

A DESCRIPTIVE STUDY OF ROUNDNET

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DEDICATION

This thesis is dedicated to my mother, father, grandmother, and grandfather. Thank you for instilling in me the value of education and always believing that I can achieve anything I set my mind to. Thank you for teaching me that hard work and perseverance can go a long way to help reach my goals. I would like to thank my grandfather for teaching me there is always something to be learned from any situation or outcome, positive or negative. Thank you all for the constant love, trust, and support I've received throughout my life.

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TABLE OF CONTENTS

	PAGE
Publication Rights.....	iii
Dedication.....	iv
Acknowledgments.....	v
List of Tables	viii
Abstract.....	ix
 CHAPTER	
I. Introduction.....	1
History of Roundnet.....	3
Statement of Purpose and Research Questions.....	5
Assumptions.....	6
Delimitations.....	6
Limitations	6
Definitions.....	7
II. Review of Literature	9
Heart Rate Studies.....	9
Pedometers and Physical Activity	12
Attitude and Motivation in Physical Activity	14
A Description of Roundnet	17
Roundnet and the Media	18
Tournament Play.....	19
Summary	21
III. Method	22
Setting/Content	22
Participants.....	22
Demographics	22

CHAPTER	PAGE
Data Collection	23
Measuring Heart Rate and Step Counts	24
Attitudes	24
Motor Skill Analysis	25
IV. Results and Discussion	27
Quantitative Data	27
Game Duration	27
Heart Rate and Pedometer	27
Roundnet Motor Skill	29
Roundnet Participant Survey	35
Discussion	41
Heart Rate	42
Pedometer	43
Motor Skill Analysis	44
V. Summary, Conclusions, and Recommendations	52
Summary	52
Conclusions	55
Recommendations	56
References	59
Appendices	
A. Participant Informed Consent	64
B. Heart Rate Data and Step Count Collection Form	67
C. Roundnet Volunteer Participant Survey	69
D. Motor Skill Data Collection Form	71
E. Individual Heart Rate and Step Count Totals	73

LIST OF TABLES

TABLE		PAGE
1.	Game Duration Summary	28
2.	Heart Rate and Step Count Summary for Experienced Players.....	29
3.	Heart Rate and Step Summary for Inexperienced Players.....	30
4.	Passing Summary for Experienced Players	32
5.	Passing Summary for Inexperienced Players.....	33
6.	Hitting Summary for Experienced Players	34
7.	Hitting Summary for Inexperienced Players.....	35
8.	Match Summary of Mean Drop Shots and Missed Serves for Experienced Players.....	36
9.	Match Summary of Mean Drop Shots and Missed Serves for Inexperienced Players	37

ABSTRACT

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The purpose of this study was to examine the heart rates, step counts, motor skills, and attitudes of male roundnet participants during match play. More specifically, the study determined if roundnet kept participants in their target heart rate (THR) zone and measured the frequency of steps while playing. Motor skills were analyzed using video and event recording of roundnet game play. Finally, the researcher surveyed participants to determine their attitudes and motivations for participating in exercise and roundnet.

The researcher recruited 20 male volunteer participants between the ages of 18 and 27 to play six games of roundnet. The participants were categorized into two groups, experienced ($N=14$) and inexperienced ($N=6$).

The mean heart rates for the experienced group were 135 bpm, while the inexperienced group registered 122 bpm. All participants in this study reached their moderate THR zone, nine reached the vigorous THR zone. The mean length per game

was 11:23 for the experienced group and 9:26 for the inexperienced group. Experienced participants demonstrated a higher mean for successful right- and left-hand passes, kills, and drop shots. Different reasons which drew participants to roundnet include novelty, physical fitness, and enjoyment of participation.

This study provides an initial database to support roundnet as a sport that may help participants, children, and adults reach their health and fitness goals. Including the sport of roundnet in elementary, secondary, and higher education levels may serve as an affordable and motivating sport to produce moderate to vigorous physical activity.

CHAPTER I

INTRODUCTION

We play and study sports and games because they are socially significant activities. They reinforce important ideas and beliefs in many societies. Many of these ideas and beliefs have been integrated into major spheres of social life such as the family, religion, education, the economy, politics, and the media (Coakley, 2015). Mechikoff (2014) provides a broad definition of sport to include growth and development, role definitions, and a supporting establishment.

Loy (1969) stated that a game is “any form of playful competition whose outcome is determined by physical skill, strategy or chance employed singly or in a combination” (p. 56). Moreover, sports and games can be used to bring people together. Physical education (PE) teachers, professors, athletes and coaches often dedicate their lives to the teaching and learning of sport and games. Individuals who value physical activity often dedicate free time for pursuing sport and games to benefit their lives.

Coakley (2015) defines sport as “physical activities that involve challenges or competitive outcomes” (pp. 7-8). This definition of sport demonstrates a difference between sport and games by viewing sport as more challenging and not necessarily done solely for pleasure. There are an array of reasons individuals participate in sport and games at differing intensity and competitive levels. Some individuals seek physical activity for reasons other than just participation. One reason individuals may value games,

sports, and physical activity is for the numerous health benefits participation may provide. Coakley states, “Pleasure and participation sports today are popular to the extent that people define them as attractive alternatives to the dominant power and performance sports” (p. 543). Pleasure and participation sports are sports that individuals seek out which emphasize freedom, authenticity, self-expression, enjoyment, holistic health, support for others, and respect for the environment. Coakley believes “power and performance sports are the more dominant sports in society, and continue to be grounded in the values of men who believe in military conquest, political control and economic expansion” (pp. 540-541). It is important for teachers and leaders of physical activity to know which sports and games fit a participant’s needs. Having knowledge of a variety of sports and games that meet both the power and performance model and the pleasure and participation model can prove beneficial for individuals who seek regular and motivating physical activity. The Centers for Disease Control and Prevention (CDC) (2014) states:

One way to help maintain a healthy lifestyle is to get the recommended amount of exercise per day. Regular participation in physical activity:

- Helps build and maintain healthy bones and muscles.
- Helps reduce the risk of developing obesity and chronic diseases, such as diabetes, cardiovascular disease, and colon cancer.
- Reduces feelings of depression and anxiety and promotes psychological well-being.
- May help improve students’ academic performance, including academic achievement and grades, academic behavior, such as time on task, factors that influence academic achievement, such as concentration and attentiveness in the classroom. (p. 1)

National recommendations are calling for all people to be active every day of the week. Children and adolescents should get at least 60 minutes of exercise a day. The National Association for Sport and Physical Education and the American Heart

Association (2012) states, “Children and adolescents (ages 6-17) should engage in 60 minutes or more of physical activity daily, including aerobic, muscle strengthening and bone strengthening exercises” (p. 4). Adults should get 150 minutes of moderate to vigorous physical activity per week (MVPA) (CDC, 2008, p. 1).

The CDC (2008) also lists the long-term consequences of physical inactivity:

Overweight and obesity, which are influenced by physical inactivity and poor diet, can increase one’s risk for diabetes, high blood pressure, high cholesterol, asthma, arthritis, and poor health status. Physical inactivity increases one’s risk for dying prematurely, dying of heart disease, and developing diabetes, colon cancer, and high blood pressure. (p. 1)

This evidence indicates a need for finding strategies to get individuals to start and maintain a health-enhancing lifestyle.

With rising healthcare costs and the need to stay well to be productive in society, maintaining a health enhancing lifestyle is vital. Teaching and learning appropriate curriculum content in school PE can also help maintain this healthy lifestyle. “In the United States, where physical education classes have been eliminated in many schools, growing concerns about healthy fitness and obesity are creating interest in new forms of PE that focus on lifetime activity, non-competitive challenges, inclusive participation philosophies, respect and support for others and responsible attitudes towards the environment” (Coakley, 2015 p. 543). Participation in non-traditional activities such as roundnet are one such way these goals may be reached.

History of Roundnet

Roundnet is one of the newest sports receiving increased attention in the United States. According to Spikeball® (n.d.), there are over 1,000,000 roundnet players in the

United States alone. The name of the sport changed from Spikeball® in 2015 to help distinguish the Spikeball® Company from the sport of roundnet. The following is an explanation of rules of game play given by USA Spikeball® (2016c):

Roundnet is a team sport played by two teams of two players. Opposing teams line up across from each other with the roundnet net in the center. The ball is put in play with a service—a hit by the server from behind the service boundary into the net to an opposing player. Once the ball is served players can move anywhere they want. The object of the game is to hit the ball into the net so that the opposing team cannot return it. A team is allowed up to three touches to return the ball. The rally continues until the ball is not returned properly. (p. 1)

Roundnet started out in its early years as a recreational game in 2005. There were no competitive leagues or tournaments, or governing bodies for the sport. As roundnet gained popularity, competitive athletes found other reasons for playing. There was a question as to whether roundnet could be classified as a sport at the time, as it had no governing body or formal competitive leagues. Currently, roundnet can be considered both a game and a sport, based on an individual's needs.

Taking into account different skill levels, experience, and motivations for playing, the style of play can be changed from “game” to “sport.” Roundnet can be utilized across the entire scale of exercisers, from competitive to recreational, to give people options for an active lifestyle. For the purposes of this study, roundnet was considered a sport.

Despite the magnitude of heart rate research for a number of commonly played games, sports, and exercise activities (Docherty & Howe, 1978; Edgett, Ross, Green, MacMillan, Milne, & Gurd, 2013; Laurson, Brown, Dennis, & Cullen, 2008; Morgans, Scovill, & Bass, 1984; Scanlan, Dascombe, & Reaburn, 2011), there is a lack

of heart rate, step count, motor skill, and attitude data for roundnet. To date, no empirical studies have examined this sport. This study provides the public, teachers, and exercise leaders with data regarding average heart rates, step counts, motor skill frequencies, and initial participant attitudes for roundnet. This research may have an effect on the validity of the sport and its applicability for maintaining a healthy lifestyle.

Statement of Purpose and Research Questions

The purpose of this study was to examine the heart rates, step counts, motor skills, and attitudes of male roundnet participants during match play. More specifically, the study determined if roundnet kept the participants in their target heart rate (THR) zone and measured the frequency of steps while playing. Motor skills were analyzed using video and event recording of roundnet game play. Finally, the researcher surveyed participants to determine their attitudes and motivations for participating in exercise and roundnet. The following research questions guided this study.

1. Does participating in roundnet keep the participants in their THR zone?
2. What was each participant's mean heart rate (MHR) during a six-game match?
3. What was each participant's mean step count (MSC) during a roundnet game played to 21 points?
4. What was each participant's MSC over the course of six games, to 21 points?
5. What motor skills do players engage in during game play? The motor skills and movements analyzed for each player were number of successful passes and passing errors per hand, number of successful kills per hand, number of drop shots in play, number of

drop shot kills, number of drop shot errors, and missed serves. Finally, what was the duration of roundnet games and matches?

6. What were the attitudes of male roundnet participants?
 - a. What were the participants' attitudes about playing roundnet?
 - b. What originally drew the participants to play roundnet?
 - c. What were the participants' favorite aspects of roundnet?
 - d. How did roundnet fit into the participants' physical activity choices?

Assumptions

It was assumed that during roundnet play all participants played to the best of their ability and demonstrated a maximal effort during matches.

Delimitations

1. The study took place in a rural northern California city.
2. Data were collected in spring 2016.
3. The study was limited to males aged 18-27.
4. Motor skill data were collected using event recording.
5. The researcher is a competitive roundnet tournament player at the national level.

Limitations

1. The researcher did not control for weather.
2. The researcher did not control for participant fitness levels.
3. The length of the game and matches varied.

Definitions

Aerobic: Most of the 60 or more minutes a day should be either moderate- or vigorous-intensity aerobic physical activity and should include vigorous intensity physical activity at least three days a week (CDC, 2008 p. 1).

Attitude: “Attitudes include enjoyment, fun, interest, likes, preferences, attraction, and value” (Blankenship, 2008 p. 309).

Bone-strengthening: As part of their 60 or more minutes of daily physical activity, children and adolescents should include bone-strengthening physical activity at least three days of the week. It is important to encourage young people to participate in physical activities that are appropriate for their age, that are enjoyable, and that offer variety (CDC, 2014, p. 1).

Drop shot: A short purposeful hit off of the net that is meant to deceive the defensive player.

Error: An attempt to strike the ball that fails (example: A hit off the rim, an unplayable pass to a teammate, the ball bouncing twice off of the net).

Event recording: Observers check the frequency and count a behavior, such as a kill shot (Rink, 2014).

Experienced roundnet player: An individual who has played roundnet at least 15 games before the study, or a player who has played in an official tournament prior to the study.

High heart rate: Highest heart rate recorded during gameplay.

Hitting: Attempting to strike the ball off the net to change possession.

In play hit: Striking the ball off the net to change possession and continue the rally.

Inexperienced roundnet player: An individual who has played roundnet less than 15 games before the study and has not played in an official tournament.

Kill: A legal hit off of the net that cannot be returned.

Low heart rate: Lowest heart rate recorded during gameplay.

Maximum heart rate: Maximum number of heartbeats per minute and predicted by an individual's age (formula: $\text{age} - 220 = \text{maximum heart rate}$).

Muscle-strengthening: As part of their 60 or more minutes of daily physical activity, children and adolescents should include muscle-strengthening physical activity at least three days of the week (CDC, 2014, p. 1).

Pass, successful: Striking the ball to a teammate to continue a rally.

Pass, error: Inability to make a successful pass to a teammate.

Roundnet: Sport played by two teams of two players. Opposing teams line up across from each other with the roundnet net in the center. The object of the game is to hit the ball off of the net in such a way that ball is unable to be returned (USA Spikeball®, 2016c).

Spikeball: Former term for roundnet that was changed in 2015.

Target heart rate zone: Moderate target heart rate zone = 50-70% of participant's maximum heart rate; vigorous target heart rate zone = 70-85% of participant's maximum heart rate (CDC, 2015).

CHAPTER II

REVIEW OF LITERATURE

The review of literature explores relevant studies and information related to the sport of roundnet. This chapter begins with a focus on heart rate studies, pedometers and physical activity, and attitude and motivation in physical activities with similar characteristics to roundnet. These similarities include, but are not limited to, game play demands, strategies, tactics, movement patterns, attitudes, and rules. The chapter concludes with a description of roundnet, roundnet and the media, tournament play, and a brief summary.

Heart Rate Studies

There are a handful of studies that have examined the heart rate of individuals while performing a sport. This information is useful for many reasons. Heart rate can be used to determine if a person is training at the proper intensity, to validate the activity as a useful form of exercise to achieve a health enhancing level of fitness, and to share more information to the public on a growing sport or game.

One of the first studies on heart rate included a study by Seliger, Ejem, Pauer, and Šafařík (1973) who examined the physiological responses of a group of 16 experienced tennis players under the conditions of a ten-minute training match. The researchers collected the data using wireless heart rate monitors. The researchers found that during

the match the MHR of participants was 143 beats per minute (bpm). The results concluded that participants reached their THR zones during the activity.

Docherty and Howe (1978) monitored the in-game heart rates of 30 male squash players of three different skill levels. They found that the MHR reached 80-85% of predicted maximum heart rate for the duration of the game. This shows that the participants were within their desired THR zone. This information was useful because it shows that squash can be a way for an individual to achieve a health enhancing level of fitness.

Montgomery (1981) monitored heart rate during racquetball with stronger and weaker male players with an average age of 30 years. He found that the highest MHR was 181 and the lowest was 146, which was found to be 87% and 90% of the player's maximum intensity. These data are important showing that racquetball can help people reach their THR zone.

Morgans, Scovil, and Bass (1984) monitored heart rate during racquetball matches to determine the intensity of exercise in doubles and singles play with players aged 22-46. They found that in singles play the average heart rate was 161 bpm, which was 83% of one's maximum heart rate. In doubles play the average heart rate was 145 bpm for 15 male subjects, producing 72-82% of one's maximum heart rate.

Laurson, Brown, Dennis, and Cullen (2008) examined heart rates and time spent in the THR zone during high school PE classes. The results showed that students participating in individual- and fitness-based PE classes showed higher average heart rate during activity and more time in the THR zone compared to students who were enrolled in a team sports PE class. These results may show a link between activity choice in high

school PE and the cardiovascular output level of the activity an individual engages in. Fewer participants, in most physical activities, often allows increased physical activity opportunities for players during a game or sport.

Training at the proper intensity level is key to achieving an individual's health and fitness goals. Murray and Kenney (2016) stated, "Training intensity during workouts is typically monitored using heart rate, metabolic equivalents (METs), or rating of perceived exertion (RPE)" (p. 133). It is important to track exercise intensity during workouts. Murray and Kenney also stated, "Heart rate is an obvious response to track during exercise because changes in heart rate are related to changes in oxygen consumption, the gold-standard measure in exercise intensity" (p. 133). Tracking heart rate can be one of the best methods of determining exercise intensity levels. Baumgartner, Jackson, Mahar, and Rowe (2007) stated, "Heart rate monitors offer a convenient method for measuring a physiological indicator of the amount and intensity of physical work that is being performed" (p. 189).

Edgett, Ross, Green, MacMillan, Milne, and Gurd (2013) examined VO₂ peak, VO₂ kinetics, and steady-state exercise performance following four weeks of participation in recreational sport which consisted of basketball, floor hockey, and soccer. Eight males and nine females participated in the study. After training, heart rate during constant load exercise was reduced in both males and females, but exercise respiratory exchange ratio was only reduced in females. Mean heart rate during participation in sport was higher in males than females and higher during basketball than both floor hockey and soccer. These results demonstrate that training adaptations traditionally associated with

endurance exercise can also be obtained through regular participation in recreational sport. This heart rate information can be beneficial in showing that recreational sports may be utilized as a way to achieve and maintain a healthy physical fitness level. Traditional cardiovascular exercise, such as bicycling, jogging, or swimming, is beneficial, however, recreational activities can produce similar fitness benefits.

Pedometers and Physical Activity

Pedometers are a commonly used method of tracking an individual's steps. Pedometers have been used in many studies to assess the number of steps an individual takes while participating in different modes of physical activity (Brusseau, Kulinna, Tudor-Locke, Ferry, Mars, & Darst, 2011) used pedometers to validate the best physical activity mode for achieving the recommended amount of moderate to vigorous physical activity for an average American elementary school student. The researchers studied 298 5th graders from the southwestern United States and compared the exercise intensities that the students reached during four different school based physical activity types; recess only, multiple recesses, one recess and PE class, and multiple recesses and one PE class. To validate these activities, the researchers used pedometers to track the students' step count during a normal school day. The results showed that multiple recesses and one PE class achieved the highest amount of average steps; boys averaged more steps (5,129) than girls (4,115) each day. This study shows that using pedometers may be a useful method of validating how many steps an individual takes during exercise. Step count may also help in tracking an individual's daily activity level, which may help determine

whether the activities in which they participate are helping them achieve the recommended amount of daily physical activity.

Moreover, pedometers may be an inexpensive way to efficiently track steps of an individual participating in physical activity. Hart, Brusseau, Kullina, McClain, and Tudor-Locke (2011) compared step counts detected by four low-cost, objective, physical-activity-assessment instruments and evaluated their ability to detect MVPA compared to the ActiGraph accelerometer (AG). The researchers used one accelerometer and three different pedometers. Results demonstrated that two of the evaluated instruments provided similar group averages for MVPA and step counts compared to AG. The researchers concluded that low-cost instruments may be useful for measurement of both MVPA and steps in children's physical activity interventions and program evaluation. This study was valuable to identify effective tools used for tracking activity when trying to achieve the recommended amounts of physical fitness.

When collecting data it is important to use reliable tools. A number of contemporary technologies have been developed to assess energy expenditure during physical activity. And, most of these tools measure physical activity and caloric expenditure to increase exercise adherence and motivation. Popular brands include Fitbit™, Jawbone Up Wristband™, Garmin Vivofit™, and Nike FuelBand™. Although attractive and user friendly, these measurement tools have not been validated and reported in the literature on exercise (Porcari, Bryant, & Comana, 2015).

All of these studies show that step count has been previously used as a means of gathering useful physical activity data to determine recommended levels of fitness.

Finding many physical activities which are attractive and motivating are important for children and adults.

Attitude and Motivation in Physical Activity

How a participant views an activity can have a huge effect on whether or he or she enjoys and seeks out participation in this activity. Finding an activity that an individual finds value in may lead to pursue continued participation in this activity. Huitt (2011) defined motivation as "... an internal state or condition (sometimes described as a need, desire, or want) that serves to activate or energize behavior and give it direction" (p. 1). Huitt describes other characteristics of motivation as "internal state or condition that activates behavior and gives it direction, desire or want that energizes and directs goal-oriented behavior, influence of needs and desires on the intensity and direction of behavior" (p. 1). Motivation plays an important role in how much physical activity an individual participates in. If an individual can find ways to be motivated to participate in an activity, he or she may be more likely to seek out regular participation in that activity.

Looking at how attitudes about exercise change over time may prove useful to help finding long lasting ways to motivate individuals to exercise. Nowak-Zaleska, Zaleski, Wilk, Walentukiewicz, and Pasek (2014) studied the differences in the motivations of students in physical activity in the years 2000 and 2010. The study took place in Poland and researchers involved first-year students studying at the Faculty of Physical Education at the Gdansk University of Physical Education and Sport. The results showed that "the students from 2000 differed in a statistically significant way in taking care of their health, looks and figure and they were enjoying physical activity more (than in

2010)” (p. 1). Both groups of students from 2000 and 2010 cited a lack of financial means as one of the main reasons limiting their physical activity.

Nowak-Zaleska et al. (2014) reported a disturbing trend from 2000 to 2010. In general, the population was less motivated to participate in physical activity. The individual’s number one motivation for participation in physical activity was not for health in 2010, as it was in 2000. This shows that there is less of a value put on health among this population and perhaps on a more broad scale. Finding out the motivations of individuals can potentially lead to finding more ways for them to start and maintain regular participation in physical activity.

Babic, Morgan, Plotnikoff, Lonsdale, White, and Lubans (2014) conducted a systematic review and meta-analysis to determine the strength of association between physical activity and physical self-concept in children and adolescents. The secondary aim was to examine potential moderators of physical activity and physical self-concept. The results showed that an individual’s perceived competence was most strongly associated with physical activity, followed by perceived fitness, general physical self-concept, and perceived physical appearance. Gender was a significant moderator for general physical self-concept, and age was a significant moderator for perceived appearance and perceived competence. No significant moderators were found for perceived fitness.

Babic et al. (2014) concluded that a significant association has been consistently demonstrated between physical activity and physical self-concept and its various sub-domains in children and adolescents. Age and gender are key moderators of the association between physical activity and physical self-concept. The results of this meta-

analysis demonstrated that finding activities that an individual may participate in which raise one's level of self-confidence and self-concept may lead to higher levels of participation in physical activity. Finding ways to include all ages, abilities, and both genders in different physical activity modes that enhance physical fitness and self-concept may be beneficial in motivating more individuals to participate in physical activity.

Attitudes of students may determine how willing they are to participate in activity. Research on attitudes by Blankenship (2008) defined attitude as, "Attitudes include enjoyment, fun, interest, likes, preferences, attraction, and value" (p. 309). Making sure that physical activity options meet some of these needs may help to boost student attitude toward participation in physical activity. Having a more positive attitude towards physical activity may help motivate an individual to participate in physical activity more often.

How attitudes are shaped may determine how an individual views and engages in activities in the future. Silverman and Ennis (2003) states:

A focus on developing attitude is an important component of teaching... Research evidence suggests that helping students learn skills so they can successfully use it will also enhance their attitudes toward the activity, physical education and activity. (p. 2)

The way an individual learns the skills required to participate in a physical activity may be very influential on attitude and future participation in physical activity.

Solmon (2003) provides a definition of attitude related to PE and physical activity: "Attitudes are factors that have a powerful influence on the decisions we make regarding many parts of our lives" (p. 149). One determining factor of whether individuals will engage in a physical activity is their attitude towards that activity. Having a more

positive attitude towards an activity may motivate an individual to participate in the more often.

Student attitudes may play a large role in how students participate in physical activities. Research on attitudes by Solmon (2003) concluded that students who have positive attitudes about PE content are more likely to exert effort, attend to instruction, and achieve success, compared to students with negative attitudes who may be taught a repetitive or meaningless curriculum. Instructors, coaches, and trainers may benefit from this information by finding ways to build positive attitudes in their students, athletes, or clients to help them achieve greater success.

A Description of Roundnet

Although there is no peer-reviewed data on the sport of roundnet, the basic playing time for an average roundnet match can be estimated. The researcher estimates a standard game to 21 points, using rally scoring, normally takes 12-20 minutes. Roundnet game play can vary depending on experience level, intensity of play, and style of play. Styles of play can range from friendly recreational games to amateur and semi-professional leagues and tournaments.

Roundnet involves hand-eye coordination, anticipation, agility, deception, teamwork, communication, and footwork. The sport exposes players to a system of exercise that can be easily and inexpensively played in many locations throughout the community. The game of roundnet provides an opportunity for individuals within a community to engage in a new physical activity. Whether it is competitive sport or for recreation

and exercise, the researcher hypothesizes that roundnet can be a good way to achieve these goals.

Roundnet is very similar in skills, techniques, movements, and strategies to many other popular sports. Some of these similar sports include, but are not limited to, volleyball, racquetball, tennis, pickleball, and handball. Individuals that enjoy certain aspects of these sports may find similar challenge and enjoyment when playing roundnet.

Roundnet and the Media

Roundnet is in its infancy as a sport and media coverage is growing. This growth is producing more interest in the sport. Sumitra (2012) described roundnet as:

Intense, competitive, trash talk – are the three terms used by the founders of roundnet to describe the game. After watching a short video of how the sport is played on their website, I'm finding it very hard to disagree. It's really quite exciting just to watch, so playing it should guarantee an absolute whale of a time.

Roundnet can be seen in many forms of media, such as online and printed news. Ruiz (2014) quotes one of the world's top players, Skyler Boles: "It's absolutely blown up in the last two years.... Everyone's starting to catch on and it's getting more organized and more intense and more fun and more people are jumping on the bandwagon."

Roundnet's growth can be largely attributed to the use of social media to spread the game. With the use of Facebook, Instagram, and Twitter, roundnet has reached many people in a way that was not available in the past. There are main roundnet pages on each of these domains that most roundnet fans go to when first searching for the sport on social media. This is just the tip of the iceberg in terms of spreading the game.

Grassroots groups such as Nashville Roundnet, Harvard Roundnet, Chico Roundnet, SoCal Roundnet, and Roundnet Pro Training have spread the game's popularity on a personal level to people across the social media world. Each of these organizations has social media accounts that can dive even deeper into the untapped roundnet crowd. They spread the game by showing their love, passion, dedication, and commitment to the sport. By making more people aware it will be easier to get them involved, and it is anticipated social media will play a major role in connecting people in 2016 and beyond.

Tournament Play

Tournaments are structured in this way: consisting of two rounds, pool play and tournament/bracket play. In pool play, teams are randomly assigned to pools and/or based upon previous USA Spikeball® (2016b) ranking to spread out the competition. In pool play, each team will play anywhere from 4-12 other teams depending on how the tournament director splits up the tournament. These games will generally be played first to 11, 15, or 21 points, depending on number of teams and time available. There is no elimination during pool play, as teams are guaranteed a certain amount of games. After pool play results are calculated, the bracket for tournament play is made, factoring in win-loss record and point differential in pool play. Depending on number of teams in the tournament, the first round of tournament/bracket play winners is determined by playing a best of three series where first team to win two of three games to 11, 15, or 21 points advances to the next round. Once the tournament gets to the round of eight, the series becomes best two of three games to 21 points.

There is generally an hour lunch break in between pool and tournament play. After this designated lunch break, the tournament play begins and is continued break free until completion of the championship match. The wait time between matches can vary because of overlap of games during the tournament. There is no designated wait time between matches by USA Spikeball®, so it is up to the discretion of the players when to start their next match. A lot is determined by overlapping matches during pool and tournament play, therefore, a break between matches can last anywhere from 2 to 20 minutes, depending on number of matches being played and the discretion of the players.

Though there is no official information for the durations of play during an average roundnet match, from the researcher's personal and video observations, a single point in roundnet can last anywhere from three seconds to one minute. A normal point lasts 12-30 seconds. In between each point there is a break in action to reset the players' positions to serve again; this can last from 10-30 seconds of walking and standing around. Currently, this information is not backed by any data, so this is another reason there is a need to gather this type of information. Games are generally played first team to 21 points winning by a margin of at least 2 points. The amount of games played in a USA Spikeball®-sanctioned tournament depends on the number of athletes competing.

Roundnet games are self-officiated and played with "Gentlemen's Rules," in which participants must cooperate to uphold the integrity of the game and agree on a ruling in the case of a dispute. In the researcher's observation, this brings the competing athletes together to show respect for the other team, their teammates, themselves, and the

game. Cheating is frowned upon as a community in roundnet and, overall, the attitude is always very positive within the community at recreational games and tournaments.

Roundnet has somewhat followed the sportsmanship model of USA Ultimate Frisbee. According to USA Ultimate (2015):

Spirit of the Game: Ultimate relies upon a spirit of sportsmanship that places the responsibility for fair play on the player. Highly competitive play is encouraged, but never at the expense of mutual respect among competitors, adherence to the agreed upon rules, or the basic joy of play. Protection of these vital elements serves to eliminate unsportsmanlike conduct from the Ultimate field. Such actions as taunting opposing players, dangerous aggression, belligerent intimidation, intentional infractions, or other “win-at-all-costs” behavior are contrary to the Spirit of the Game and must be avoided by all players.

This model works well for new sports because there is a lack of funding for trained officials similar to those in football or basketball leagues. This style of officiating that both USA Ultimate and roundnet employ seem to improve the cohesion within the playing community.

Summary

There was no published research describing the sport of roundnet to determine whether it provides a sufficient level of physical exertion to keep an exerciser in his or her THR zone. Heart rate monitors and pedometers can be an effective way to determine the level of exercise intensity during game-play. This study may validate roundnet as a useful tool for PE teachers and college physical activity classes. Moreover, the results from this study may be used to validate roundnet’s usefulness in achieving and maintaining a health-enhancing level of fitness. Finally, these data may be compared to other sports, giving individuals valuable physical activity information.

CHAPTER III

METHOD

Setting/Context

These data were collected at California State University, Chico, over multiple, non-consecutive, days in spring 2016 in a grassy space on campus, where roundnet is often played.

Participants

The researcher recruited 20 male high school and college volunteers aged 18-27 in northern California via email, social media, and telephone to ask for their participation in this study. Participants with previous roundnet game play experience were categorized as an “experienced player” and players who had not played before were categorized as “inexperienced player.” All participants were required to sign a waiver (Appendix A).

Demographics

Twenty ($N=20$) males aged 18-27 participated in the study. Of the males who participated, two (10%) were 18 years old, three (15%) were 19 years old, six (30%) were 20 years old, three (15%) were 21 years old, one (5%) was 22 years old, two (10%) were 23 years old, one (5%) was 24 years old, one (5%) was 26 years old, and one (5%) was 27 years old. The average age of these participants was 21 years old. The average age of the experienced group was 21 years old and the inexperienced group was 23 years old.

The 20 volunteers ranged in height from 5'6" to 6'1". Their weights ranged from 140 to 185 lbs. All players were right-hand dominant. The total time spent collecting game play data was 12 hours and the total time spent analyzing game play data was 30 hours.

Data Collection

Participants were given a survey asking gender, age, height, weight, hand dominance, and level of roundnet playing experience. Prior to game play, participants completed a liability waiver and participant survey. Some participants played barefoot and some played in sneakers. Depending on the day of data collection, the weather ranged from dry and warm to cool and cloudy. On the day of the event, participants wore heart rate monitors and pedometers while playing roundnet. The heart rate monitors and pedometers were provided by the CSU, Chico Kinesiology Department with prior approval. The Ekho E-10 heart rate monitor watch and chest strap were used. Participants also wore a Walk 4 Life MVPA pedometer to track their steps during each game and for the duration of the six-game match. Participants were then fitted with a heart rate monitor and chest strap, along with a pedometer, which was placed on the side of one hip.

Maximum heart rate, resting heart rate, and THR zones were calculated for each of the participants. At the end of each game, players read their pedometer count and reset the pedometer prior to each game. The recited heart rate and step count data were placed on a recording sheet by the researcher. The researcher recorded the results on a heart rate and step count data collection form (Appendix B).

The participants were lead through a general, full-body warm-up of five minutes and then free roundnet play for eight minutes to warm up. The warm up began

with a 200-meter jog, followed by various dynamic movements including high knees, skips, side shuffle, carioca, and backpedaling. The participants were then given three minutes to complete individual stretching and warm ups. The participants were grouped by the researcher, based on previous playing experience. The newly formed teams played a five-minute warm up game before data collection. Once the warm-up period was over, data collection began and participants played six games to 21 points, with a rest period between matches. Video recording and analysis were used to time code each game.

Measuring Heart Rates and Step Counts

To accurately measure the heart rates of physical activity, proper fitting of heart rate monitors was required. Durkalec-Michalski, Woźniewicz, Bajerska, and Jeszka (2013) measured the heart rate of 20 individuals aged 19-39 during bouts of different exercise intensities. The researchers found the most reliable tool for energy expenditure assessment was the heart rate monitor. Having a reliable tool to measure heart rate was crucial to the validity of this research. Tennis is similar to roundnet, when comparing the scoring and necessary body movements to play the sport.

Attitudes

Participants completed a survey generated by the researcher regarding their attitudes and motivations for participating in exercise and roundnet (Appendix C). Responses were examined for common answers and themes. Common themes were discussed as to why they may be important to the study and the sport of roundnet.

Motor Skill Analysis

The motor skill behaviors and definitions often used in roundnet are listed in Chapter 1. The essential motor skills include passes, hits, kills, drop shots, and serves. Both right-hand and left-hand motor skills were recorded. Videotapes of all games and matches were collected. The videotape was stopped and coded for each participant for each motor skill. The researcher followed the category definitions and systematic event recording techniques were used when assessing teaching and learning (Rink, 2014). A researcher generated data collection sheet is found in Appendix D.

The researcher, recorder, and one other observer were trained to use event recording. Inter-observer agreement was computed by dividing the frequency of motor skill agreements by the agreements plus disagreements. The coefficient was then multiplied by 100. A randomly selected match from the data set was selected for analysis.

Videos of each match were recorded to provide a means for data collection. Each videotape was analyzed and coded by the researcher. The researcher examined important motor skills within game play. The motor skills and movements analyzed for each participant were number of successful passes and passing errors per hand, number of successful kills per hand, number of drop shots in play, number of drop shot kills, number of drop shot errors, and missed serves. Video recordings allowed the researcher to code the motor skills listed above.

Event recording techniques were used in the study to create a cumulative record of the number of discrete instances that a defined event occurs within a specified time

period. Event recording is one of the most useful methods of collecting meaningful teaching and learning data (Siedentop & Tannehill, 2000).

Frequencies and means were calculated for game duration, heart rates, step counts, and motor skills. Once all heart rate data were analyzed, the researcher was able to determine if the participants were within their THR zone during game play.

CHAPTER IV

RESULTS AND DISCUSSION

The first section details the results from the quantitative measures including game duration data, heart rate and pedometer data, and roundnet motor skill analysis data. The second section focuses on survey results. The final section of this chapter discusses results of the study.

Quantitative Data

Game Duration

Each game was coded for length of play. Total time of play and mean time of play per game were calculated. The mean length per game for the experienced group was 11:23 and 9:26 for the inexperienced group. Game duration data are located in Table 1.

Heart Rate and Pedometer

Heart rates were measured using the Ekho E-10 heart rate monitor watch and chest strap. Step counts were measured using Walk 4 Life MVPA pedometer. Heart rates were collected for all participants, following each point. These data are reported as means per game. High and low heart rates per game and heart rates, per six-game match, are reported as means. All heart rate numbers are listed in bpm. Pedometer data were collected using steps per game and mean steps taken, per game, over the six-game match.

Table 1

Game Duration Summary

Group	Game						Total time	Mean time per game
	1	2	3	4	5	6		
1 ^a	12:30	10:24	10:20	10:25	13:00	11:38	1:08:17	11:23
2 ^a	11:00	9:55	11:20	9:20	13:40	12:40	1:07:55	11:19
3 ^a	14:37	12:15	12:20	11:20	11:00	11:57	1:13:29	12:15
4 ^b	11:00	9:50	11:15	11:20	11:20	8:38	1:03:43	10:37
5 ^c	12:20	8:05	8:00	12:00	7:30	8:40	56:35	9:26
Mean							Experienced: All:	11:23 9:26

^a4 experienced players; ^b2 experienced and 2 inexperienced players; ^c4 inexperienced players.

The MHR for the experienced group was 135 and 122 for the inexperienced group. The mean high heart rate for the experienced group was 157 and 146 for the inexperienced group. The mean low heart rate for the experienced group was 116 and 106 for the inexperienced group. The MSC for the experienced group was 797 steps per game and 552 steps for the inexperienced group. Heart rate and step counts for the both groups can be found in Tables 2 and 3. Individual heart rate statistics are reported in Appendix E. All participants in this study demonstrated a MHR within the moderate THR zone. Nine participants, eight experienced and one inexperienced, demonstrated a MHR within the vigorous THR zone.

Table 2

Heart Rate and Step Count Summary for Experienced Players

Name	Mean				% max. heart rate ^a
	bpm	High heart rate (bpm)	Low heart rate (bpm)	Step count (bpm)	
Boris	147	167	115	748	74
Tom	142	158	113	746	72
Trent	152	169	129	805	76
Luke	149	167	125	730	74
Jerry	141	165	115	999	70
Juan	112	140	91	882	56
Walter	113	160	110	866	56
Bart	126	151	103	816	63
Sergio	139	161	118	833	71
Paul	134	156	119	810	67
Brock	139	152	122	934	70
Arnold	154	171	137	756	77
Jacob	122	142	105	502	61
Darrell	126	138	115	728	65
<i>Total</i>	135	157	116	797	68

^aModerate (50-70%) to vigorous (70-85%).

Note: N=14

Roundnet Motor Skill

The researcher, recorder, and one other observer were trained to use event recording. The coding procedures were studied and practiced using sample videos and the researcher generated a data collection sheet. A criterion level of .85 was established

Table 3

Heart Rate and Step Count Summary for Inexperienced Players

Name	Mean				% max. heart rate ^a
	bpm	High heart rate (bpm)	Low heart rate (bpm)	Step count (bpm)	
Amir	111	128	77	703	56
Nick	129	146	109	583	65
Mike	117	135	103	379	59
Brody	114	127	103	403	58
Rashad	111	161	118	590	56
Don	152	176	125	656	79
<i>Total</i>	122	146	106	552	62

^aModerate (50-70%) to vigorous (70-85%).

Note: N=6

prior to and during this study (Siedentop & Tannehill, 2000). Inter-observer agreement was computed by dividing the frequency of motor skill agreements by the agreements plus disagreements. The coefficient was then multiplied by 100. A randomly selected match (from the data set) was selected for analysis. The overall mean agreements were passes .93; hits .86; drop shots .89. These data are reliable.

Data were collected for all participants on a variety of motor skills commonly used and important for success in roundnet gameplay. The goal of analyzing gameplay videotape was to answer the question: What motor skills and movements does a player engage in during game play? The motor skills and movements analyzed for each individual player were number of successful passes and passing errors per hand, number of successful kills per hand, number of drop shots in play, number of drop shot kills, number of

drop shot errors, and missed serves. The videos were coded for the entire length of each game; for all participants in the study event recording was used for each of the roundnet motor skills.

The first set of data analyzed was passing. Passing results for experienced players is located in Table 4 and for inexperienced players in Table 5. The experienced group demonstrated a mean of 21.6 successful right hand passes per game, whereas the inexperienced group had a mean of 18.4. The experienced group demonstrated a mean of 4.7 successful left hand passes per game, while the inexperienced players were coded for 4.5.

The next set of data for the passing category were errors made while attempting to pass to a teammate. The experienced group demonstrated 6 errors per match with the right hand and 3 with the left hand. The inexperienced group exhibited 7.5 passing errors per match for the right hand and 3 with the left hand.

The hitting data were divided into three categories hits in play, kills, and errors. For experienced players, the mean hits in play per game with the right hand was 4.6 per game and the left hand was 1.8. The inexperienced players demonstrated a mean of 7.3 hits per game with the right hand and 2.3 with the left hand. Left-hand kills per game were insignificant.

The second area in the hitting category was kills per hand per game. The experienced group demonstrated a mean of 3.2 kills for the right hand. The inexperienced group demonstrated a mean of 1.2 kills for the right hand.

Table 4

Passing Summary for Experienced Players

Name	Successful RH ^a		Successful LH ^a		Total pass errors	
	Total passes	Passes	Total passes	Passes	RH	LH
Boris	183	30.5	18	3.0	3	2
Tom	163	29.0	31	5.2	10	3
Trent	165	27.5	17	2.8	4	3
Luke	135	22.5	40	6.7	3	4
Jerry	121	20.2	42	7.0	11	2
Juan	106	17.6	66	11.0	8	0
Walter	155	25.8	13	2.2	11	2
Bart	110	18.3	39	6.5	6	7
Sergio	110	18.3	19	3.2	2	2
Paul	92	15.3	36	6.0	5	3
Brock	102	17.0	18	3.0	2	3
Arnold	104	17.3	14	2.3	4	4
Jacob	132	22.0	38	6.3	5	0
Darrell	123	20.5	4	.66	7	2
<i>Total</i>	1801	301.8	395	65.9	81	37
<i>Mean</i>	129	21.6	28	4.7	6	3

^aRH=right hand; LH=left hand.

Note: N=14

The final hitting statistic that was measured was hitting errors per hand. The mean hitting errors per six-game match for experienced players were 9 errors for the right hand and 3 errors for the left hand. The mean hitting errors per six-game match the

Table 5

Passing Summary for Inexperienced Players

Name	Successful RH ^a		Successful LH ^a		Total pass errors	
	Total passes	Passes	Total passes	Passes	RH	LH
Amir	123	20.5	26	4.3	5	1
Nick	129	21.5	34	5.7	4	2
Mike	74	12.3	12	2	3	4
Brody	84	14	52	8.7	7	5
Rashad	150	25	22	3.6	8	2
Don	102	17	17	2.8	18	1
<i>Total</i>	662	110.3	163	27.1	45	15
<i>Average</i>	110	18.4	27	4.5	7.5	3

^aRH=right hand; LH=left hand.

Note: N=6

inexperienced group were 15 for the right hand and 4.5 for the left hand. Hitting data for experienced and inexperienced players can be found in Tables 6 and 7.

The final category of motor skills analyzed was drop shots and missed serves. The mean number of drop shots in play per game for the experienced group was 3 for the right hand and 2 for the left hand. For the inexperienced group, the mean number of drops shots in play, per game, was 1 for the right hand and 1.5 for the left hand.

Drop shot kills was the next category to be analyzed. The experienced group demonstrated a mean number of drop shot kills, per six-game match, of 3.5 for the right hand and 2.0 for the left hand. The mean number of drop shot kills, per six game match, for the inexperienced group was less than 1 for both right and left hands.

Table 6

Hitting Summary for Experienced Players

Name	Hits in play				Kills			Hits error	
	RH ^a	RH/ game	LH ^a	LH/ game	RH	RH/ game	LH	RH	LH
Boris	39	6.5	8	1.3	29	4.8	6	13	4
Tom	38	6.3	10	1.7	15	2.5	4	5	3
Trent	56	9.3	7	1.2	14	2.3	0	13	3
Luke	31	5.2	13	2.2	22	3.7	8	7	4
Jerry	14	2.3	12	2.0	12	2.0	2	10	9
Juan	27	4.5	32	5.3	7	1.2	9	11	5
Walter	22	3.7	14	2.3	17	2.8	5	15	3
Bart	58	9.6	13	2.2	16	2.7	9	12	4
Sergio	18	2.5	3	.7	18	3.0	3	6	0
Paul	9	1.5	3	.5	21	3.5	11	1	0
Brock	26	4.3	3	.5	21	3.5	0	12	2
Arnold	17	2.8	3	.5	20	3.3	1	10	2
Jacob	13	2.1	6	1	18	3	3	13	5
Darrell	20	3.3	13	4.3	36	6	16	4	4
<i>Total</i>	388	63.9	140	25.7	266	44.3	77	132	48
<i>Mean</i>	28	4.6	10.0	1.8	19.0	3.2	6.0	9.0	3.0

^aRH=right hand; LH=left hand.

Note: N=14

The next category was drop shot errors per game. The experienced group exhibited a mean for drop shot errors per game of 1.0 for the right hand and 1.0 for the left hand. The inexperienced group demonstrated a drop shot error per game mean of 1.5 for the right hand and 1 for the left hand. The final category that was analyzed was

Table 7

Hitting Summary for Inexperienced Players

Name	RH ^a	Hits in play		Kills			Hits error		
		RH/ game	LH ^a	LH/ game	RH	RH/ game	LH	RH	LH
Amir	34	5.7	12	2	11	1.8	0	14	4
Nick	18	3	8	1.3	5	.8	1	8	1
Mike	62	10.3	19	3	9	1.5	5	33	7
Brody	77	12.8	22	3.7	11	1.8	4	12	5
Rashad	36	6	4	.7	3	.5	1	13	4
Don	37	6.1	21	3.5	5	.8	1	12	6
<i>Total</i>	264	43.9	86	14.2	44	7.2	12	92	27
<i>Mean</i>	44	7.3	14	2.3	7	1.2	2	15	4.5

^aRH=right hand; LH=left hand.

Note: N=6

missed serves. The experienced group demonstrated a mean of 6, per six games, for missed serves, while the inexperienced group demonstrated a mean of 2.7 missed serves per six game match. The data for drop shots and missed serves are located in Table 8 for experienced players and Table 9 for inexperienced players.

Roundnet Participant Survey

The following section provides an overview of the survey responses by the participants. This survey was administered to the participants prior to roundnet gameplay; they were instructed to answer questions to the best of their ability.

Table 8

Match Summary of Mean Drop Shots and Missed Serves for Experienced Players

Name	Drop shots						Missed serves
	In play RH ^a	In play LH ^a	Kills RH	Kills LH	Errors RH	Errors LH	
Boris	7	3	3	1	2	1	4
Tom	8	5	4	4	3	4	8
Trent	3	2	3	2	3	2	5
Luke	9	2	2	5	2	0	2
Jerry	0	1	0	0	0	0	11
Juan	0	2	4	2	0	3	12
Walter	2	2	2	1	1	0	9
Bart	0	0	0	0	0	0	5
Sergio	2	1	4	4	1	0	6
Paul	1	1	4	3	1	0	9
Brock	3	0	6	0	1	0	6
Arnold	2	1	7	2	2	0	11
Jacob	4	2	2	1	0	1	0
Darrell	4	2	8	5	0	3	1
<i>Total</i>	45	24	49	30	16	14	89
<i>Mean</i>	3.0	2.0	3.5	2.0	1.0	1.0	6.0

^aRH=right hand; LH=left hand.

Note: N=14

The researcher was interested in knowing the physical activity background of these participants prior to the study. All participants had a background in physical activity, including multiple sports. The most common physical activities listed by the participants were soccer, baseball, and basketball. Activities listed less frequently were football,

Table 9

Match Summary of Mean Drop Shots and Missed Serves for Inexperienced Players

Name	Drop shots						Missed serves
	In play RH ^a	In play LH ^a	Kills RH	Kills LH	Errors RH	Errors LH	
Amir	1	3	0	1	1	0	2
Nick	2	0	0	0	1	0	4
Mike	0	3	0	1	2	1	3
Brody	3	2	2	1	3	3	2
Rashad	0	1	0	1	2	2	2
Don	0	0	0	1	0	0	3
<i>Total</i>	6	9	2	5	9	6	16
<i>Mean</i>	1.0	1.5	.3	.8	1.5	1.0	2.7

^aRH=right hand; LH=left hand.

Note: N=6

lacrosse, track and field, disc golf, ultimate disc, field hockey, golf, ice hockey, and muay thai. Four participants listed competitive sport at the collegiate level.

The researcher was also interested in the current activity levels of the participants. Many of the participants chose roundnet as one of their current activity choices. Common physical activity choices were soccer, basketball, and weightlifting. A few participants responded as being very physically active and currently participating in many different physical activities. When asked about current physical activity participation, Brock (experienced) stated, “All sports. Specifically, roundnet and going to the gym. These are a good mix of cardio and weights mixed with competition and fun.” Juan

(experienced) mentioned he likes to engage in a mix of physical activities, “Basketball, soccer and roundnet because it keeps me in shape.”

A few of the participants did not mention roundnet in their current physical activity choices. Mike (inexperienced) responded, “Basketball. I play at least twice a week, but in a perfect world I’d play about 4 times a week. I play it because it’s probably the sport I’m best at.” Rashad (inexperienced) enjoyed participating in multiple activities, stating, “Baseball because of its competitive nature and flag football because I feel I am pretty good at it.” Several participants wrote that they enjoyed certain activities because they perceived themselves as being good in a particular sport. Darrell (experienced) wrote about one aspect that was much different than all of the other responses: “Games/sports that involve quick reaction times and a strong mental component. For all those things, squash was probably my favorite, but I can’t play this in Chico.”

Most experienced participants mentioned roundnet as their most common physical activity choice. Sergio (experienced) said, “Roundnet, I love it and I play 3-4 times a week.” Trent (experienced) also fits roundnet into his physical activity choices: “I love playing roundnet. It gets me active and is very competitive. I play at least 5 times per week.”

The participants were asked what originally drew them to play roundnet. Several participants were drawn to roundnet because it was new to them. Paul (experienced) wrote, “It was something new and another sport to master!” Nick (inexperienced) also mentioned that roundnet was a new activity to him: “There were people playing on the lawn in front of my dorm freshman year and it looked like something new and interesting

to do.” Some participants were introduced to the sport of roundnet by others. Arnold (experienced) said, “My brother played roundnet in his high school PE class, bought a net, and the rest is history.” Other participants mentioned seeing the game for a brief period of time and going out to buy their own roundnet equipment. Trent (experienced) stated, “I saw people playing in the park and wanted to try it so I bought a set.”

There were a few participants that were drawn to roundnet because of other reasons. Bart (experienced) said, “Saw it being played at a high level and wanted to play. It is unique and challenging.” Along with Bart, Brock (experienced) stated, “I am very competitive and love to play sports with my friends.” Sergio (experienced) mentioned that he was drawn to the sport by its unique style of play, the rules, and the 360 degree playing area.

The participants were asked about their favorite aspects of roundnet. A variety of reasons were mentioned, but several themes emerged. Game play style was a category that multiple participants mentioned as part of their favorite aspect of roundnet. Many participants favorably mentioned the quick pace of play as an aspect of roundnet they enjoyed. Arnold said, “I love the fact that it is fast paced, fun, competitive and a good way to stay in shape.” Tom stated, “I like the creativity, the quickness of the game, the transportability of the set, and the level of physical exertion.” Several participants mentioned that roundnet provided a way to meet their physical fitness demands.

Another common theme that emerged was game play strategy. Jacob mentioned, “Power is important but placement can change the game.” About one of his favorite aspects of roundnet, Darrell mentioned, “Being able to predict/read your opponent and

responding with the correct strategy. Also passing effectively so that your teammate can make a good shot.” This emphasized the mental aspect needed for success in roundnet. Finally, Boris summed up his favorite aspects of roundnet by stating, “The friendly atmosphere at tournaments and how easy it is to play, casually or competitively, depending on the group of friends.”

The final question on the survey asked the participants how they see roundnet fitting into their physical activity choices. There were a few common answers that emerged. Participants stated roundnet fit into their physical activity choices because of the workout it provided. Boris stated, “It is a cardio exercise for sure and it works on your quickness and reflexes, and I play for the love of the sport. It’s a great game!” Amir said, “It’s great for my cardio because I prefer something I enjoy rather than just running.” Rashad also compared it favorably to another activity: “It is similar to volleyball which I like. I get a good workout in a small area.”

There was a small group of participants that was interested in playing the sport of roundnet but lacked resources to do so. Darrell stated, “I try to play as often as I can, but it’s a challenge to play/make time with a busy schedule.” One barrier to roundnet may be schedule conflicts. Don stated, “Would be a fun activity to participate in with competitive friends, but I need to identify others with similar ability level.” Another barrier to roundnet play may be finding others with a similar skill level so games are played with success and enjoyment. Tom stated, “I love playing but I don’t have enough people to play with usually.” Nick mentioned, “I don’t know many people who have it so I don’t get to play much but if people offer I’m always down to play.”

Two participants chose roundnet as their main activity for a variety of reasons. Walter stated, "Roundnet is my go to activity. It helps me with quick movement and coordination." Not only does Walter seem to enjoy roundnet but he believes it helps him improve aspects of his athleticism. Arnold enjoys the effect playing roundnet has on the entire body, he said, "It is my main form of physical activity because it works the whole body and mind!" Two other participants said it was a daily physical activity for them. Brock stated, "It's almost a daily physical activity on my schedule." Finally, Bart summed up why he chooses roundnet as one of his primary forms of physical activity, "It's one of my favorite and active choices, I play almost every day and work things around roundnet in my life." Not only does Bart enjoy roundnet as part of his physical activity, but he plans other life events to include roundnet.

Discussion

Heart Rate

Many studies (Docherty & Howe, 1978; Montgomery, 1981; Morgans et al., 1984; Seliger et al., 1973) have examined the heart rate of individuals while performing physical activity but never for the sport of roundnet. Heart rate can be used to determine if a person is training at the proper intensity, to validate the activity as a useful form of exercise to achieve a health enhancing level of fitness, and to share information to the public about a growing sport.

Heart rates were gathered for each player during gameplay. The experienced group scored higher in every heart rate category compared to the inexperienced group.

During game play the experienced group was able to keep their heart rate sustained at a higher rate throughout the six-game set compared to the inexperienced group.

The goal during exercise is to maintain a heart rate within the individual's THR zone. All participants in this study demonstrated a MHR within the moderate THR zone. Nine participants, eight experienced and one inexperienced, demonstrated a MHR within the vigorous THR zone. The lowest MHR percentage was 56% and the highest was 77%. This is important because if roundnet is played vigorously, it may help to validate the sport as a way to achieve an individual's health and fitness goals.

Although all participants were within their THR zones, experienced players achieved a higher average heart rate. The researcher observed that roundnet games played by individuals with more experience and higher skill level increased the game length when compared to less experienced and lower skilled players. Because the rallies lasted longer and fewer errors were observed, players were able to move for longer periods to elevate their heart rate.

Collecting MHRs was useful for comparing roundnet to other physical activities. Seliger et al. (1973) examined the heart rates of 16 tennis players after a ten-minute training match. The researchers found that, during the match, the MHR of participants was 143 bpm. They concluded that participants reached their THR zones during the activity. The results of the study on tennis players' heart rates seem to be comparable to that of roundnet players, 143 bpm for tennis players and 135 bpm for roundnet players.

An activity that is similar to roundnet is racquetball. Since roundnet is played with a teammate, comparing it to doubles racquetball data would be relevant. In doubles

play, the average heart rate was 145 for 15 male subjects, who demonstrated a maximum heart rate percentage between 72-82%. These racquetball data can be compared to the roundnet data in terms of MHR, 135 for roundnet and 145 for doubles racquetball.

Pedometer

Skill and experience level is a key factor when recording the amount of steps a player takes during a sport, game, or exercise. These factors may be, but are not limited to, length of rallies, hitting power and accuracy, passing efficiency, footwork around the net, and other technical skills.

The researcher assumed that the longer a rally lasted, the higher the step count. This can be compared to a player who plays in games with a shorter duration. The experienced participants demonstrated a higher MSC (797) than the inexperienced players (552).

Previous studies (Brusseau et al. 2011; Cledes, Hamilton, & Lindley, 2007; Colley, Janssen, & Tremblay, 2012; Tudor-Locke et al., 2011) looked at daily step counts. Tudor-Locke et al. (2011) performed studies which demonstrated continuous MVPA walking produces 3,300-3,500 steps in 30 minutes, or 6,600-7,000 steps in 60 minutes in 10-15 year olds. Roundnet participants demonstrated a mean of 4,782 steps per six-game match, an average of 66 minutes. Even though roundnet is not an activity that involves continuous movement, such as walking, game play requires taking numerous steps.

Cledes, Hamilton, and Lindley (2008) found that normal weight participants with a mean age of 34 years exhibited a mean steps per day of 10,247 over a four-week

period. A study by Colley, Janssen, and Tremblay (2012) involving 1,613 participants looked at daily step counts for 6-19 year olds. The participants demonstrated a mean daily step count range between 11,290 and 12,512 steps per day. The researchers determined 12,000 to be the goal daily step count for 6-19 year olds. Engaging in roundnet may help when trying to achieve daily step count recommendations.

Motor Skill Analysis

Currently, roundnet has no published statistical data related to the motor skills used during a game and match. In this section, the motor skill data will be discussed by comparing the experienced and inexperienced participants in this study. There was no need to examine statistical differences in this seminal descriptive study.

The first set of data discussed will be game duration. Each game was coded for length of play. Each group's total time of play and mean time of play per game were calculated. The average length per game for the experienced group was 11:23 and for the inexperienced group the mean time per game was 9:26. Average game time may be affected by many factors. The factors include familiarity with the sport, higher skill level, increased passing and use of tactical strategies. The experienced group averaged longer games, but there were fewer inexperienced players ($N=6$) in this study.

The second set of data discussed will be passing data. The mean number of successful passes for the experienced group, per six-game match, was 129 right hand passes and 28 left hand passes. Comparatively, the inexperienced participants demonstrated a mean, per six-game match, for successful right and left hand passes of 110 and 27, respectively. In terms of successful right hand passes, the experienced group

demonstrated a larger mean per game. This may be due to their level of skill and ability to control the ball. Left hand hits were observed with a much lower frequency than right hand hits. Both experienced and inexperienced groups demonstrated similar means for left handed, successful passes. This may be due to less experienced players hitting the ball softer off the net, making it easier to receive and attempt a pass.

The third set of data in the passing category includes errors made while attempting to pass to a teammate. The experienced group demonstrated the mean passing errors, per six-game match, with the right and left hand were 6 and 3, respectively. The inexperienced group demonstrated a passing error mean for the right and left hand of 7.5 and 3. However, the inexperienced group did make 1.5 more errors per game than the experienced group. This small difference is insignificant in terms of recreational roundnet play, but in a competitive tournament one point lost can mean losing a match.

The hitting data were broken down into three categories: hits in play, kills, and errors. For the experienced groups the mean hits per game for right and left hand hits in play were 28 and 10, respectively. The inexperienced group had a mean for right and left hand of 44 and 14 hits per hand.

The researcher assumed that experienced players would have a higher hits in play because of their higher skill level, which presumably lowers the chance for error. Conversely, during game play the researcher observed that the inexperienced players chose to hit the ball off the net more often rather than use all three of their passes with their teammate. The researcher observed that the experienced group frequently used of three of their touches more often than the players in the inexperienced group. Using all of

the allotted passes helps to better control the ball and allows them to set up a better shot to score a point.

There is also a disparity in the number of hits in play per hand. Most of the hits in play were performed with the dominant right hand of the players. However, the inexperienced group used their non-dominant hand more often, per game, than the experienced group. This means players who are experienced may use their dominant hand more than an inexperienced player because they are better able to position their body to use their dominant hand.

The experienced group had a mean kills per game of 19 for the right hand and 6 for the left hand per game. The inexperienced group's recorded mean for kills per game for the right and left hand were 7 and 2. Both groups had more right hand kills than left. This was expected as all players were right-hand dominant. The experienced group had a larger number of kills for the right and left hand than the inexperienced group. This is most likely due to skill level and roundnet experience. Roundnet is a unique sport that requires a frequency of eye-hand coordination and skill that is not often found in other mainstream American sports. Having more exposure and experience to roundnet, such as practice, teaching, and higher competition levels, can sometimes be the reason for skill level differences in individual roundnet players, instead of innate athletic ability.

The mean hitting errors for experienced players per six-game match, were 9 errors for the right hand and 3 errors for the left hand. The mean number of hitting errors per hand for the inexperienced group, per six-game match, were 15 and 4.5 for the right

and left hand, respectively. As expected, each group experienced a higher number of right hand errors; this is most likely due to hand dominance.

The inexperienced group had a higher mean for hitting errors, for both hands, when compared to the experienced group. This was due to the lower skill of, minimal practice of, and less familiarity with roundnet. The researcher believes that hitting errors are sometimes caused by a bad pass from a teammate. These data were not discussed in the study.

The fourth category of game play recording analysis was drop shots and missed serves. There are four categories within this section: drop shots in play, drop shot kills, drop shot errors, and missed serves. The mean for number of drop shots hit in play, per six-game match, for the experienced group was 3 for the right hand and 2 for the left hand. For the inexperienced group, the mean number of drops shots in play, per six-game match, was 1 for the right hand and 1.5 for the left hand. The means in this category are relatively small compared to other categories in terms of percentage of shots hit per game. As expected, each group demonstrated used the right hand more when hitting drop shots in play. Overall, the experienced group averaged more drop shots in play per game. This might be due to a higher level of skill and experience. Performing a drop shot requires execution of a difficult motor skill based on the defense positioning of the defensive team.

Drop shot kills are the next category. The experienced group demonstrated a mean number of drop shot kills, per six-game match, of 3.5 for the right hand and 2 for the left hand. The mean number of drop shot kills, per six-game match, for the

inexperienced group was less than 1 for the right and left hands. The experienced group hit more right-hand drop shot kills per game, while the inexperienced group hit more left-hand drop shot kills per game. The experienced group averaged more drop shot kills per game with both the right and left hands.

The fifth category was drop shot errors per game. The experienced group demonstrated a mean for drop shot errors, per six-game match, of 1 for both the right and left hands. The inexperienced group demonstrated a drop shot error mean, per six-game match, of 1.5 for the right hand and 1 for the left hand. These statistics do not add much to the total number of errors per game, though the inexperienced group had a slightly higher average number of drop shot errors for the right hand than the experienced group.

Missed serves were observed as errors. The experienced group demonstrated 6 missed serves, per six-game match, while the inexperienced group demonstrated a mean of 2.7 missed serves per six-game match. The experienced group of players had a higher number missed serves, per six-game match than the inexperienced group.

During competitive games a missed serve may cost a team valuable points, and one missed serve can sometimes be the deciding factor in roundnet. The researcher speculates that the experienced group missed more serves than the inexperienced group for a few reasons. One reason could be because the experienced group are regularly serving harder, more technically challenging serves in games compared to inexperienced players. This may lead to a higher rate of errors because of the level of difficulty of each serve. From what the researcher observed, the inexperienced group may have a lower mean, per six-game match, for missed serves because they served the ball with much less

force and more room for error than the experienced group. A lot of times more experienced players will aim for what is commonly called a “front pocket,” where the ball takes a sharp low trajectory after hitting off the portion of the net nearest to the server, without hitting the rim. Though this serve sometimes catches the opponent off guard and not able to place a successful touch on the ball, this serve is also difficult and more likely to be faulted. Serve accuracy is crucial to success in roundnet.

Research questions focusing on participant attitudes are as follows: What are the attitudes of male roundnet participants? What are the participants’ attitudes about playing roundnet? What originally drew the participants to play roundnet? What are the participants’ favorite aspects of roundnet? How does roundnet fit into the participants’ physical activity choices? What motor skills do players engage in during game play?

The motor skills and movements analyzed for each individual player were number of successful passes and passing errors per hand, number of successful kills per hand, number of drop shots in play, number of drop shot kills, number of drop shot errors, and missed serves, and duration of roundnet games and matches.

During roundnet gameplay, all 20 participants demonstrated a MHR within the moderate THR zone. Nine participants, eight experienced and one inexperienced, demonstrated a MHR within the vigorous THR zone. The average heart rate for the participants in the experienced group was 135 and 122 for the inexperienced group. The MSC for participants in the experienced group was 797 steps and 552 for the inexperienced group.

The researcher made several changes during the study. Some of these changes were made out of necessity for equipment and some changes were made because better methods were found along the way through the process of trial and error. Although the study yielded positive results for roundnet, the next researcher might want to consider the following. One piece of equipment that posed a lot of difficulty during the data collection process were the heart rate monitors. The monitors sometimes would take a long time to pair up with their chest strap, or not pair up at all. If the monitor and chest strap did not pair up, the participant had to be fitted with a new watch and chest strap which functioned correctly. The potential for inaccuracy while using these tools may have altered the data.

Future researchers should consider different methods of collecting heart rates. Instead of having the players report their heart rates to a recorder after each point, the researcher would have the players report at designated intervals, such as every 5 or 10 points. Baumgartner et al. (2007) state, "Heart rate monitors have few practical limitations. Perhaps the only major drawback is their expense, particularly for models with memory and the capacity to download stored data" (p. 190). The optimal way to record heart rate data would be through wireless technology that reports heart rates in real time to a program on a laptop. Relatively inexpensive heart rate monitors, with multiple-day storage capacity for minute-by-minute heart rates, have made continuous heart rate monitoring a more feasible method for assessing physical activity (Trost & Rice, 2012). In the end, all participants' heart rate monitors ended up working and data were able to be

collected. In the future, if there are funds available, a more reliable, technologically up-to-date heart rate monitor product would make the data collection much easier.

Future researchers may want to use accelerometers when studying roundnet. Relative to heart rate monitors, accelerometers present few burdens to participants and are capable of detecting intermittent activity patterns (Trost & Rice, 2012). Using reliable, user-friendly physical activity assessment tools may help future researchers collect new and important roundnet data.

All 20 participants in this study reported positive attitudes about the sport of roundnet, however, social psychologists have debated the connection (and correlation) between attitudes and behavior for decades (Brehm & Kassin, 1996). Future researchers might consider a longitudinal study of attitudes, motivation, and behavior for recreational and elite players.

Future researchers might want to ask different questions to experienced and inexperienced players. Asking different, experience-specific questions to the experienced and inexperienced groups results may yield new responses. Examples might be asking experienced players how participation in roundnet tournaments affects motivation, frequency of participation, motor skill level, and enjoyment.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter addresses the summary, conclusions, and recommendations of the study. The second section discusses the conclusions based on the research. The third section provides recommendations for the future.

Summary

The purpose of this study was to examine the heart rates, step counts, motor skills, and attitudes of male roundnet participants during match play. Heart rate can be used to determine if a person is training at the proper intensity level and to validate types of physical activity as a useful form of exercise. Heart rates have been researched for several decades.

Pedometers are a commonly used method of tracking an individual's steps to determine one's physical activity level. Pedometers have been used in many studies to assess the number of steps an individual takes while participating in different modes of physical activity.

A participant's attitudes about an exercise, game, or sport activity may have a huge effect on whether they enjoy and seek out participation in this activity. Babic et al. (2014) found that a physical activity that produces individual value may lead to continued participation.

To date, no studies have examined the sport of roundnet. The results of this study provide the public, teachers, and exercise leaders with average heart rates and step counts, motor skill frequencies, and participant attitudes for roundnet. This initial research effort may validate the sport and its applicability for maintaining a healthy lifestyle.

The researcher recruited 20 male volunteer participants between the ages of 18 and 27 to play six games of roundnet. The participants were categorized into two groups, experienced ($N=14$) and inexperienced ($N=6$). The study took place on a grassy field, near Yolo Hall, on the campus of California State University, Chico. The space was large, safe and accommodating for roundnet. Prior to game play, the participants completed a liability waiver and participant survey. Moreover, the participants were asked about their background in sport and exercise. Finally, they were asked about their roundnet playing experience. Participants were divided into teams based on previous playing experience. After a group warm up, participants played six games of roundnet. Each match was video recorded for eventual data analysis. Each videotape was coded by the researcher to determine the frequency of motor skills within game play.

The MHRs for the experienced group were 135 bpm and for the inexperienced group the MHR was 122 bpm. The mean high heart rate for the experienced group was 157 and for the inexperienced group it was 146. The average low heart rate for the experienced group was 116 and 106 for the inexperienced group. The MSC for the experienced group was 797 steps and 552 steps per game for the inexperienced group.

This descriptive study provides a beginning database to support roundnet as a sport that may help a participant reach their health and fitness goals. Including roundnet in elementary, secondary, and higher education programs may serve as an affordable and novel sport with the potential to produce MVPA.

The motor skills and movements analyzed for each individual player were number of successful passes and passing errors per hand, number of successful kills per hand, number of drop shots in play, number of drop shot kills, number of drop shot errors, and missed serves.

The mean time per game for the experienced group was 11:23 and 9:26 for the inexperienced group. The mean number of successful passes, per six-game match, for the experienced group was 129 right-hand passes and 28 left-hand passes. The inexperienced participants demonstrated a mean number of successful right- and left-hand passes of 110 and 27, respectively. The experienced group demonstrated fewer mean passing errors, per six-game match than the inexperienced group.

For the experienced group the mean hits, per six-game match, for right- and left-hand hits in play were 28 and 10, respectively. The inexperienced group had a mean for right and left hands of 44 and 14 hits per hand. The experienced group demonstrated a mean kills, per six-game match, of 19 for the right hand and 6 for the left hand. The inexperienced group's recorded means for kills, per six-game match, for the right and left hand were 7 and 2. The mean hitting errors, per six-game match, for experienced players were 9 for the right hand and 3 for the left hand. The mean numbers of hitting errors, per

six-game match, for the inexperienced group were 15 for the right hand and 4.5 for the left hand.

All participants had a background in physical activity including multiple sports. A few participants responded as being very physically active and currently participating in many different physical activities. Common physical activity choices were soccer, basketball and weightlifting. Most of the experienced participants mentioned roundnet as their most common physical activity choice. Several participants were drawn to roundnet because it was new to them.

Conclusions

This section presents the study's conclusions about the participants' heart rate, step counts, motor skills and attitudes associated with roundnet. One goal during exercise is for an individual to maintain a heart rate within their THR zone. The MHR of all participants was within their THR zone. The lowest MHR percentage was 56% and the highest was 77% maximum heart rate. This is very important because if played vigorously, the sport of roundnet may serve as a useful activity to help achieve an individual's health and fitness goals.

Although all participants in this study were within their THR zones, experienced players achieved a higher average heart rate. The researcher has observed that roundnet games played between individuals with more experience and higher skill level can last longer than games played between less experienced and lower skilled players. Because the rallies lasted longer and fewer errors were observed, the experienced players were able to increase both steps and heart rates.

Recommendations

Future researchers might want to survey experienced players at roundnet tournaments. Another suggestion for future research might include different methods of collecting participant responses, such as focus groups and one-on-one interviews. Surveying individuals with different roundnet experiences and skill levels might produce a needed database about motivations to participate in roundnet.

Future researchers studying heart rate, step count, and game play analysis may want to examine, at the elementary, secondary, and higher education levels, a larger population of players. As important, future researchers may want to investigate both female and co-ed players and teams.

Future studies of roundnet involving different age groups and skill levels may be important to the development of the sport. Researchers might want to perform a similar roundnet study on heart rate, step count, motor skill analysis, and attitudes with a PE class. How might the students' heart rates, step counts, motor skills, and attitudes change during an extensive unit of instruction?

Studies investigating the biomechanics of roundnet may also be important to the development of the sport. Future researchers might want to examine the biomechanics of top ranked tournament players. Analyzing how elite roundnet players execute important roundnet motor skills might be beneficial to individuals seeking improvement in roundnet.

Future researchers might want to examine the movements and motor skills of elite players while playing in a regional or national tournament. Does their style of play

and movement differ in a tournament compared to practice matches? What is their heart rate and step count in the late rounds of a tournament compared to an earlier rounds? Do experienced players perform roundnet motor skills differently than a less experienced or skilled player? Investigations using accelerometers to track player movement in multiple planes might be important for the in-depth study of this sport.

The researcher suggests multiple marketing strategies to grow the sport of roundnet. One way is to make roundnet more available through schools, camps, and community centers. Having roundnet in elementary and secondary PE programs may serve as a new, affordable physical activity for youth to participate in while raising their heart rate. More accessible information is needed about the strategies and tactics of roundnet's most successful tournament players.

Teachers and community leaders play a large role in the growth of roundnet. There are multiple ways teachers and community leaders can advance the sport of roundnet. One method might be creating fun, successful roundnet experiences for inexperienced roundnet players. One method to achieve this might be modifying roundnet game play and creating game-like drills. Experienced roundnet players might be invited to events to help inexperienced players with their skills and spread their knowledge of the sport.

Creating open play days at schools and local parks might be another way to help spread the merits of roundnet. Teachers might have students demonstrate roundnet at school rallies, create lunch time roundnet leagues, and intramural roundnet clubs.

Community leaders might want to hold roundnet demonstrations and open play at local parks for all members of the community.

The researcher suggests that roundnet might be improved with rule and court modifications. The researcher often observes that when a ball is hit with a lot of power and force off the net, the ball travels a long distance, shortening many rallies. The researcher suggests roundnet rules might want to enforce a “boundary” line circling the court which the ball cannot travel past. This line might be 10-20 feet away from the net, depending on player preference. The researcher hypothesizes that this rule modification might help to lengthen roundnet rallies and increase fitness. This might be because players would be forced to control their hard shots off the net to keep their hit within the boundary line. Defensive players would also have to be aware of the boundary line to determine if a hit off the net will be in or out of bounds.

This study of roundnet is the first step in the scientific investigation of an emerging sport. It is the hope of this researcher that further empirical evidence will support the growth of this sport in the United States and across the world.

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APPENDIX A

PARTICIPANT INFORMED CONSENT

Dear Roundnet Player,

My name is Tom Witt and I am a Master's student at CSU Chico. I am conducting a research project to examine the heart rates, number of steps, motor skills and movements used and associated attitudes of male roundnet participants during match play. You will be asked to play in six roundnet matches over several days. You will be asked to go through a 5 minute general warm up led by an instructor, followed by a roundnet specific warm up. You will then play 6 games to 21 points.

Prior to data collection you will be given a survey about your physical activity background and why you play roundnet. You do not need to worry about your name being disclosed to others.

If you have any questions during the survey please ask. It is very helpful that you answer all parts of the survey honestly and to the best of your ability. There are always minimal risks of any physical activity program which include muscle or ligament injuries, fatigue, altered heartbeat, gastrointestinal distress, chest pain and breathing difficulties. If any of these side effects occur, contact your medical provider or the Student Health Center immediately.

Your participation in this study helps to provide an empirical base for the sport of roundnet. By completing this study you will help the researcher and possibly other teachers understand more about this new sport.

Having read the information on this form, you decide to consent to involvement in this study. Please sign and return this consent form. Participation in this program is entirely voluntary. You may choose not to participate at all or you may withdraw at any time. By signing below you are confirming that you understand what is being asked of you during the study.

Thank you,

Tom Witt

M.A. Student Researcher

My signature on this line affirms that I am interested in participating in this research project. I have had the protocols and procedures explained to me and all my questions have been answered. I understand that my signature below does not mean that I have to participate fully in this research and that I can stop my participation at any time I wish without consent.

Student Name

Date

Student Signature

APPENDIX B

HEART RATE DATA AND STEP COUNT
COLLECTION FORM

Number of Point	Participant 1 Heart Rate	Participant 2 Heart Rate	Participant 3 Heart Rate	Participant 4 Heart Rate
1				
2				
3				
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31				
Step Count				
High HR				
Low HR				
Average HR in Match				

APPENDIX C

ROUNDNET VOLUNTEER PARTICIPANT SURVEY

1. Age:
2. Height:
3. Weight:
4. Resting Heart Rate:
5. Max Heart Rate:
6. THR Zone:
7. Roundnet Playing Experience:
8. What is your dominant hand?
9. What is your background in sports and exercise prior to participation in roundnet?
10. What is your favorite form of physical activity to engage in? Why? How often do you participate in this activity?
11. What originally drew you to play roundnet?
12. What are your favorite aspects of roundnet?
13. How does roundnet fit into your physical activity choices?

APPENDIX D

APPENDIX E

INDIVIDUAL HEART RATE AND STEP COUNT TOTALS

<u>PLAYER 1 Boris-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	153	140	158	144	146	141	147
High Heart Rate	174	159	180	163	169	158	167
Low Heart Rate	100	117	119	119	120	117	115
Step Count	915	667	751	654	786	717	748

<u>PLAYER 2 Tom-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	148	133	145	145	139	139	142
High Heart Rate	160	150	170	163	155	150	158
Low Heart Rate	93	117	118	114	121	119	113
Step Count	969	667	749	704	733	655	746

<u>PLAYER 3 Trent-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	158	147	155	151	153	147	152
High Heart Rate	175	162	171	165	172	167	169
Low Heart Rate	112	118	141	141	133	128	129
Step Count	927	730	794	677	995	704	805

<u>PLAYER 4 Luke-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	159	153	151	149	143	140	149
High Heart Rate	170	164	170	171	165	161	167
Low Heart Rate	123	116	133	126	128	126	125
Step Count	964	726	701	686	680	622	730

<u>PLAYER 5 Jerry-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	138	143	144	136	150	133	141
High Heart Rate	164	171	166	157	170	164	165
Low Heart Rate	103	105	127	115	130	111	115
Step Count	980	823	1119	769	1150	1152	999

<u>PLAYER 6 Juan-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	103	106	116	118	113	106	112
High Heart Rate	119	133	143	148	166	130	140
Low Heart Rate	85	90	89	95	94	91	91
Step Count	620	568	943	663	1382	1117	882

<u>PLAYER 7 Walter-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	130	120	137	124	149	137	113
High Heart Rate	155	138	170	138	178	180	160
Low Heart Rate	98	98	115	114	123	114	110
Step Count	680	702	993	726	1169	904	866

<u>PLAYER 8 Bart-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	118	118	130	124	136	130	126
High Heart Rate	141	135	159	140	171	157	151
Low Heart Rate	94	96	97	101	115	117	103
Step Count	704	624	824	648	1106	977	816

<u>PLAYER 9 Sergio-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	143	146	145	138	137	134	139
High Heart Rate	172	165	157	161	163	155	161
Low Heart Rate	114	128	113	118	123	114	118
Step Count	1020	737	821	696	976	748	833

<u>PLAYER 10 Paul-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	133	139	134	133	139	128	134
High Heart Rate	158	158	157	152	157	152	156
Low Heart Rate	113	116	113	120	132	117	119
Step Count	1011	680	766	655	922	823	810

<u>PLAYER 11 Brock-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	144	147	141	130	138	132	139
High Heart Rate	159	168	158	145	155	147	152
Low Heart Rate	118	121	116	128	129	118	122
Step Count	1101	951	964	781	984	823	934

<u>PLAYER 12 Arnold-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	155	159	156	153	154	148	154
High Heart Rate	180	178	168	161	170	170	171
Low Heart Rate	135	135	151	133	139	130	137
Step Count	1035	800	931	703	900	795	756

<u>PLAYER 13 Nick-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	124	134	134	120	130	129	129
High Heart Rate	158	155	143	142	138	139	146
Low Heart Rate	100	84	122	115	115	115	109
Step Count	583	652	688	546	560	470	583

<u>PLAYER 14 Jacob-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	119	120	125	121	122	122	122
High Heart Rate	136	149	146	145	130	136	142
Low Heart Rate	96	106	113	109	105	102	105
Step Count	502	560	407	583	531	428	502

<u>PLAYER 15 Amir-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	114	112	117	105	106	112	111
High Heart Rate	132	134	126	127	132	117	128
Low Heart Rate	90	90	100	93	90	87	77
Step Count	703	702	797	727	699	589	703

<u>PLAYER 16 Darrell-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	120	122	129	126	125	136	126
High Heart Rate	128	137	140	144	133	146	138
Low Heart Rate	106	97	114	113	117	112	115
Step Count	728	641	856	766	708	671	728

<u>PLAYER 17 Mike-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	113	115	119	125	118	114	117
High Heart Rate	135	137	142	137	136	124	135
Low Heart Rate	89	102	103	112	110	100	103
Step Count	543	318	337	460	317	298	379

<u>PLAYER 18 Brody-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	114	114	114	120	109	111	114
High Heart Rate	127	124	126	139	117	129	127
Low Heart Rate	103	101	105	106	101	100	103
Step Count	307	342	371	617	439	342	403

<u>PLAYER 19 Rashad-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	149	124	127	147	129	135	111
High Heart Rate	174	160	159	172	150	153	161
Low Heart Rate	119	122	119	109	119	118	118
Step Count	748	493	477	774	526	519	590

<u>PLAYER 20 Don-Heart Rate and Step Count</u>							
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Average
Heart Rate Average	148	150	154	161	152	155	152
High Heart Rate	181	180	175	176	170	172	176
Low Heart Rate	103	135	124	125	135	130	125
Step Count	823	539	558	708	713	576	656