133	12.2882057	131	136	129	132	3.6055513
SHAU	14XL	157	147	147	150.333	5.77350269	167	164	169	166.667	2.5166115
VAZA	15XL	143	152	156	150.333	6.65832812	138	133	159	143.333	13.796135