**Dance Simulation Games in Physical Education**

by

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## Preface

This paper is an original work by Brett Barron. The research project, of which this Masters Project is a part, received research ethics approval from the University of Alberta Research Ethics Board, Project Name "Dance simulation games in physical education", No.0029500, September 11, 2014.

## Abstract

Recently, a new wave of gaming known as active gaming or exergaming has shown it can be an educationally functional and enjoyable method of learning within areas of the curriculum which highlight dance or other individual activities. This study aimed to better understand the impact dance and rhythm exergames had on students within a physical education setting and whether or not these devices should be a consideration for practitioners within the field of physical education to aid in curricular instruction.

This concurrent mixed methods study rotated the dance and rhythm exergame, Dance Dance Revolution Classroom Edition, among six participating schools within an urban school district in Alberta, Canada. Cooperating schools used the exergaming tool for approximately three weeks. During this time students came into contact with the dance and rhythm exergame due to its insertion into regularly scheduled physical education classes.

Each of the participating schools designated a lead teacher responsible for the use and maintenance of the equipment. After participants had used the equipment for approximately three weeks, lead teachers administered a five point Likert-type scale survey, allowing students to rate their motivation and attitude levels towards the device. In an effort to triangulate the data, two group interviews were conducted with three students within each of the respective age demographics: one group to represent the elementary sites, and another group of junior high students.

A total of 121 students participated in the study, 64 females and 57 males. Data from the surveys was analyzed in four separate categories then analyzed with the qualitative group interview data. First, each individual site was examined, next elementary students were compared

to secondary students, then male survey results were compared to female, and finally the results of all the surveys were looked at as a whole.

Overall, the use of a multiplayer dance and rhythm exergame within a physical education setting was a safe and enjoyable experience for the majority of participants. This study noted high levels of intrinsic motivation towards the use of dance and rhythm exergames within a physical education dance unit. In particular, female and elementary aged participants showcased the highest efficacy levels towards the multiplayer dance and rhythm exergame intervention. Additionally, despite how interested students were in the game a high rate of student participation was sustained throughout the intervention period.

Overall, large-scale multiplayer exergaming devices are still in their infancy and more time is required to better understand the long-term sustainability of these devices before jumping to spend large sums of money to purchase the equipment. However, based on the results of this study it is clear that participants viewed the multiplayer dance and rhythm exergames as a natural component within a PE program, both now and in the future. Therefore, future research should focus on and continue to develop the topics highlighted in this study.

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## Approach

The following is a Master's project for the Department of Secondary Education at the University of Alberta. In accordance with good academic writing the content of each section was based on an external authority within the field of mixed methods research. In this case Creswell's (2009) third edition of *Research and Design* was used as a road map to provide objective reasoning for the contents of the Introduction, Literature Review, Methodology, and Procedures sections. Finally, the expertise of Dr. David Chorney and the understanding that I arrived at as the primary researcher will make up the Discussion and Summary sections of this paper.

# Section One: Introduction

## Background

The problem of childhood inactivity has many repercussions for the general health and wellness of Canadian youth as well as negative consequences for the publicly funded healthcare system. I have outlined some of the steps the Alberta government has taken to address the matter within its own schools, and I have highlighted the deficiencies within the current legislation. I have also offered insights about the significance of this study while providing some context for the use of dance and rhythm exergames within a school setting. Finally, I have drafted a purpose statement that will convey the intent of the proposed study while clearly defining the boundaries between the research questions and the central phenomenon.

## The Problem

The World Health Organization (WHO) has identified childhood physical inactivity as the fourth leading risk factor for global mortality. The inactivity crisis has many implications for the prevalence of noncommunicable diseases and the general health of children and youth worldwide (WHO, 2010).

Canadian officials are also concerned about the inactivity levels of today's youth, as the opportunity for school-aged children to participate in moderate to vigorous physical activity has sharply declined over the past three decades. Active Healthy Kids Canada (2013) indicated that the conveniences of motorized transportation, fewer opportunities to safely participate in neighborhood sports or games, and the growth of sedentary leisure activities such as television viewing are predominant factors that contribute to the overall inactivity levels of Canadian youth. Several professional bodies have determined that dietary habits and time spent being physically inactive are key contributors to the alarming obesity rates seen within Canadian society

(Canadian Fitness and Lifestyle Research Institute [CFLRI], 2009; Janssen, 2007; Janssen, Katzmarzyk, Boyce, King, & Pickett, 2004; Statistics Canada, 2010).

The dangers of an inactive lifestyle cannot be overstated, children and youth who are unable to maintain a healthy body weight through their childhood and adolescent years face a greater chance of developing chronic diseases such as hypertension, asthma, orthopedic injuries, sleep apnea, and diabetes (Ranjana et al., 2002; Rodriguez, Winkleby, Ahn, Sundquist, & Kraemer, 2002).

Compounding this gloomy outlook is the cost associated with providing healthcare to a population with suboptimal health. Every year the Canadian healthcare system incurs an additional five million physician and hospital visits due to insufficient levels of physical activity within the country (Sari, 2009). According to the Public Health Agency of Canada (2007) the total cost to taxpayers due to physical inactivity is currently estimated to be over five billion dollars per annum, or 2.6% of the total healthcare cost in Canada. If left unchecked, medical needs of the overweight and obese population has the potential to financially cripple the Canadian healthcare system (Katzmarzyk & Janssen, 2004).

**Measures Taken to Address the Problem**

**DPA.** As a result of the burden placed on the healthcare system and the belief that active students are better able to learn and participate in school communities, Alberta Education (2006) introduced the Daily Physical Activity (DPA) initiative. This legislation mandated that effective September 2005, school authorities would ensure all students from grades 1 to 9 would be engaged in physical activity for at least 30 minutes per day. The document accompanying this mandate provided a large list of physical activities that could be performed, and different ways to accommodate student needs with the equipment and physical spaces available to schools.

***Deficiencies.*** Since its inception there has been little evidence to suggest the DPA initiative has had any effect on student activity levels. Often, school administrators are left with the choice of whether or not to accommodate the initiative within their timetable. But, even when scheduling is provided, typically a lack of quality instruction of DPA and/or inadequate facilities leaves the initiative falling short of its target outcome (Chorney, 2008).

**Health and wellness framework.** In an attempt to better address the health and activity levels of children Alberta Education (2009) completed a review of the wellness related programs of study and developed the Framework for Kindergarten to Grade 12 Wellness Education. The definition of wellness within the parameters of education is defined as a "balanced state of emotional, intellectual, physical, social, and spiritual wellbeing that enables students to reach their full potential in the school community" (Alberta Education, 2009, p. 3). This integrated, student centered document provides guidance for future developments within Alberta's physical education, health and life skills, and career and life management programs of study. Implementation of the new wellness framework will begin with the development of Health and Physical Education (HPE) 10-20-30 curricula at the high school level. Other programs of study will be addressed as future works unfold.

***Deficiencies.*** Although, Alberta Education has set forth the target date of 2014, this is still several years from being fully implemented into schools, and there is no guarantee this new strategy will provide students with the knowledge, skills, and attitudes to live a healthy active lifestyle. Additionally, Alberta Education has not set out dates for the deployment of the wellness framework for any new curricula other than senior high school. In the meantime practitioners and theorists need to come up with creative solutions to contribute towards the framework rather than wait for the next government document to appear.

**Significance of this Study**

Playing video games is a popular free-time activity among adolescents and an influential medium within youth culture (Kretschmann, 2010; Nippold, Duthie, & Larson 2005; Sweeny, 2010). Traditionally seen as yet another contributor to the sedentary lifestyles of youth, some scholars have found reason to investigate the curricular implications of this ever-evolving technology, particularly with respect to physical education (Yang, Smith, & Graham, 2008). Recently, a new wave of gaming known as active gaming or exergaming is showing it can be an educationally functional and enjoyable method of learning for participants who find a traditional physical education setting unappealing (Papastergiou, 2009). Sheehan and Katz (2010) describe exergames as "videogames with an interface that requires active involvement and exertion of physical force by participants" (p. 13). Exergames go beyond the simple finger movements of conventional videogames by requiring the participants to engage a virtual space with their entire body (Mears & Hansen, 2009).

Exergames will not replace the action of physically participating in sports or games. However, they may provide physical educators with a new medium to reach students who have lost the motivation to take part in a traditional physical education setting. Exergames can potentially be a tool that encourages participation by maximizing the positive aspects of physical education, such as socialization, and the benefits of daily activity while limiting the negative aspects of peer exclusion and aggressive activities. In particular, one exergame has garnered a lot of attention due to its ability to get the body moving while maintaining the engagement of participants.

In 1998 Konami released Dance Dance Revolution (DDR). The pressure sensitive dance floor interface required players to synchronize their lower body movements to arrows scrolled

onto a screen (Konami, 2010). Soon after, media reports from the southern United States surfaced indicating that DDR could be a useful tool within a physical education classroom (Morales, 2002). However, the game's true potential within a school setting was not made public until 2004 when Dr. Linda Carson initiated a pilot project that brought the dance and rhythm exergame into the homes of 50 overweight children. Participants in the clinical study were shown to have had improved vascular and aerobic functions following the DDR intervention (O'Hanlon, 2007).

Since then, many quantitative studies have concluded that dance simulation games consistently raise the heart rate of participants to a moderate or vigorous level (depending on duration and style of game play), thus improving the participants overall health and fitness (Foley & Maddison, 2010; Murphy et al., 2009). As a result of its popularity Konami has recently released the Dance Dance Revolution Classroom Edition. The platform allows up to 48 students to participate simultaneously and continuously at their own level of difficulty.

However, little is known about how participants feel when using dance simulation exergames, especially within the context of a Canadian physical education classroom. To address this question evidence is needed to determine whether or not dance and rhythm exergames provide a motivating physical education experience for school-aged children.

**Purpose Statement**

The intent of this concurrent mixed methods study is to explore students' experiences while using the dance and rhythm exergame Dance Dance Revolution Classroom Edition and decide whether or not multiplayer dance and rhythm exergames are suitable for use within a physical education classroom. In the study, a post survey will be used to determine students' attitudes towards physical education after using the device for approximately three weeks. At the same time, the usefulness of dance and rhythm exergames within a school setting will be

explored using two separate group interviews of six students from two different schools located in an urban setting within Alberta. The reason for combining both quantitative and qualitative methods is to better understand the impact dance and rhythm exergames have on youth within a school setting. Although it is not the primary consideration of this project, the inquiry may reveal insights relevant to the future curriculum developments within Alberta Education's wellness framework.

**Research Questions.** In an effort to better understand the attitudes and perceptions of students while using dance and rhythm exergames, as well as provide practitioners with some insights as to whether or not exergames are a worthwhile investment the following research questions were developed:

1. How do students perceive the use of a multiplayer dance and rhythm exergame within a physical education setting?
2. Are multiplayer dance and rhythm exergames suitable for sustained use within a physical education classroom?

**Section Summary**

This section highlighted the debilitating effects of physical inactivity and obesity on both an individual and societal level. Since these startling statistics have come to light, Alberta Education has attempted to remedy the problem with the DPA legislation. Unfortunately, this initiative failed to have any real impact on the activity levels of school-aged youth, and since then Alberta Education has adopted a holistic approach that will be used to develop new curricular outcomes based on the wellness framework. The first of the new developments will be the HPE 10-20-30 programs of study which will be released in the coming years. In the meantime, this study investigated the impact exergames such as DDR had on school-aged youth. These new

devices are familiar within youth culture and have shown the ability to raise heart rates to a moderate to vigorous level. However, most of the studies done thus far have focused on a quantitative methodology and little is known about students' perceptions of exergames such as DDR within a physical education setting.

## Section Two: Literature Review

### Approach

Creswell (2009) indicated that a successful research project needs a topic worth studying, while limiting the scope to a manageable level of inquiry. To do this a review of literature that carefully selects relevant and insightful topics is required. Not only should the author identify and expand on the topic, s/he should provide evidence that the study is useful and practical within the current body of literature. If the discussion has successfully proven the merits and provided a thematic organization of the subject these principles will then lend themselves to the methodological design of the study.

### Section Introduction

This literature review focuses on published peer-reviewed research studies about the health and activity levels of Canadian youth, the rise of mainstream exergames, and mat-style dance and rhythm exergames. Databases, including ERIC, Google Scholar, ProQuest, Medline, and Sport Discus were used to identify relevant works. Key search words and phrases included but were not limited to "health and children or youth," "physical activity and children or youth," "dance and rhythm exergame," "active game and physical education," as well as, "dance simulation or dance dance revolution and physical education."

As a result, three major topics were created. First, the health and activity of Canadian youth is of paramount importance and it is necessary to understand to what extent the overweight and obesity epidemic has impacted Canadian society. Second, the history of exergames will address the cultural significance of active gaming, as well as showcase the time, money, and effort that have gone into developing this genre of videogames. Finally, this review will extend

into the greater body of research concerning mat-style dance simulation exergames and reveal common themes that have emerged through long-term, short-term, and school studies.

**Health and Activity of Canadian Youth**

Despite a consensus among authors within the field of health and physical activity that 90 minutes per day of moderate to vigorous physical activity would provide children and youth with optimal growth and development opportunities, in Canadian society, this target is simply too ambitious (Active Healthy Kids Canada, 2013; Canadian Society for Exercise Physiology, 2011; Janssen, 2007). Therefore, experts have recommended children receive at least 60 minutes of physical activity per day.

From 2007 to 2009 Statistics Canada (2010) performed the Canadian Health Measures Survey (CHMS), a comprehensive national study that assessed fitness levels of over two thousand youth aged 6 to 19. The results from the CHMS were compared with findings from the Canadian Fitness Survey, a similar study performed by Statistics Canada in 1981. Statistics Canada (2010) indicated that regardless of age or sex, children today are taller, weaker, and have a higher level of adiposity than their 1981 counterparts. Overall, the physical fitness, strength, and flexibility of Canadian youth has significantly deteriorated over the past three decades. Perhaps without surprise the percentage of overweight or obese male children from 1981 to 2009 rose from 14% to 31%, and in female children from 14% to 25%. Although the average height of a Canadian child has marginally increased since 1981 (5.0 cm in boys and 2.8 cm in girls) the average weight has skyrocketed. The study indicated both boys and girls shared an increased Body Mass Index (BMI) of 1.1 $kg/m^2$. Additionally, due to physical inactivity levels of Canadian youth, authors of the study pointed out that the increase in BMI was a result of greater adiposity not increased muscularity (Statistics Canada, 2010).

Statistics Canada is not the only national agency that has reported on the lack of physical activity sustained by contemporary youth. Since 2005 the CFLRI has published an annual quantitative report that measures daily step counts of children ages 5 to 19 from all over the country. Since its inception the average participant daily step count has never reached more than 12,000 steps, meaning approximately 85% of Canadian children do not attain 60 minutes of moderate to vigorous physical activity per day. The annual study also indicated boys are typically more active than girls, and older teens take fewer steps per day than young children (CFLRI, 2013).

After receiving these startling statistics it comes as no surprise that the extensive annual Active Healthy Kids Canada (2013) report card handed out some very poor grades in the categories of active play and screen time. The report indicated that childhood obesity has sharply increased and that inactivity is becoming the norm for many Canadian youth (Active Healthy Kids Canada, 2013). The report stated that for the fifth straight year physical activity levels due to increased sedentary behavior among Canadian youth merited a failing grade. This alarming assessment was due to the amount of time spent watching television, playing videogames, or surfing the Internet, which often replaced valuable time that could be spent performing physical activity. Furthermore, Active Healthy Kids Canada (2013) indicated that more "research is needed on effective strategies for reducing sedentary behaviors in different settings" (p. 33) before a better understanding of screen-based sedentary behavior could be established.

Youth fitness is a paramount public health concern for Canadians. The decline of physical activity among Canadian youth can have tragic implications with respect to premature morbidity and mortality (Statistics Canada, 2010; Tremblay & Willms, 2000). The CFLRI (2009; 2013) recognized that sedentary lifestyles of Canadian youth were, and are continuing to have a

disastrous impact on the overall health and wellbeing of our children. Interventions must be sought out that youth can use at home and school to become more physically active in an effort to attain the health related benefits.

## History of Exergames

**Introduction.** From the early conception and development of hand-held consoles in the mid 1970s commercial videogames have continually evolved to produce the highest quality gaming experience possible with the technology available (O' Hanlon, 2007). Although not always widely publicized or popular, exergames have been part of this steady progression. This segment of the literature review will outline some historical events that have shaped the development of exergames. It will begin by recognizing the contributions made by Atari and its imitators, then discuss the discovery of DDR, and end by acknowledging the contributions made by contemporary developers within the videogame industry.

**Atari and its imitators.** The Atari 2600 was released in 1977, used only 128 bytes of RAM, was one of the earliest plug in console devices available to the general public, and was typically bundled with two joystick controllers. Subsequently, when the third-party developer Amiga saw an opportunity to replace one of the joysticks with an exergame interface, Atari was keen to capitalize on the experimental device. In 1982 Atari released the Joyboard for the Atari 2600 console, "a player stood on [a platform] and leaned in different directions in lieu of normal joystick functions" (Blogost, 2008, p. 4). Unfortunately, consumers found that the Joyboard did not respond well during gameplay due to the device's inability to precisely map the standard joystick controls. Hence, the game cartridges marketed for the 2600 were not compatible with the Joyboard and the product was short lived.

However, Atari was determined to create the first successful exergame and later that year began testing another product behind closed doors. The top secret Puffer Project prototyped handgrips of a stationary bike that replaced a game controller, allowing the bike and game console to be connected. Originally, two racing games, Pole Position and Riverboat, allowed the user to control the movement of the onscreen vehicle with the pedaling speed of the stationary bike (Gardiner, 2008). Atari had plans to expand the Puffer game selection outside the racing genre, as well as experiment with a variety of exergame interfaces including, rowing machines and footpads. However, by 1983 the videogame industry suffered a string of financial setbacks and the ambitious Puffer Project was abandoned before ever hitting the market (Wolf, 2008).

While Atari struggled with financial woes and a change in ownership, another company made its attempt to reinvent the stationary bicycle into a videogame. Similar to Puffer, Autodesk's Highcycle used an exercise bike connected to a game console, but required a user to pedal across a virtual landscape in order to attain certain goals and objectives (Sinclair, Hingston, & Masek, 2007). Despite the lack of competition within the market, Autodesk's Highcycle was aborted due to the high cost related to production, complicated parts that were easily broken, and a gameplay that was not engaging.

However, these early setbacks and financial hits were not enough to deter further experimentation. In 1987 Atari made another attempt to enter the exergaming market when third-party developer, Exus, helped them to launch the Foot Craz for the Atari 2600. The Foot Craz was a small foot-operated pad with five coloured buttons that responded to touch and replaced the users' fingers with their feet (Blogost, 2008). Unfortunately, the device was released late in the lifecycle of the Atari 2600 and was unable to compete with other gaming consoles available

at the time and as a result the Foot Craz failed to gain any recognition within the gaming community.

Although Atari was unsuccessful with its pad-style controller, Nintendo, the company that released the wildly popular Nintendo Entertainment System (NES) in 1985, attempted to reinvent the idea a year later when they purchased the rights to a grey mat with 12 pressure sensors that functioned as buttons triggered by a player's feet. In 1988 the Power Pad was released as an accessory of the NES system and was packaged alongside the game World Class Track Meet (Blogost, 2008). With events like the 100-meter dash, 110-meter hurdles, and long jump the primary focus was to engage the user by running and jumping on the padded game mat. Unfortunately, the initiative was yet another exergaming flop, consumers did not feel the game and mat combination was a suitable trade off for the hand-held controllers already in use. Even though Nintendo's first attempt to create an engaging exergame failed, it marks the introduction of foot-operated pads that led to a second generation of exergames.

**The discovery of DDR**. A decade after the inception of foot operated pads, the first cost effective exergame was Konami's DDR. In 1998 the arcade game allowed players to match musical and visual cues given on a screen to a foot activated gamepad with coloured arrows laid out in a cross. If a player could consistently time his or her dance steps to the pattern presented on the screen a passing grade was earned and more music was made available. For the first time in history, not only did an exergame become popular within youth and videogame culture, but the game also produced a significant amount of caloric expenditure among its users (Lanningham-Foster et al., 2006; Staiano & Calvert, 2011). Together with the overwhelming popularity of DDR and strong patents that prevented any company from creating a similar device, Konami was the first to sit atop the unpredictable exergaming market.

However, Positive Gaming, a European distributor, soon became aware of a distinct nuance that had not been acknowledged within Konami's copyrights. Up until then exergaming had been a solitary or two-player pursuit, the development of dance and rhythm games designed to accommodate larger numbers of participants had not been explored. In 2008, with a marketing agenda targeting schools, fitness centers, and other large participant venues, Positive Gaming introduced the iDance. Similar to DDR, the iDance required participants to synchronize their rhythmic movements on a dance pad to directions scrolled on a screen, but offered the experience to be shared with up to 32 players simultaneously via wireless dance platforms (Positive Gaming, 2009). In 2010 the upgraded iDance2 was released and offered synchronized play with up to three separate difficulty levels on screen at once, as well as a variety of software and gameplay updates.

After the iDance2 received rave reviews and a sizeable chunk of Konami's exergaming market, other companies wanted to compete for a piece of the market. Although businesses such as Geodance, Cobalt Flux, and BluFit distributed their own downgraded versions of multiplayer dance and rhythm exergames they failed to compete with the successful iDance franchise. Not to be outdone, in the spring of 2012 Konami released Dance Dance Revolution Classroom Edition (DDRCE). This product allowed up to 48 users to play simultaneously at three levels of difficulty, and was complemented with Smart Cards capable of tracking an individual's step count, calories burned, and BMI (Active Gaming, 2012).

After the numerous exergaming flops during the mid 80s and early 90s mat-style dance and rhythm exergames could not have come at a better time for the videogame industry, as they are singlehandedly responsible for catapulting exergames into mainstream society. In fact, it is foreseeable that without the inception of DDR many contemporary exergames would not exist

today. Wolf (2008) accredited the popularity of DDR to the synchronous balance between the foot-operated dance pads and the simplistic graphics within the gameplay. Concurrently, it was this pairing that Nintendo paid close attention to when developing its next exergame.

**Contemporary developers.** Nintendo, in efforts to compete against videogame frontrunners Sony and Microsoft, took a gamble on a low-resolution exergaming console aimed at attracting as many gamers as possible. In 2006 Nintendo released the Wii console with the game Wii Sports. The device used a wireless remote that transmitted a signal to a sensor bar located above or below the viewing screen; together the devices took the movement of exergames into the third dimension. The Wii remote or Wiimote acted like a pointing device to target specific items onscreen, or as an extension of a piece of sporting equipment such as a tennis racquet or golf club. When playing virtual golf or tennis users would swing the wireless remote to make contact with the manipulative within the game (Pearson & Baily, 2007). The console devoted to exergaming turned out to be a worldwide success, consumers were willing to sacrifice graphics for the unique physical interaction offered within the gameplay.

To date, Nintendo has sold over eighty-five million units and has a wide selection of games to accompany the console (Nintendo, 2012). After the release of the Wii, Nintendo had the only home exergaming console available to consumers and the company wanted to take advantage of their unique placement in the video gaming market.

In 2007 Nintendo released a successful Balance Board accessory for the Wii. The board was a pressure sensitive device that looked like a household bathroom scale and has been compared to Atari's Joyboard (Gardiner, 2008). The board used Bluetooth technology and four pressure sensors capable of gauging the displacement of an individual's weight to determine where his/her center of balance was located at any given moment. The Balance Board was

packaged with Wii Fit, a game that contained over 40 mini competitions designed to engage players in a variety of activities such as yoga poses, strength training, aerobic activities, and balance challenges (Nitz, Kuys, Isles, & Fu, 2010). Audiences found the gameplay so appealing that in 2010 Wii Fit had sold over thirty-four million copies and was awarded the Guinness World Record for the best-selling physical fitness series (Guinness World Records, 2010). Following Nintendo's exergaming success, competitors have now released their own motion control interfaces.

In 2010 the two other major console developers, Sony and Microsoft launched slightly alternative exergaming devices. Sony's Playstation Move was also a hand-held motion sensing wireless controller wand. But, instead of using a sensor bar the Playstation Move used a small camera called the Playstation Eye to track the movements of a coloured orb located at the end of the wand. "The colour of the orb changes [colours] dynamically to allow it to be easily distinguishable by the camera" (Benatan, Symonds, & Ng, 2011, p.14). According to one of the cocreators of the device, Mikhailov (2009), the Playstation Eye is capable of determining the distance of controller to the viewing screen based on the corresponding size of the image produced by the orb. Therefore, based on the wand style controller, the Playstation Move was able to develop games similar to Nintendo's Wii.

That same year, Microsoft took exergaming development one step further. Unlike the Wii or Playstation Move, Microsoft's Kinect system did not require any form of controller, instead the webcam style interface enabled users to control and interact with the gameplay through gestures and spoken commands (Benatan, et al., 2011). Through the use of a motion sensor technology, and biomechanical algorithms, the Kinect was capable of following a person's movements in space as well as tracking and responding to different body parts of the user.

**Summary.** Currently, Nintendo, Microsoft, and Sony are the three largest commercial videogame distributors in the world and each has invested large amounts of time and money into creating exergames that are both engaging and fun for individuals of all ages. Consequently, the quest to create the latest and greatest exergame is not a passing fad, but something that is just coming of age through a thirty year progression. With no end in sight, should educational institutions be looking at the implications these devices could have within a physical education setting?

## Review of Dance Simulation Games

**Introduction.** In the spring of 2004 public officials in the state of West Virginia turned to Dr. Linda Carson to help find a solution to the growing obesity epidemic within the state. She introduced a one-of-a-kind clinical study that brought a popular dance and rhythm exergame, DDR, into the homes of 50 overweight children. Participants were asked to use the device in 30 minute increments five times a week (Konami, 2011). Results indicated participants experienced: increased blood flow, boosted aerobic capacity, and no weight gain. More importantly, parents of the participants stated that their child was more willing to try new activities or sports as a result of the intervention. These findings were so impressive that the state immediately expanded the DDR exergame into a large pilot project. In the fall of 2004 all 103 middle and junior high schools had a DDR exergame within their walls (O'Hanlon, 2007).

Since then, a number of long-term (> 1 month) and short-term (< 1 month) studies have appeared from around the globe devoted to finding out if dance simulation games are sustainable interventions for influencing physical activity levels of school-aged children. Although the majority of studies have taken place within a laboratory or home setting, a small handful of studies have taken place within schools. All of the inquiries were necessary to gain a better

understanding of how best to construct and facilitate the research being undertaken within this study, as well as continue the ongoing dialogue within the literature. Due to the scope and focus of the research questions addressed within this paper, only studies that used a pad-style dance and rhythm exergame were reviewed.

**Long-term studies.** In one of several long-term studies headed by Dr. Ann Maloney, she and her colleagues provided 40 children aged 7 to 8 with unlimited at home access to DDR machines for 10 weeks. DDR use was logged within the game consoles, and physical activity was measured using an accelerometer worn seven days a week during waking hours. Results showed participants played the game an average of 90 minutes per week. These numbers translated to an overall increase in the amount of moderate to vigorous physical activity each child performed and a decrease in the amount of sedentary screen time (Maloney et al., 2008). The pilot study suggested DDR aided in the development and promotion of an active lifestyle.

These findings were supported by another DDR study that took place over the course of 3 months (Murphy et al., 2009). Thirty-five overweight or obese (BMI > 85$^{th}$ percentile) participants between the ages of 7 to 12 were randomly assigned to a delayed treatment control group, or given 12 weeks of aerobic exercise using DDR. Participants were instructed on the amount of time they needed to play the device to achieve health related benefits; subsequently these weekly totals pyramided upward. The first week involved eight songs per training session, while the final week required 24. Both groups provided baseline readings for waist/hip circumference, blood pressure, blood chemistry, and aerobic capacity. After 12 weeks, all experimental variables were retested and compared. The intervention group gained significantly less weight than the control group, improved cardiovascular fitness, and decreased arterial pressure.

On the other hand, when Maloney, Threlkeld, and Cook (2012) explored the use of dance and rhythm exergames within overweight and obese populations of children the results were inconclusive. The randomized control trial of 65 families who had children with a BMI over the 85$^{th}$ percentile allowed a treatment group to use a home DDR console for 12 weeks. Participants within the treatment group were instructed to play the device as often as they liked, but no other supports, information, or intervention sessions were offered. Data collections included a self-report on physical activity levels, as well as pedometer and accelerometer readings from both the treatment and control group. After comparing the two groups, a large increase in moderate to vigorous physical activity levels were self-reported within the intervention group. But, the objective data neither refuted nor affirmed the self-reported findings, as there was little difference between the two groups with respect to pedometer and accelerometer records, leading the authors to question the validity of participants self-reporting their physical activity levels.

However, the inability to arrive at a conclusive recommendation may rest within another paper written by Dr. Maloney and her colleagues several years prior. Paez, Maloney, Kelsey, Wiesen, and Rosenberg (2009) set out to define specific environmental factors that led children aged 7 to 8 to play more active videogames. The randomized control trial assigned 40 children to an intervention group and 20 to a control. Physical activity was measured through accelerometers and the game console's log. Parental support for their child's physical activity was measured with a questionnaire. Primary findings indicated that parental and peer participation were the most significant factors for DDR participation during and after the home 10-week intervention. Leading Paez et al. to conclude that the role of significant others and peers is of vital importance in the promotion of wellness and sustained use of DDR.

Further investigation leads to another home intervention that highlighted the potential

hazard of dance and rhythm exergames becoming a solitary pursuit when Madsen, Yen, Wlasiuk, Newman, and Lustig (2007) examined the effect of DDR on the BMI levels of 30 overweight children over a period of 6 months. Findings stated that active video gaming was not associated with change in BMI. Despite prescribing similar protocol as Murphy et al. (2009) for home use of the dance simulation game, Madsen et al. found very low levels of participant compliance. Data provided from memory cards within the participants' DDR console led the authors to believe "children [are] unlikely to yield positive results unless the intervention incorporates children's suggestions to add group participation, competitions, and peer or family support" (Madsen et al., 2007, p. 107). Unlike Murphy et al. who allowed a wide variety of games and gameplay alternatives to be used within their study because they provided participants with a DDR console, Madsen et al. only recruited subjects who already owned a videogame console. Additionally, it is conceivable that a single user would become bored with a game after playing it every day for six months. However, Madsen's et al. work does showcase the potential problem of boredom if a dance and rhythm exergame is played in solitude over a long period of time.

One study contrasted the difference between playing exergames alone and using the device within a social setting. Paw, Jacobs, Vaessen, Titze, and van Mechelen (2008) randomly assigned 27 participants aged 9 to 12 to one of two experimental groups. The first group was assigned to play a dance and rhythm game similar to DDR at home, while the second group played at home and participated in weekly multiplayer sessions. The 12-week study indicated that the multiplayer cohort logged twice as many hours as their home stationed counterparts and had fewer participants become disinterested in the dance simulation game altogether.

These findings indicated that dance simulation games added an interpersonal element that aided in the promotion of a successful social dynamic, thus making dance and rhythm exergames

a natural fit for a physical education classroom. Along with evidence brought forth within the long-term studies, practitioners and theorists should also note the short-term studies that indicated dance simulation games, even in small doses, are capable of raising metabolic rates and improving youth fitness.

**Short-term studies.** These laboratory style studies typically analyzed quantitative data in an effort to determine whether or not dance and rhythm exergames produced a moderate level of energy expenditure. First, a participant's energy expenditure was recorded from a resting baseline, and then these results were compared to vigorously walking on a treadmill, and playing a dance and rhythm exergame.

One such study took 25 lean and overweight children aged 8 to 12, and compared energy expenditure when playing activity promoting videogames, to playing videogames while seated, and to watching television while walking on a treadmill at 1.5 miles per hour (Lanningham-Foster et al., 2006). Energy expenditure was determined through the use of a calorimeter built specifically for children. The results stated that energy expenditure while seated was 13% higher than resting values. When subjects were walking on a treadmill and watching television, energy expenditure was 40% higher than resting rates. However, when DDR was substituted into the study energy expenditure jumped to 68% above resting values, leading the authors to conclude that dance simulation games are a reasonable consideration for treatment and prevention of obesity among school-aged children.

In another laboratory style study Graf, Pratt, Hester, and Short (2009) compared energy expenditure of 23 healthy children aged 10 to 13 when playing DDR and Nintendo's Wii Sports to walking on a treadmill. After measuring heart and step rate twice during a 30-minute period, the team concluded that exergaming and DDR are suitable methods for sustaining moderate

activity levels. Thus, active games can be a safe and fun way to promote energy expenditure and break up sedentary screen time.

A similar study measured the energy expenditure of 40 subjects who were introduced to DDR (Tan, Aziz, Chua, & Teh, 2002). Both oxygen consumption and heart rates were measured after 10 minutes of activity on a dance simulation game at a self-selected level of difficulty. The study also monitored participants for injuries. Findings included that the dance intensity reached the minimum American College of Sport Medicine (ACSM) recommendations for developing and maintaining cardiovascular fitness of 70% $HR_{max}$ and 53% heart rate reserve. These results prompted authors of the study to suggest that if the duration of play were extended, the overall energy expenditure would continue to increase. Additionally, no injuries occurred during the game play.

Using the same ACSM standards for cardiovascular fitness as Tan and his colleagues, another group of scholars compared metabolic responses of 22 overweight and nonoverweight adolescents while playing dance simulation exergames (Unnithan, Houser, & Fernhall, 2006). Again, after just 12 minutes of playing DDR participants in both groups were above the recommended heart rate intensity for developing and maintaining cardio respiratory fitness.

Similar results were found when a study from the United Kingdom monitored the oxygen uptake of 20 adolescent girls while playing on exergaming dance mats for 30 minutes (Fawkner, Niven, Thin, Macdonald, & Oakes, 2010). After a resting measurement for energy expenditure was calculated, participants were asked to play the dance simulation game in three, 10 minute intervals, each interval increasing in difficulty level from easy, to medium, and finally hard. During the gameplay, gas exchange and heart rates were recorded. As one might expect, the energy expenditure of the participants steadily increased throughout the investigation, yet the

authors were surprised when activity levels reached a moderate intensity within the first 10 minutes. Prompting Fawkner et al. to state that regular playing would contribute to daily physical activity recommendations for good health.

Additional insights were offered when several authors described the prevalence of exergaming in adolescents. The team surveyed 1209 adolescents and their parents in the Montreal area about many factors such as weight related stress, sedentary screen time behavior, and cigarette smoking. Approximately 25% of all the participants were classified as exergamers, meaning these individuals reported exergaming for an average of 50 minutes, mostly at moderate or vigorous intensity, at least two times per week. Although the study did not provide any objective data with which to measure physical activity levels it did bring forth relevant insights about the topic. The authors suggested exergamers are more likely to be girls, engage in more than two hours of screen time activities per day, are stressed about their weight, and are less likely to be cigarette smokers than nonexergamers. Also indicating, that a "lack of school-based exergaming may represent a 'missed opportunity' to introduce young people to another form of physical activity, as well as increase the number of opportunities for young people to be physically active" (O' Loughlin et al., 2012, p. 811). Overall, the study suggested that exergames warrant further investigation, as the devices could be used as a tool to help adolescents meet physical activity recommendations.

Both the long-term and short-term studies have indicated that dance simulation exergames could be a suitable component of a physical education course due to their ability to produce a moderate amount of energy expenditure within participants over a short period of time as well as promote a positive social dynamic. Currently one author merits special attention as he has written several articles that have focused on DDR within a school setting.

**School studies.** Dr. Zan Gao is a researcher at the University of Minnesota and he, along with several colleagues, published numerous works in recent years examining DDR in a school and physical education setting. These works have been published within the past three years and utilized an identical procedure when implementing the devices into a physical education classroom. First, before students arrived, six to eight DDR stations are setup; each station consisted of two master dance pads connected to a PlayStation gaming system and multiple dummy pads or practice dance mats that were not electronically connected to the system. The gameplay consisted of one or more songs in a series, or multiple attempts at the same song. Hence, if the two students on the master pads successfully matched their steps to the directions scrolled across the screen, their overall scores increased, if this was sustained throughout the song a passing grade was awarded and the next song was unlocked. But, if steps were offbeat or mis-timed the scores would drop, subsequently the students would fail the song usually resulting in a "game over." Depending on the study, students were either randomly assigned to the master pads, or teachers actively selected these individuals. Throughout the duration of each study, research assistants helped with the instruction and implementation of the device while collecting data.

In Gao's first publication 195 junior high students participated in daily 50-minute DDR sessions for 2 weeks. Throughout the study, accelerometers were used to gauge the students' levels of physical activity, and at the end of the intervention participants were asked to fill out a survey that indicated their situational motivation and mastery experience while using DDR within a physical education setting. Results from the analysis indicated that students were motivated to play the game but their moderate to vigorous physical activity levels were low. Additionally, participants who had a strong sense of mastery while using DDR scored significantly higher in both motivation and overall activity levels. Leading Gao (2012) to state, "DDR is an exciting and

innovative way to motivate students to learn" (p. 798). Based on participants' inability to select different songs and play at different difficulty levels Gao speculated that if students were able to make these choices it would produce higher levels of motivation within the gameplay.

In another 2-week study Huang and Gao (2013) again examined the situational interests, mastery experiences, and activity levels of junior high students who participated in a 50-minute-a-day DDR unit. In total, 135 participants were included in the data collection process as students were assigned to one of the eight aforementioned DDR stations based on their gender. Following similar protocols as Gao's (2012) study, student activity levels were monitored through the use of accelerometers, while situational interest and mastery experience were determined through the use of a self-reported survey. Given the two studies were only a year apart and used interchangeable data collection tools it is easy to understand why results from Huang and Gao's study mirrored Gao's earlier work.

However, given the amount of evidence indicating that dance and rhythm exergames meet the standards for moderate to vigorous physical activity levels it may come as a surprise that in both of Gao's studies energy expenditure totals were nowhere near the expected output. These limitations were addressed, as both articles explained that the actual time spent on the master pads was not monitored or controlled, as a result there was no way of telling if a difference existed between activity levels when students were on the practice pads versus the master dance mats. Also, it was recommended that heart rate monitors be used instead of accelerometers. The devices were placed on the left side of the participant's body and "there is a possibility that the accelerometers could not capture the physical activity motion when students made right foot movements, which would significantly affect students' moderate to vigorous physical activity levels in DDR" (Gao, 2012, p. 798). It was also suggested that students required more time to

gain experience with the device, this would allow participants to attain a greater level of mastery and result in higher levels of energy expenditure (Huang & Gao, 2013).

In a subsequent publication Gao, Podlog, and Huang (2013) extended the length of the study from 2, to 18 weeks. During that time 215 elementary students in grades three through six received a 30-minute weekly DDR class on top of their regular physical education schedule. Once again physical activity levels were recorded via accelerometers, but in this instance the category of perceived enjoyment was added to the survey that also measured situational motivation. Nevertheless, as it was noted in the previous reports, children in this study demonstrated high levels of efficacy toward the DDR intervention. Physical activity levels were still reported as low with respect to the percentage of time spent within the moderate to vigorous activity range despite jumping from 4.95% (Gao, 2012) to 29.99% (Gao et al., 2013).

Perhaps noticing that participant enjoyment was the common denominator within all of the previous research, Gao, Zhang, and Podlog (2013) pitted traditional tag games against six of their DDR stations within a physical education setting. Two hundred and ten participants aged 8 to 12 took part in the 2-week intervention. During the first week students played a variety of tag games, then self-reported their enjoyment levels within a standardized survey. The next week required participants to use the DDR stations, and then fill out the same questionnaire. The results indicated that students exhibited higher levels of enjoyment when using dance and rhythm exergames compared to traditional games. Additionally, girls had higher levels of enjoyment towards interactive dance games than did boys. Overall, the authors concluded that it was practical and meaningful to incorporate mat-style dance and rhythm exergames into physical education.

Although it is not fully known at this juncture whether or not the works of Dr. Zan Gao are the only peer reviewed studies that utilize dance and rhythm mat-style exergames within a school setting, but these were the only articles that surfaced after an extensive search using the aforementioned criteria. Additionally, there are academic articles that speak to implementation of dance exergames within a physical education setting, yet there are few pieces that provide a worthwhile investigation of this specific topic. However, given the recent speculation that exergames can be used as a tool to help curb inactivity levels of youth among developed nations, it is reasonable to assume that other studies are either under construction or currently being implemented and many relevant scholarships will surface within the coming years.

**Summary.** The majority of research surrounding pad-style dance and rhythm exergames has set out to discover whether or not dance and rhythm exergames are a suitable means to battle the childhood inactivity crisis. Short-term reports have focused on comparing exergame use to baseline readings while seated, resting, or walking on a treadmill. Due to the evidence related to energy expenditure, this body of scholarship could justify the use of mat-style dance and rhythm exergames as an effective tool to curb the prevalence of overweight and inactive youth. However, the long-term studies available were not as definitive. Typically, these studies were performed at home and utilized an objective data collection tool (accelerometer or pedometer) as well as a survey or questionnaire to help triangulate data. Results did not provide a consensus with regards to the amount of physical activity exerted by participants, as some reports indicated mat-style dance and rhythm exergames were a good method of sustaining high levels of physical activity while others suggested these games would eventually lead to boredom. The small number of studies that took place within a school setting validated the ambiguity of physical activity levels provided by these exergames. Although procedural methods and data collection tools were

identical in the studies mentioned, they too showcased low levels of total energy expenditure and physical activity.

However, the question of whether or not to include dance and rhythm exergames within a physical education setting is not easily encapsulated within the parameters of physical activity/inactivity. Through a review of long-term studies we can be sure that mat-style dance and rhythm exergames become more enjoyable when done in a group setting with peers and significant others. The recent school studies have highlighted that more experienced players will elicit greater levels of physical activity and stronger motivational levels with regards to gameplay. Overall, participants have shown high degrees of intrinsic motivation when dance and rhythm exergames have been placed within a school setting. These early studies are an excellent starting point when gauging whether or not students see these devices as a worthwhile activity within a physical education program. Also, it is unclear why the authors of the school studies opted to use a multistation approach, with two master pads and numerous practice mats, when the alternative to have every student connected to a master platform was available. Perhaps funding was an issue as these devices can be very expensive. Nevertheless, a sizable gap in the literature exists when gauging school-aged children's perspectives on the use of multiplayer mat-style dance and rhythm exergames within a physical education setting. Given the lessons provided by earlier research studies there are some key ingredients that can help maximize the positive aspects of using these devices within a classroom setting.

**Section Summary**

As part of the ongoing dialogue within the literature it is necessary to highlight the concerns the inactivity crises has within the Canadian context. With the overwhelming cost that inactivity has on our healthcare system and contemporary youth, practitioners along with health

and wellness advocates are forced to look in new directions and make physical activity appetizing for school-aged youth. Exergames, specifically mat-style dance and rhythm interfaces offer a compelling and somewhat hopeful vista of new opportunity for school-aged youth to exchange sedentary screen time with physical activity. Based on the history of exergames and the familiarity of the interface for school-aged youth, it is reasonable to assume that these devices are here to stay and will only improve with time. Recently, manufacturers of these devices have seen promise in accommodating a large number of users connected to a single platform (iDance2 & DDRCE), and given the research available, there are several key suggestions moving forward. Overall, dance units based on mat-style exergames should be student centered, meaning participants are able to choose their own difficulty level during gameplay without sacrificing individual assessment through the use of dummy mats or practice pads. Activities should be done as group instead of individually, and the duration should run between 2 and 4 weeks.

## Section Three: Methodology

### Approach

Although Creswell (2009) contends there is no one way to approach writing a mixed methodology section, he does offer a checklist of items to bolster the integrity and credibility of the work. In this case, the basic characteristics of a methodology section included: (a) a basic definition of mixed methods research, (b) reasons for choosing a particular mixed method over another, (c) a visual model that represents the research strategy being undertaken, (d) a description of each of the data collection tools, (e) and an explanation pertaining to the procedures undertaken to analyze the data.

### Section Introduction

This section will primarily address the theoretical perspectives of research design. Due to the scale of the research project, partnership established with the school district involved, and the logistics of moving the Dance Dance Revolution Classroom Edition exergame from one school to the next, a separate Procedure section was created to help explain each of these components within the research project.

To begin, a background of the mixed methods design will make a clear distinction between qualitative and quantitative methods, then move into a brief historical perspective to identify the inception of mixed methods and provide a context to describe why authors may choose to combine the quantitative and qualitative discourses. This will lead into a description of three different mixed methods that are generally accepted within the academy of social science and educational research. Next, a rationale of the *concurrent* mixed methods approach will further illuminate the context with which this study will take place. Finally, each of the data collection tools will be examined individually. A description of the tools, proper analysis

guidelines, as well as the strengths and limitation of quantitative surveys and qualitative interviews will conclude this section of the paper.

**Mixed Methods Research**

**Background.** The simplest way to distinguish between qualitative and quantitative design is to determine *how* a researcher is comparing the characteristics of people and events within a given instance (Thomas, 2003). Quantitative measures focus on using standardized measurements and comparing amounts of the characteristics displayed by the people or events being studied; qualitative methods focus on the interpretation of events or a phenomenon and the meaning people associate with it. Adding to the clear distinction between the two, Creswell (2009) listed several characteristics of each discourse. Creswell indicated quantitative methods were predetermined, used performance, attitude, or observational results and relied on statistical interpretation. Qualitative methods focused on open-ended questioning and interviews, observational data, and used documented analysis to interpret patterns and detect emerging themes within the data stream. Currently, there is little doubt that both of these methods are an acceptable form of inquiry capable of withstanding the conjecture and rigors of academic legitimacy, but is the same true when these two methods are combined?

The first instance of mixing methods began in 1959 when Campbell and Fisk advocated for the use of their multimethods matrix to validate psychological traits, arguing that the use of two methods increased the validity of their work (Campbell & Fisk, 1959). Over the next 30 years a pragmatic discussion developed about how mixed methods should be viewed and analyzed. As a relatively new model of research, proponents of mixed methods research sought to combine both qualitative and quantitative procedures, recognizing that all methods have limitations and by combining them it is possible to neutralize the bias in one method by

triangulating it with the results of another (Tashakkori & Teddlie, 1998). These discussions prompted other scholars to combine and mix various methods and by the 1990s the idea had evolved from seeking validity, to a recognized theoretical method that sought to sequentially combine two different forms of data. "These are studies that are products of the pragmatist paradigm and that combine qualitative and quantitative approaches within different phases of the research process" (Tashakkori & Teddlie, p. 19).

Consequently, Creswell (2009) identified three major frameworks that have emerged upon which researchers can model their studies. A sequential mixed method study makes an initial finding with a singular method, either quantitative or qualitative, and then the second tool is tailored to expand on the results of the first method. The result is a rich and deep understanding of a single phenomenon allowing the audience to view both the statistical significance and greater knowledge of the contexts in which it exists. Concurrent mixed methods research calls for both data collection tools to be set out before hand and used within the research simultaneously. After everything has been collected both data sets are pooled in an effort to provide a comprehensive analysis of the research question(s). Conclusions based on this form of research attain a broad understanding of the topic and often result in well validated and substantiated findings when the autonomous data correlate. Finally, a transformative method uses a theoretical lens to provide an overarching perspective of data analysis, and has the added advantage of mirroring the theoretical perspectives within the results and discussion.

Overall, selection of the research design should be determined by the nature of the question(s), the problem it raises, and the audience it is intended for. The questions driving this study look to better understand students' perceptions and attitudes towards the use of a multiplayer dance and rhythm exergame within a physical education classroom. Once these

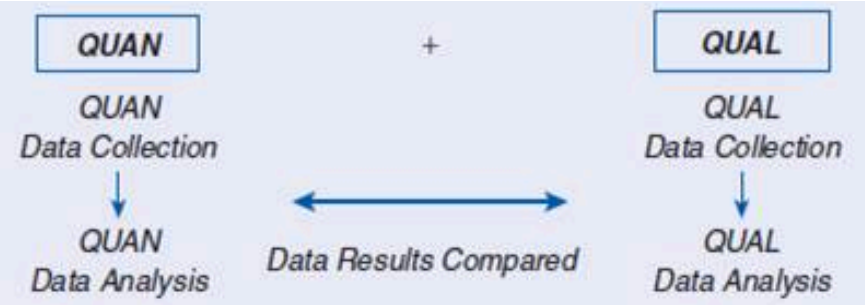
questions are better understood practitioners and theorists can make informed decisions about the sustainability and use of these devices in the future.

**Rationale.** By combining two methodologies a more complete understanding of the research question(s) can be attained. Due to the fact there is very little evidence surrounding the topic of student participation and attitudes towards multiplayer dance and rhythm exergames, data collection tools must saturate the research questions to provide reliable correlations from which valid conclusions can be drawn. Rather than designing a study to capture one specific theme within the phenomena by sequentially applying methods based on the results from one data collection tool to the other, this study allows for simultaneous data collection through Creswell's (2009) *concurrent triangulation strategy*. The researcher collects both quantitative and qualitative data autonomously and simultaneously, and then compares the two data sets to determine the differences and similarities.

> This model generally uses separate quantitative and qualitative methods as a means to offset the weaknesses inherent within one method with the strengths of another (or conversely, the strength of one adds to the strength of another). In this approach, the quantitative and qualitative data collection is concurrent happening in one phase of the research study. Ideally, the weight is equal between the two methods, but often in practice, priority may be given to one over the other. . . This side-by-side integration is often seen in published mixed methods studies in which a discussion section first provides quantitative statistical results followed by qualitative quotes that support or disconfirm the quantitative results. (Creswell, 2009, p. 213)

For further consideration of the concurrent triangulation strategy refer to Figure 1.

*Figure 1*. Concurrent Triangulation Design. [1]




**Data Collection Tools**

**Surveys.** Survey methods can be applied to a wide variety of topics and are frequently used as a self-reporting data collection tool. Their purpose is to generalize from a sample to a population so an inference can be made about a characteristic, attitude, or behavior of the population (Babbie, 1990). The questionnaire is constructed to elicit information relevant to a researcher's subject of inquiry. There are a variety of ways with which a researcher can deliver the surveys, either face-to-face within an interview or a written format, by telephone, via mail, and often surveys are now done electronically through third-party web-based servers. Regardless of how the survey is administered the responses are coded in a quantitative format and guided by stable constraints.

"In practice, moreover, survey data facilitate careful implementation of logical understandings" (Babbie, 1990, p. 41). Likewise, Sapsford (2007) contended that the survey format provides a clear and rigorous elaboration of a population at a given moment in time and is able to differentiate from one individual/group to the next. In principle, psychological traits such as attitude, beliefs, or opinions are all unverifiable except for the reporting of the individual. Therefore, in all survey construction it is essential that predetermined guidelines exist to create

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[1] SOURCE: Creswell (2009). Reprinted with permission from Sage Publications.

[2, 3] Student responses are purposefully included as they appear on the interview transcript. Any colloquial

the desired impact. When planning a survey, the object or event from which the attitude is being derived or impacted must be clearly stated. It is also necessary to make clear distinctions between affective, cognitive, and physical domains, in addition to assessing the strength of the desired attitude (Sudman & Bradburn, 1982). Experts within the field also indicated the importance of identifying a population for the study and the selection process for individuals within the study, methods of organizing data, and the techniques that will be used to interpret the results (Babbie, 1990; Sapsford, 2007). Babbie also contended, the "availability of numerous cases and variables permits the survey analyst to document more elaborate causal processes" (p. 41). Hence, survey research is logical, deterministic, and its purpose is to capture the attitudes and perceptions of a specific population within a finite period of time with respect to one or more variables.

***Data analysis.*** When performing survey research, it is important for the author to provide an accurate representation of all surveys completed, in addition to this, the total number of nonrespondents should be accurately traced. As such, response bias needs to be addressed within the interpretation of results (Fowler, 2002); if the nonrespondents had responded, their input would have made a significant impact on the results of the survey. But rather than set a statistical benchmark for an acceptable response rate, Sapsford (2007) indicated the researcher should provide the total number of respondents and nonrespondents for each sample or cluster. In doing this, the author should make note if the rates remain constant or fluctuate throughout the data collection period and provide some explanation about the event.

As mentioned earlier it is important to have predetermined guidelines that will ensure a comprehensive and succinct analysis of the target variable. Survey analysis begins by identifying the collectivity and stratification within different cohorts of the sample, along with the group as a whole. This will help define characteristics of the variable as well as provide an in-depth review

of the sample population and a rationale for including these individuals within the study. Next, the information will be summarized and the results converted into a readily comprehensible format, allowing the reader to bridge the insider-outsider perspective and readily assess the results for their own interpretation (Thomas, 2003). The transparency by which this process is conducted will aid in the promotion of concurrent methods and promote a thematic orientation of the data.

***Strengths and limitations.*** Surveys are very useful when trying to determine a single variable within a particular segment of society, the tool is widely used and arguably one of the oldest forms of data collection, dating back to census information of early civilizations. Numerical responses add to the accuracy of the data and provide clear concise results pertaining to the variable in question (Babbie, 1990). However, because survey data typically report on averages and percentages, they fail to show how the pattern of individuals fits into the greater sample. This prevents both the author and the audience from gaining a contextual perspective that has impacted the variable in question.

**Interviews.** On the other hand, qualitative methods provide the researcher with rich data that provides a robust understanding of the context with which an event has occurred. However, Bogdan and Biklen (1992) suggested that the principal researcher must attain some first-hand knowledge within the field before the work can be seen as valid or reliable. Historically, concepts such as "hope" or "values" are not easily quantified within a laboratory setting, and the qualitative field opens the research to a variety of different observations and evaluations if the researcher is familiar with the topic.

Some studies naturally lend themselves more to qualitative types of research, for instance, research that attempts to uncover the nature of persons' experiences with a phenomenon

> like illness, religious conversion, or addiction. Qualitative methods can give the intricate details about which little is yet known. (Strauss and Corbin, 1990, p. 19)

To bridge the insider-outsider perspective the researcher must understand the phenomenon from the subject's point of view rather than his or her own. Not only must the researcher become immersed within the context studied, he or she is also the key instrument of data collection (Mirriam, 1998).

Traditionally, interviews involve a researcher having in-person or telephone interviews with participants, however with the advent of the Internet, interviews can now be conducted in written form within a chat space or face-to-face via webcams (Creswell, 2009). Interviews can range from a focus group of six to eight participants or be done individually with the researcher.

Similar to quantitative methods, qualitative studies also require procedures and protocols to ensure data are of the highest integrity and generally free of biases. Although, due to their nature interview practices are much less stringent, Creswell (2009) outlines several guidelines to ensure successful data collection. First, the participant(s) must agree upon a mutually beneficial date, time, and location; in the case of school-aged children, the school at which the participant attends is usually the best fit. The interviewer reads the instructions to the participants and allows for questions regarding the process, this is a standard procedure used from one interview to the next. A typical procedure will include several open-ended questions aimed at identifying a participant's interpretation of a general query, then the interviewer will give several follow-up questions to probe for deeper meaning (Thomas, 2003). Researchers can record the events of the interview by making hand notes, audiotaping, or videotaping. In the case of audiotaping an interview a plan for the transcription should be determined in advance.

***Data analysis.*** Qualitative studies incorporate multiple sources of data to ensure results are comprehensive and accurate. Rather than rely on a single interview, observation, or document the researcher is forced to "review all of the data, make sense of it, and organize it into categories or themes that cut across all the data sources" (Creswell, 2009, p. 175). In doing this, the researcher may find opportunities that were previously overlooked due to personal bias.

Bogdan and Biklen (1992) support the notion that qualitative research is produced "from the bottom up, from many disparate pieces of collected evidence that are interconnected" (p. 31). The inductive process illustrates working back and forth between the data and the themes until a comprehensive set of categories and subcategories is established. Briefly, the data analysis follows these steps: Begin by reading all the data to get a sense of the information and reflect on its contents. Next, commonly referred to as coding, organize the material into chunks or segments that readers would expect to find based on the literature and common sense. Assemble the material belonging to each category and perform a preliminary analysis. Then use the coded material to generate a description of the context and the setting with which participants were exposed to. This will provide the scaffolding necessary to categorize the results into themes that will help in the final interpretation. The final step in the data analysis addresses the greater meaning of the data collected within the interviews and captures the essence of the idea, as well as lessons learned to fill gaps within the literature.

***Strengths and limitations.*** "In comparison to direct observation, interviews are more efficient at collecting information about people's knowledge, personal background and opinions" (Thomas, 2003, p. 66). Interviews provide a great deal of rich qualitative data, from which scholars can gain a great deal of information, while allowing the researcher a great deal of flexibility and control throughout the process. As a result the interviewer can clarify questions

and probe for deeper meanings while respondents are able to easily elaborate on the answers they provide. The one-to-one relationship gained within the interview allows the participant to associate greater meaning to the research process he or she is taking part in, rather than the impersonal relationship provided by questionnaires (Creswell, 2009). However, face-to-face interactions may prevent respondents from disclosing information about sensitive issues, or in some cases, participants may withhold their true feelings if they wish to avoid disappointing the researcher or other members of the focus group. Another drawback is the amount of time necessary to complete the interviews. Often researchers need to meet with participants individually and set aside large amounts of time to collect the data, or in the case of group interviews, go back-and-forth between respondents to ensure everyone is able to meet at a mutually agreed time and location (Thomas, 2003).

**Section Summary**

Combining methods is a relatively new form of research and with it comes risks and rewards. In order to achieve a successful mixed methods approach not only must the author become familiar with both qualitative and quantitative methods, he or she must also tactfully design and implement the study in a way that offsets the limitations and bolsters the strengths of the data collection tools. Due to the legitimacy mixed methods have gained within the last 30 years, researchers are now able to draw on past experiences and place their studies within a predetermined model. Sequential, concurrent, and theoretical models all bring value to the area of inquiry, yet all three models provide a different outlook and perspective on the execution of the study and interpretation of results. Before choosing one of the models it is of paramount importance the researcher spend a substantial amount of time within the field and literature. This will provide the oversight necessary to subscribing to a single theory or mixed method.

Furthermore, the guidelines that adhere to the administration and data analysis of each data collection tool is of paramount importance and should remain a focal point within the procedure. In order for a mixed method study to remain valid and reliable, each of its individual methods must do the same. Hence, the guidelines and protocols explained within this section should be mirrored within the Procedure.

## Section Four: Procedure

### Approach

Although Creswell (2009) combined the procedure and methodology into a single section, within this paper the two are separate. As mentioned earlier, due to the scale of this research project, for the reader to fully understand my role as the researcher and the impact this project has had on all of the participants, the procedure must be a standalone section. This will also help to disclose biases and deliver the scope and sequence of the project.

### Section Introduction

This section explains how the project was administered within a school district with which I also worked as a teacher. This included purchasing the equipment, efforts made to distance myself from the research participants so not to influence their decision making, and recruiting lead teachers to help oversee the project at each school site. Next the data collection tools and the specific protocols necessary to accurately acquire results are explored. Finally, this section discusses when and how data from the qualitative and quantitative portions of the study will be mixed.

### Researchers Role

**About me.** Over the past 7 years I have had the opportunity to teach both overseas in London, England and locally within Alberta, Canada. My experiences have taken place in public, private, and separate school systems where I have taught a wide variety of subject matter in both elementary and junior high schools. My extracurricular involvement has included coaching and officiating an assortment of sports teams such as volleyball, basketball, floor hockey, track, and softball.

Upon entering graduate school in the summer of 2010, I started playing with the idea of incorporating technology into physical education. This was a combination of my interests and the lack of technology used in present day physical education classes, contrasted with the pervasive role technology now plays in the everyday lives of our students. Since entering the department I have built a virtual gymnasium using prerecorded drills displayed on a projector and screen, created music videos based on the theme of physical education, and written papers on the ability of robots to introduce a game or sport. Using the dance simulation exergame Dance Dance Revolution Classroom Edition (DDRCE) within a physical education setting is the crowning achievement of my graduate studies thus far. As a result of hard work, determination, and the availability of the technology this research project was able to come to fruition.

When an individual earnestly applies himself or herself to a goal or outcome, he or she would like to see his or her vision produce good results and have long-term success. However, it is at this stage I recognize my inherent bias and commit myself to conducting this inquiry with ethical integrity, allowing the participants to drive the results of the study and not the researcher. Hence, within the following procedure every effort is made to ensure legitimate and accurate results, while creating a healthy margin of distance between the research participants and myself.

**Teacher-researcher.** This study took place in an urban school district within Alberta, Canada, of which I am also an employee. At the time of this study I was teaching full-time in a grade five-six combined class. Due to my efforts bringing the DDRCE into Canada, students at the school I taught were given the opportunity to use the dance and rhythm exergame within their physical education classes; however, they did not participate in any part of the study for fear I would have influenced their decision making during the data collection periods.

The only individuals I was required to have a working relationship with were the teachers and administrators who aided in the development of the study. In an effort to minimize these interactions and to avoid unintentionally influencing their actions or thoughts, a third-party was added to aid in the execution of the research project. For this role, the school district's Health and Physical Education Consultant acted as a liaison between myself and other staff members involved with the project. In some cases individuals did reach out to me directly, but these occasions were rare and overall administrators and teachers were encouraged to contact the school district's consultant if they had any questions or concerns.

***Site selection.*** The participating school district is made up of over 50 elementary, junior, and senior high schools. Selecting only a few to participate required stringent inclusion criteria. It may be argued, in the early developmental years of life, there is no school subject that has more appeal to elementary aged children than physical education. However, all too often, students lose the motivation to take part in a traditional physical education class, and their attitude towards the subject becomes negative and uncomplimentary (Deacon, 2000). Typically, somewhere between the ages of 8 and 15 students lose the motivation to participate in physical education, for this reason, and the fact my teaching experiences have primarily taken place within this age group, the study only included elementary and junior high schools. Next, participating sites also needed an area to securely store the device, the DDRCE is a bulky piece of equipment and requires additional storage over and above what already existed within a school. Also, due to the responsibilities associated with the care and maintenance of the DDRCE equipment only schools that were interested in the project and had the ability to provide a lead teacher to oversee the data collection procedures of the project were considered. Finally, in an effort to stratify results across

a variety of socioeconomic demographics, schools from different areas of the city were actively selected.

Due to the aforementioned criteria and the Health and Physical Education Consultant's working knowledge of all schools within the district, he contacted 10 schools as potential participants. Each school was asked to provide a written statement confirming its involvement, of the 10, eight including my own school indicated their support for the project. This brought the total amount of data collection sites to seven due to the fact the school that I taught at during the implementation of the study would not be participating in the research portion.

**Research Project Administration**

**Equipment Purchase.** To determine the impact of dance and rhythm exergames within a physical education setting it was important to select a piece of equipment that was durable enough to withstand the day-to-day rigors of school use, but was also cost efficient. In total, the 48 wireless mats and computer tower that made up Konami's DDRCE cost approximately twenty thousand dollars, and an additional five thousand was needed to purchase a sound system, projector and the items necessary to transport the equipment from one school site to the next. At this point, it is worth noting that this was the first DDRCE to be sold in Canada, and the first research project that looked at the impact of a multiplayer dance and rhythm exergame within a classroom setting. Three granting agencies provided the funds necessary to purchase the equipment and cover costs associated with the research project.

**Gatekeepers.** After receiving permission from the Ethics Review Committee at the University of Alberta, a request to work with the aforementioned schools within the urban school district was approved by the Cooperative Activities Coordinator. Upon gaining access, the school district's Health and Physical Education Consultant contacted the seven schools ensuring their

eligibility to participate in the study. Additionally, the diverse demographics represented within all seven schools ensured there would be little discrimination towards race, gender, and socioeconomic status while targeting the elementary and junior high age range.

**Responsibilities of lead teachers.** Each of the participating schools provided a lead teacher responsible for overseeing the project while at his or her school. To ensure all teachers felt comfortable with the expectations that accompanied the project, a day of training was provided free of charge. During this time, participating teachers were given a complete breakdown of each of the DDRCE's components, as well as an opportunity to learn the functions and commands of the device. A schedule was also established so each school had the device for approximately three weeks, during which the multiplayer dance and rhythm exergame was to be used by the entire student body during regularly scheduled physical education classes. The DDRCE system would be set up in the morning before classes started, then taken down and charged overnight. To aid in the development of the project and decrease the workload of the lead teachers, the research team suggested that a student leadership component be employed. In doing this, before a school was scheduled to receive the exergaming device the lead teacher and the team of student leaders took a half-day field trip to the school that currently housed the exergaming device. During this meeting the student leadership team currently in charge of the DDRCE would demonstrate how to use and properly maintain the device. Additionally, the student leaders helped with the setup and charging of the dance mats, as well as solved small issues that arose in their own physical education classes.

## Data Collection Tools

**Survey Protocol.** Lead teachers administered two surveys based on the enjoyment levels, attitude, and participation of students within physical education before and after using the

multiplayer dance and rhythm exergame. Before students completed the survey they brought home an information letter and consent form (see *Appendix A*). After the forms had been returned, the lead teacher assigned each student an alphanumeric code to avoid using their names. Students were then allotted time to write the presurvey in class, if a student or his/her parent(s) did not consent to participating in the research project s/he was given a placebo survey. It was made explicit that participation or nonparticipation in this study did not influence grading or academic scores in physical education or any other subjects, nor did the choice have any affect on the relationship between the teacher and the student (see *Appendix A*). A large envelope was placed at the front of the classroom, and as students finished they placed their surveys into the envelope, the last student sealed and handed the envelope back to the lead teacher who then sent the contents to the research team. After students had used the dance and rhythm exergame for approximately three weeks participants also filled out a post survey to help quantify major themes with respect to attitude, enjoyment, and participation levels while using the DDRCE (see *Appendix B*). The same protocol was used for the second survey as was in the first.

*Survey Creation*. With the goal of capturing students' perceptions and attitudes while using the dance and rhythm exergame within various grade levels, and without the luxury of having a similar study from which to draw or adapt data collection tools, a survey was designed and created for this research project. Originally, the survey was created during the research proposal phase of the Secondary Education Master's Program at the University of Alberta. Both Dr. David Chorney and myself, the primary researcher, refined the survey to capture a variety of themes that could potentially emerge within the data collection, as well as stratify the results to showcase different demographics within the study (see *Appendix B)*.

*Participant selection.* Although the entire student body used the dance and rhythm exergame while it was housed at their school site, the surveys only included students within the lead teacher's homeroom (approximately 25 students per site), this was because the lead teacher was the only one who received specific instructions about the protocols involved when administering the surveys. The relatively small number of participants within each of the designated study sites limited the amount of confusion and error on the part of lead teacher, while still allowing for an adequate sample when surveys from all participating schools were combined.

**Group interview protocol.** The research project included three elementary schools and three junior high schools; one school from each age cohort was selected at random to provide the students who would take part in the group interview. Hence, a total of two group interviews took place, one to represent each of the age demographics within this study.

*Participant Selection*. Students who received the pre and post-surveys and indicated they were interested in taking part in the interview portion of the study became eligible participants (see *Appendix A*). Suitable group interview participants were chosen based on their ability to demonstrate a competent understanding of the English language and their ability to proficiently articulate thoughts and feelings. Due to the unique position of the lead teachers at each individual school site and the in-depth understanding of potential participants, it was the lead teacher's responsibility to select three participants to take part in the interview. Additionally, the individuals within the group interview consisted of students from the same classroom, which helped establish a comfort level during the interview. Students were interviewed simultaneously rather than individually to save the primary researcher time and effort travelling back and forth to the research site.

After lead teachers had determined who would be good candidates to interview, an interview consent form was sent home with each of the students (see *Appendix C*). In this instance all consent forms were returned and each participant's contact information was forwarded to the research team. The primary researcher called each member within the cohorts to schedule a time and location. Both the elementary and junior high age groups chose to do the interview at their school shortly after dismissal. Each of the interviews consisted of six open-ended questions that each participant was given the opportunity to respond to (see *Appendix D*). Often students provided a rich and deep analysis of the question being asked, either by responding to the original questions and probes of the researcher or continuing to explore thoughts expressed by other participants.

**Disruptions**

Although the participants were well insulated from anyone directly involved with the research team, having a lead teacher administer the surveys did at times have an adverse affect. Due to the fact a couple lead teachers were unclear about research protocols some of the results were deemed invalid and unusable. In one instance a lead teacher neglected to distribute the presurvey portion of the procedure and instead only completed the second of the two surveys. Although data from the second survey was considered valid, it was not paired with the corresponding presurvey. In one case a lead teacher failed to administer the surveys to a single class, but instead hand selected individuals from several classrooms to complete the survey. These surveys were immediately deemed invalid as the method of administration broke the guidelines approved by the University of Alberta's Ethics Review Committee.

Upon further review it was noted that the presurvey was systemically flawed as it often referred to previous attitude and participation levels related to physical education rather than

dance. Originally, it was hoped a regression analysis would demonstrate the impact a dance and rhythm exergame intervention would have on a school community, but after careful analysis of the results it became clear the surveys were comparing dance and rhythm exergames to regular physical education classes. After taking this into consideration and the desire to salvage the research site that failed to perform the presurvey, my supervisor, Dr. David Chorney, and I decided it would be in the best interest of the study to remove the presurveys from the data analysis section. In total, six sites were included in the final analysis, three elementary and three junior high schools.

**Data Analysis**

In mixed method research the analysis of data is heavily dependent on the researcher's framework, skills, and previous experience. Although there are no formal rules that dictate how mixed methods research should be analyzed it is helpful to discuss the timing, weighting, mixing, and theorizing of the data to provide transparent reasoning for the design, procedures and results of the study (Creswell, 2009).

**Timing.** The data collection took place between the months of October and June, during this period surveys and interviews took place concurrently. Typically students would have finished the post survey before being asked to take part in an interview, however neither the qualitative or quantitative measures drove this study; rather the two are simultaneously collected information about the specified phenomenon. In an effort to remove the sequence component from the design of the method, sites selected to participate in the interview portion were done at random.

**Weighting.** Due to the inductive approach of the research both qualitative and quantitative data were weighted equally, no one set of data was given preference over the other. It

is important to remember the aim of this research is not to test a hypothesis or theory (deductive), but to uncover common experiences of the participants and therefore it was vital that themes and understandings emerged within either research method.

**Mixing.** "There are two different questions here: *When* does mixing occur? And *how* does mixing occur?" (Creswell, 2009, p. 207). The concurrent triangulation design calls for separate collection and analysis of both the survey and interview data. Once this has been completed the researcher interprets the meaning of qualitative and quantitative data together. Keeping the two pools of data separate at one end of the spectrum (Results), then combining them in the other (Discussion and Conclusions) allows for topics to emerge within either of the methods then become substantiated, refuted, or unacknowledged within the triangulation process.

**Theoretical Lens.** The social constructivist worldview aids in the interpretation of data as it aims to gather information based on the complexity of views with which humans live and work (Lincolin & Guba, 1985). "The goal of the research is to rely as much as possible on the participants' view of the situation being studied" (Creswell, 2009, p. 8). It is important to carefully analyze the life stories and experiences of the phenomenon in both qualitative and quantitative forms, as it is the duty of the researcher to identify the meanings and interpretations people attach to their daily lives. As a result, the social constructivist inherits several assumptions. (a) Human beings construct meaning by engaging the world they are interpreting, (b) this engagement is based on an individual's social and historical perspective, and (c) humans are social creatures therefore the creation of meaning is based on the interaction one has within their community (Crotty, 1998).

**Section Summary**

Beyond acquiring the funds to purchase the equipment and instructing lead teachers on their responsibilities within the research project, it was imperative that the lead researcher be adequately insulated from research participants. Conversely, this did lead to complications while administering the survey. But overall, the interview and survey protocols ensured the theoretical background described within the methodology section would establish reliable and valid results. From those results the mixing of data within the social constructivists framework will aid in the narrative structure present within the later sections of this paper.

## Section Five: Data Analysis

### Section Introduction

The following section of this paper is based on student-generated results, which were derived from data collection tools specifically designed for this concurrent mixed methods study aimed at discovering whether or not a multiplayer dance and rhythm exergame (D&RE) is a suitable device for a physical education (PE) classroom. The goal is to deliver the results in a format that promotes transparency and clarity; accompanying each thematically organized data set are brief observations that will highlight the significance of the study. By doing this it is hoped that the reader will be able to make clear connections between the data and the relevant discussion points they provoke. To begin, the participation rates of the quantitative surveys were discussed to provide the reader with a clear understanding of the number of students who participated in the study portion compared to the number or students who were eligible but decided not to participate. Next the quantitative data, compared in four different tables, provides another layer of contextual understanding and synthesis. Finally, emerging themes within the qualitative data provided insights related to students' interactions while the multiplayer D&RE was in use.

### Participation Rates

Although the 71% total response rate indicated in Table 1 is a favorable degree of participation, there was an obvious discrepancy between the elementary and the junior high schools that participated in the survey portion of the study. One might assume that older, more mature students would remember to return their survey forms, however this was certainly not the case. Unlike their elementary counterparts who may have had inquiring parents and a single

homeroom teacher who could ensure forms be returned in a timely fashion, the junior high cohorts had homeroom teachers who only saw the class for a limited amount of time each day.

Table 1

*Participation Rates by Site*

| Site | School type | Participants | Eligible Participants | Rate |
|---|---|---|---|---|
| 1 | Elementary | 28 | 29 | 97% |
| 2 | Elementary | 20 | 20 | 100% |
| 3 | Elementary | 18 | 22 | 82% |
| 4 | Junior High | 14 | 26 | 54% |
| 5 | Junior High | 16 | 25 | 64% |
| 6 | Junior High | 25 | 49 | 51% |
| Total | Elem./Jr. High | 121 | 171 | 71% |

Given that the homeroom and/or physical education teacher was responsible for the collection, and encouraging the return of consent forms, there were considerable variations between each individual site. It is also worth noting that each lead teacher's professional assignment and experience level varied from one site to the next. This could have had an impact on whether or not he or she viewed the return of the consent forms as a priority. For instance, a teacher with few years in the profession may consider this research project a low priority due to the additional effort required to develop his or her program of studies, along with extracurricular commitments (coaching, clubs, or celebrations) s/he are encouraged to run in an effort to achieve tenure contract status. On the other hand, a more experienced teacher would have the advantage of using a developed program of studies and therefore be able to devote larger amounts of time and effort to the research project to promote a successful result.

**Quantitative Survey Results**

**Introduction.** All results from the quantitative surveys were recorded, stored, and analyzed using IBM's Statistical Package for the Social Sciences (SPSS®) version 21 software. Using the outcomes from the student surveys SPSS was used to calculate descriptive statistics

including means, standard deviations, and frequencies. The software easily pivoted independent variables embedded within the survey to generate tables and figures to represent survey responses. As a result, a table based on the responses of all participants was created, as well as tables dedicated to comparing different age groups, gender, and each individual school site. The original survey questions were included within each table. This was done to avoid confusion when triangulating data and developing conclusions based on results. Survey questions were all based on a five-point Liket-type scale in which circling a one indicated the participate 'never' agreed with the statement offered within the survey, circling a three indicated the participant 'sometimes' agreed with the statement, and circling a five meant s/he 'always' agreed with the statement (see Appendix B).

Table 2

*Survey Responses of All Participants*

| | Mean | SD | N |
|---|---|---|---|
| *How often did you play D&REs before they were introduced to your school?* | 2.88 | 1.152 | 121 |
| *How often did you enjoy PE while using the D&RE?* | 4.26 | .911 | 121 |
| *Did you look forward to using the D&RE in PE?* | 4.22 | .953 | 121 |
| *How often did you participate in PE when the D&RE was in use?* | 4.52 | .788 | 120 |
| *Where you motivated to use the D&RE?* | 4.15 | .950 | 120 |
| *Did you feel safe when using the D&RE in PE?* | 4.55 | .796 | 121 |
| *Did you have a positive attitude towards PE while using the D&RE?* | 4.41 | .833 | 121 |
| *How often would you like to see a D&RE as a part of your PE class?* | 4.03 | 1.032 | 121 |

*Note*. Survey results based on a five-point Likert-type scale. SD = Standard Deviation; N = Number of responses. 1=Never; 3=Sometimes; 5=Always.

Overall, students who came into contact with DDRCE approved of the device and its

insertion into regularly scheduled PE class. Mean scores based on enjoyment, motivation, and attitude towards PE all stayed above a 4.0 on the five-point Likert-type scale (see Table 2). The lowest mean score amongst all participants surveyed was the amount of D&RE experience an individual had before using it in their PE classroom (Mean = 2.88), at this juncture it is unclear whether that is a result of being uninterested in the exergaming devices or not having the opportunity to use a similar exergame at home or elsewhere. Yet, with a mean score sitting right above the halfway mark of the five-point Likert-type scale, coupled with the highest standard deviation, it is clear that much like any other activity or game introduced within a PE setting there is a large discrepancy between the experience levels of participants.

When students were asked how often they participated in PE while the D&RE was in use, the category yielded the lowest standard deviation (SD = 0.788) and the second highest mean score (Mean = 4.52). These results are clear evidence that students were consistently able to engage with the exergame within a PE setting. However, when this result is compared to enjoyment (Mean = 4.26) and/or motivation (Mean = 4.15) a slightly lower mean total is noted. Therefore, even if an individual was not highly motivated to use the exergaming equipment, more often than not he or she would still participate in PE while the device was in use.

This may partially explain the larger standard deviation when participants were asked how often they would like to see the D&RE as a part of PE class (SD = 1.032). Although this question maintained a relatively high mean score (Mean = 4.03) indicating that most students would like to see the multiplayer exergaming devices within their PE classes in some capacity, the large standard deviation (SD = 1.032) signified that others preferred limited exposure to these multiplayer exergames.

Table 3

*Survey Results by Age*

| | Elementary | | Junior High | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| *How often did you play D&REs before they were introduced to your school?* | 2.85 | 1.113 | 2.91 | 1.206 |
| *How often did you enjoy PE while using the D&RE?* | 4.48 | .808 | 4.00 | .962 |
| *Did you look forward to using the D&RE in PE?* | 4.50 | .809 | 3.89 | 1.012 |
| *How often did you participate in PE when the D&RE was in use?* | 4.65 | .672 | 4.36 | .890 |
| *Were you motivated to use the D&RE?* | 4.51 | .850 | 3.73 | .891 |
| *Did you feel safe when using the D&RE during PE?* | 4.61 | .762 | 4.47 | .836 |
| *Did you have a positive attitude towards PE while using the D&RE?* | 4.48 | .881 | 4.33 | .771 |
| *How often would you like to see the D&RE as a part of your PE class?* | 4.08 | 1.057 | 3.98 | 1.009 |

*Note.* Survey results based on a five-point Likert-type scale. SD = Standard Deviation. 1=Never; 3=Sometimes; 5=Always.

Perhaps even more important are the differences between elementary and junior high schools. When looking at Table 3 as a whole, it is evident that elementary students not only enjoyed using the device but also looked forward, and were highly motivated to use the multiplayer D&RE. In fact, when all survey questions' means were compared, the junior high cohort's mean scores saw a decrease in every category except for previous exposure to the device compared with the elementary (see Table 3). This single discrepancy could be accounted for by the fact that older students would have greater life experience and therefore more opportunities to come in contact with similar exergames.

Typically, mean scores were lower within the junior high group while the standard deviation was higher. For instance, when participants were asked if they looked forward to using

the device in PE, the junior high cohort had a higher standard deviation (SD = 1.012) and a lower mean score (Mean = 3.89), than the elementary group, which had a smaller standard deviation (SD = 0.809) and a greater mean score (Mean = 4.50). This Suggests that while most elementary surveys gravitated towards the high end of the five-point rating scale the junior high survey responses were mixed. Of the 66 elementary surveys completed 45 of surveys indicated the student *always* (5 out of 5) looked forward to using the device while only 19 of the 55 junior high surveys indicated the same level of enthusiasm. The only instance where this trend was reversed was when participants were asked if they had a positive attitude towards PE while using D&RE. Although results are similar between age groups the lower standard deviation in the junior high section (SD = 0.771) reveals that their motivation levels towards D&RE may have varied, but overall most research participants had a positive attitude (Mean = 4.33) during PE while the multiplayer DDRCE was in use.

Similarly, when comparing the two age cohorts' motivation levels, the mean total dropped from 4.51 within the elementary to 3.73 in the junior high group while the standard deviation remained fairly constant. Hence, while the most common answer among elementary participants was to indicate they were *always* motivated to use the device, of the 55 junior high respondents who answered the question, 41 scored their motivation either a *3* or *4* on the five-point scale.

Perhaps the most telling piece of information is the nearly identical means and standard deviations for both groups when asked how often they would like to see D&RE as a part of PE. These numbers indicated that students viewed this activity as a worthwhile endeavor and would welcome its use in future PE classes.

Table 4

*Survey Responses by Gender*

| | Female | | Male | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| *How often did you play D&REs before they were introduced to your school?* | 2.83 | 1.047 | 2.93 | 1.266 |
| *How often did you enjoy PE while using the D&RE?* | 4.36 | .880 | 4.16 | .941 |
| *Did you look forward to using the D&RE in PE?* | 4.45 | .890 | 3.96 | .963 |
| *How often did you participate in PE while the D&RE was in use?* | 4.64 | .627 | 4.38 | .926 |
| *Were you motivated to use the D&RE in PE?* | 4.23 | .938 | 4.05 | .961 |
| *Did you feel safe when using the D&RE?* | 4.78 | .519 | 4.28 | .959 |
| *Did you have a positive attitude towards PE while using the D&RE?* | 4.55 | .688 | 4.26 | .955 |
| *How often would you like to see a D&RE as a part of your PE class?* | 4.19 | .906 | 3.86 | 1.141 |

*Note*. Survey results based on a five-point Likert-type scale. SD = Standard Deviation.

When looking at Table 4 it is undeniable, that regardless of previous exposure or experience levels, both males and females were engaged in the experience of using a DDRCE within PE. Perhaps these positive results were due to the fact that the electronic medium was a familiar interface that provided individualized results while combining contemporary music with dance. However, the survey results took on new relevance when the data was stratified to indicate the differences between female and male responses. Aside from having a slightly lower mean based on the amount of time spent playing a D&RE before it was introduced to their school, females had higher means and lower standard deviations on all survey questions when compared to their male counterparts.

Of these scores the largest discrepancy existed when participants were asked whether or not they looked forward to using the D&RE in PE. When combining this statistic with enjoyment

levels while the exergame was in use (Mean = 4.55), it could be argued that females had a very high efficacy level towards PE while the multiplayer D&RE was in use. Concurrently, results comparing males to females are similar in every category, but the consistency with which females enjoyed, participated, and were motivated to use exergames in a PE setting is of paramount importance given the substantial amount of literature dedicated to female perceptions and disinterest in PE (Craike, Symons, & Zimmermann, 2009; Gibbons & Gaul, 2004; Gibbons, Temple, & Humbert, 2011; Pate, Ward, O'Neill, & Dowda, 2007; Robinson, 2009).

Table 5

*Mean Survey Results for All Sites*

| | Elementary | | | Junior High | | |
|---|---|---|---|---|---|---|
| | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 |
| *How often did you play D&REs before they were introduced to your school?* | 2.68 | 3.35 | 2.56 | 2.60 | 2.81 | 3.17 |
| *How often did you enjoy physical education while using the D&RE?* | 4.64 | 4.55 | 4.17 | 3.80 | 3.81 | 4.25 |
| *Did you look forward to using the D&RE in PE?* | 4.75 | 4.45 | 4.17 | 3.67 | 3.94 | 4.00 |
| *How often did you participate in PE when the D&RE was in use?* | 4.74 | 4.85 | 4.28 | 4.07 | 4.31 | 4.58 |
| *Were you motivated to use the D&RE?* | 4.59 | 4.80 | 4.06 | 3.93 | 3.19 | 3.96 |
| *Did you feel safe when using the D&RE during PE?* | 4.57 | 4.95 | 4.28 | 4.40 | 4.69 | 4.38 |
| *Did you have a positive attitude towards PE while using the D&RE?* | 4.71 | 4.60 | 4.00 | 4.20 | 4.31 | 4.42 |
| *How often would you like to see a D&RE as a part of your PE class?* | 4.46 | 3.65 | 3.94 | 4.13 | 3.88 | 3.96 |
| Number of participants surveyed | 28 | 20 | 18 | 14 | 16 | 25 |

*Note.* Survey results based on a five-point Likert-type scale.

Adding yet another layer of discussion to the quantitative results is the data analysis of each individual site. As it might be expected, based on the difference between elementary and junior high survey responses (see Table 3), sites 1 and 2 consistently produced the highest mean scores of all the survey questions. However, it should be noted that sites with the lowest numbers

of participants surveyed, also provided the lowest mean scores for all quantifiable categories except when indicating how often they would like to see a D&RE in PE. Not only did sites 3, 4, and 5 produce relatively low response rates (see Table 1) they also had the lowest means for interest, participation, and positive attitude for the intervention. Furthermore, these high and low means were between elementary and junior high divisions. Four of the lowest survey response totals came from junior high sites while the other four occurred within the elementary division. Here a connection was made to the number of participants at each site and the level of students' efficacy while using the D&RE.

A possible explanation for the link between low participation rates and low survey means could be the enthusiasm level of the teachers who administered the activity. As it was mentioned earlier, teachers who deemed this research project a low priority may have spent less time and effort recruiting participants to take part in the research. If this were the case, these same teachers may not have placed a large amount of emphasis and/or expectations on students when using the D&RE equipment within their PE classes. Conversely, lead teachers who considered the multiplayer exergame intervention a top priority may have provided extensive follow up when making sure students returned their consent forms and may have most likely wished to promote positive results within the surveys.

**Summary.** The results garnered from the survey provided useful insights about D&RE within a PE setting. By focusing on different variables it was possible to see nuances within the data and witness how the intervention affected different demographics within a school population. This quantitative data makes generalizations about the target population, yet it is only half of the accumulated results within this study. In an effort to reinforce some of these findings and further explore the students' experiences while using a D&RE qualitative measures were also employed.

**Qualitative Interview Results**

**Introduction.** In addition to the quantitative data collected from the 121 surveys, two group interviews were conducted to provide a greater description of the context with which the multiplayer D&RE intervention occurred. One group interview served to document the elementary cohort while the second helped to explain some of the experiences within a junior high setting. Each interview lasted approximately 20 minutes and took place on school grounds shortly after dismissal. Potential participants were approached individually by lead teachers and asked to sign a separate interview consent form as seen in *Appendix C*. Although the research team did not mandate or set specific guidelines for the gender of participants, both group interviews included one girl and two boys. Responses varied in length from single word retorts, such as "yes" or "no" to well thought out multiple sentence answers that accurately depicted the setting and emotion related to the experience. In fact all of the students interviewed provided some type of response to the questions asked, even if only to agree with other comments made within the interview.

Once the initial transcripts were produced, the researcher analyzed student responses for commonalities, original insights, and patterns. The transcripts were read multiple times and coded into themes. Based on the six questions asked during the interview (see *Appendix D*) and some probing done by the interviewer to maximize participant output, five themes emerged: (a) novelty, (b) participation, (c) competition, (d) physical fitness, and (e) physical safety. These themes were largely a result of the questions asked during the interview, consequently and appropriately they were also related to the quantitative results captured within the survey and relevant literature.

In an effort to protect the identities of the students who participated in the group

interviews, while allowing the reader to clearly understand who is speaking at any given moment, a set of respondent abbreviations were used (see Table 6).

Table 6

*Respondent Abbreviations for Qualitative Analysis*

| Respondent | Abbreviation |
|---|---|
| *Elementary Male Number One* | EM1 |
| *Elementary Male Number Two* | EM2 |
| *Elementary Female* | EF |
| *Junior High Male Number One* | JrHM1 |
| *Junior High Male Number Two* | JrHM2 |
| *Junior High Female* | JrHF |

**Novelty.** As one may expect, bringing a videogame or any other unique interface into a classroom could illicit a novelty effect among students, and in the case of using a DDRCE within a PE classroom this was no different. When students were asked how they felt when they first learned they would be playing a videogame during PE a notable level of intrigue accompanied their responses. "I was excited because, I like playing videogames and dance videogames are pretty fun" (EM1). Some participants chose to relate this portion of the interview to their past experiences with videogame consoles.

> JrHM2: Well, I was really excited because normally videogames and physical education don't really mix together so when we found out we were combining the two I thought it would be really fun.
> Interviewer: Okay.
> JrHM1: And I was kind of like[2], now a days[3] most people play videogames, well most guys anyways, and so I was kind of happy and like I wouldn't think they would mix cause normally videogames you sit down in a chair and use a mouse and stuff, or a controller.

On the other hand, one of the female participants indicated that it would be a welcome break from a typical PE class.

> JrHF: I thought it was like a really cool way of taking a different medium and involving it in physical education, or gym itself because usually you're like (participant

[2, 3] Student responses are purposefully included as they appear on the interview transcript. Any colloquial expressions or errors in grammar are the students and not the researchers.

> makes hand gesture for quotation marks) oh my goodness we have to go to gym and play like ball or something.

Students also seemed surprised to learn they would be using the exergaming equipment within a PE setting. One student stated, "I was kind of shocked with it cause I never heard of something like a videogame in gym before" (EF). This feeling of novelty was summed up when EM2 affirmed, "I was kind of excited but I was really surprised."

It is reasonable to suggest that most students who came into contact with the D&RE shared similar feelings and appreciated the fact they were going to be using an electronic interface that they may or may not have had previous exposure to. Additionally, depending on the PE program already in use students may have seen value in the intervention as it provided an alternative to everyday activities.

**Participation.** Consistently the highest mean among all questions within the quantitative survey, the theme of participation was often talked about during the interview process. After the elementary cohort was asked if the D&RE affected their participation in PE they offered up these insights.

> EF: I found it really like, I don't know, I like participating in gym all the time. Sometimes the games we play (laughs) like some of the games they're not as fun as others. And this was probably the best game, or one of the best games.
> Interviewer: But that's like any other PE class. Right? There's going to be things that you like, and things that you don't like.
> EF: We were all so excited even though I know a lot of my friends who don't like to participate in gym like loved it, they loved gym.
> Interviewer: So you think some of your friends who normally don't participate in gym liked this more?
> All: Yea.
> EM1:I think everybody in the class… well participated in this as hard as they could.

This discussion highlighted the strong motivational capacity of the D&RE game while in use within a school setting. Immediately eliciting greater levels of participation was noted as a major attribute of the device. This phenomenon was reiterated within the junior high interview, as one

interviewee explained how the alternative assignment in her PE class led to a higher efficacy levels towards participation.

> JrHG: But in terms of participation I hate gym, I'm sorry. I do not like gym class, I'm not a person who's very active, I trip on flat ground. Yea, very bad, but DDR for some reason I really like, cause rhythm gaming I just like rhythm and stuff and I'm a person who gets very hyped up about random things. (Laughs)
> Interviewer: But normally you're not a very active participant perhaps? But in this case…
> JrHG: I'll try my best, but that's the whole thing, it's not like I like, like it completely.
> Interviewer: But it gave you an opportunity to work at your own level of difficulty.
> JrHG: It gave me the opportunity to do something I could do better at.

During this portion of the conversation the interviewee was referring to the different difficulty levels available when using the DDRCE exergame. While utilizing real time individualized scores and simultaneously providing three different difficulty levels this participant was able to map her progress and aim to do better the next time she played. Additionally, it would be reasonable to assume that this experience was not isolated to this single participant, as most videogames including DDRCE are designed to engage the user within their proximal zone of development. Moreover, the simultaneous use of three different difficulty levels promoted a challenge that was neither too hard nor too easy for the user.

In some instances the participation of an individual shifted from the original design of the exergaming platform.

> EF: I know a couple of the girls when they got tired they would sit down and do it with their hands, that was kind of cool too.
> EM2: Yea they would sit down and do it with their hands. Yea it was pretty cool watching it because of how fast they were able to move their hands too.
> EF: It was funny because they were so exhausted but they didn't want to stop playing
> EM2: And it was fun.
> EF: So they just kept going.

Whether the desire to play the game seated instead of standing was a result of overexertion or due boredom in unclear. However, the same behavior was repeated within a junior high setting, "they tried to use their hands to touch the arrows" (JrHM2). Notwithstanding, during the junior high

interview the goal was to reach another level of mastery within the gameplay as JrHM2 stated, "and they [still] couldn't do the expert." The term "expert" refers the highest difficulty level that exists within the gameplay. Additionally, playing seated is not the only instance when students within the junior high setting noticed gameplay modification in an effort to maximize potential scores.

> JrHM2: They had like four people on one mat and they were all trying to push individual buttons.
> JrHM1: To do expert.
> JrHM2: It was really funny.
> Interviewer: Oh really?
> JrHM2: Yea.
> JrHM1: And they got first.
> All: (Laughs)
> Interviewer: Did they really? So that ended up working.
> JrHM2: Yea they got first!
> JrHM1: They had like one [person] on each [arrow] and then on expert they just put four on like each corner and then they'd have them touching it when it's their turn.
> JrHM2: All team up and press one button each time.

Again, it may not have been the original intent or design of the multiplayer exergame, but this creativity showcases the flexibility of the device if students with special needs are able to either sit on the dance mat or only be responsible for a single arrow.

Not only did students try to continually challenge themselves while using the multiplayer equipment they also offered suggestions about how best to use the D&RE device in the future.

> JrHG: Well I thought like normally, I really like to do gym and stuff and then like I found at first it was really fun to do it, but then at the last couple of days it kind of got boring cause it was the same songs. But it was really fun at first, so like I would do it for like a unit but not for like a couple months. I think it should just be an enhancer. Not complete curriculum, an enhancer.
> JrHM2: Yea, just like exercise for your legs before you start dancing.
> JrHF: Yea, or just maybe a week of that and then you go into like your dance unit and you're learning swing or something.
> Interviewer: So how long would you say is a good timeline to use the device?
> JrHM1: Three weeks would be pretty good.
> Interviewer: 3 weeks?
> JrJM1: Like it's like fun to do.
> JrHM2: Yea, 3 weeks.

Despite being unaware the equipment was at their school for approximately a three-week period, it seems that at the end of this timeframe some students began to withdraw from their original motivations towards the device.

> JrHF: We had to do it every gym class.
> JrHM2: I liked that.
> JrHM1: It would be every second day that would be fun.
> JrHF: Yea every second day, or maybe like once a week we only did it like three times or something.
> JrHM2: It may have been repetitive but I still liked it.
> JrHM1: Yea, it was still fun!

Perhaps a shorter time frame would be ideal but no clear consensus within the interview cast was adopted to dictate how often the device should have been used.

However, when asked about using the D&RE device in PE, both interview groups compared it to dance units they had done in the past.

> EM1: For our dance classes in previous years we had to learn the…
> EM2: Chicken dance.
> EM1: Yea the chicken dance, and a bunch, the Cadillac ranch and that's that wasn't very fun for me.
> EM2: Yea it's different
> Interviewer: Okay.
> EF: And especially like because we're so used to learning the same dances over and over again when you're more motivated to do something you tend to do better at it. A lot of the kids were really motivated to do DDR so I think that was really good too.

These comments were similar to ones made within the junior high interview, which presented insights about the complexities of offering dance instruction within PE.

> JrHG: Because we did square dancing last year, and it was horrifying.
> JrHM1: Oh my.
> JrHM2: It was terrible!
> Interviewer: What was the difference of using exergames as apart of your dance curriculum rather than something more traditional like square dance?
> JrHM2: Like, when you square danced it was really awkward, because sometimes you would chose your partner and sometimes you would just get randomly paired with someone, so you're just…
> JrHM1: Uncomfortable.

> JRHM2: It'd be really awkward just dancing with someone that you either don't interact with or have no attraction to.

At this juncture, it should once again be made clear that fun is a tool that educators use to promote engagement within PE and like any other subject discipline it is not the primary consideration or outcome. Instead, the goal is to give students the knowledge, skills, and abilities to live healthy active lives, and undoubtedly students would have received curricular outcomes from lessons based on traditional dance. Also, it is clear that students saw value when using multiplayer exergames within a PE setting and had a favorable disposition towards these devices when compared with traditional dance.

A possible explanation for this could be the camaraderie of multiplayer gameplay, "instead of going one at a time you get to do it all at the same time" (EM). Unlike traditional home game consoles that focus on single or dual user experiences, the exergaming system allowed a whole class to play simultaneously.

**Competition.** As a result of the multiplayer design and real time scoring systems the theme of competition among friends and classmates often surfaced as a major motivator. "Sometimes in your group of friends you had competitions of who could get the better score" (EM1). Depending on the scoring system in place, the exergaming interface allowed individuals to match their skill set with others in the group. "There was a lot more competition between us because of the scores" (JrHM1). In many instances the element of competition aided a successful dynamic, motivating individuals to play the game with vigorous intensity. "It was really fun because sometimes in your group of friends you had competitions of who could get the better score" (EM2). Not only limited to males, females also engaged this element of the D&RE. "When competitions and stuff with our friends got really competitive, that was so fun" (EF).

The DDRCE exergaming system offered different gameplay options, which altered the experience for participants. Students also spoke about a team competition rather than individual.

> EM2: There were different teams
> EM1: Yea, yea there were four different teams. Like blue red…
> EM2: Green, yellow and red.
> EM1: Yea, and if we were all on one we would try to get the highest scores.
> EM2: So that our team would win
> EM1: Yea
> EG: Yea ahaha
> EM1: Yea, so that the team would get the best score.

Alternatively, if the tournament mode was selected it ranked students based on their performance rather than display individual or group scores.

> JrHM2: Most people when they found out it was in tournament style and you had to beat people and not their scores, most people got really into that and were really competitive and so they decided to push themselves more.

While the alternative gameplay modes were not a primary consideration when purchasing the D&RE, it seems that both teachers and students made good use of everything the DDRCE had to offer.

Furthermore, the bouts of competition inspired by the exergame interface also prompted a great deal of spontaneous engagement. One of the interviewees indicated he saw some of his friends who did not typically participate in PE competing during his class. “I noticed some of my friends who don’t like gym always challenging each other” (JrHM1). In another instance an interview participant admitted, “I went home on the weekends and practiced it because we have one at our house” (JrHM2). After probing him for the reasoning behind this behavior he responded, “I couldn’t beat [person’s name], so I decided to just go home and practice it” (JrHM2).

Given the amount of effort exerted by participants and the quantitative results within the category it would seem a natural consequence that some element of physical fitness would result from these activities.

**Physical Fitness.** Recent scholarship on the subject of D&RE has primarily investigated an individual's ability to attain moderate to vigorous physical activity levels while using these devices (Graf, Pratt, Hester, & Short, 2009; Lanningham-Foster et al., 2006; Unnithan, Houser, & Fernhall, 2006). Likewise, due to the inductive design of this study it is appropriate the subject emerge within the qualitative data stream. Albeit, participants did not have any tools to gauge physical activity levels (i.e. heart rate monitors or pedometers), but they did indicate achieving marked levels of exertion while using the D&RE. As mentioned by one interviewee earlier, not only did students push themselves to the point where they needed to sit down to play the game, but one student indicated "it's a great way of building stamina… you're always working harder so that's working your brain, your body too" (JrHF). Students also equated increased levels of physical activity to perspiration.

> JrHM1: Cause people think dancing isn't exercise, but then you go out and try and you're like oh… When I first saw it, I was like how is this gym? And then I go out and then at the end of the gym class I was sweating. I was like oh wow!

As it was noted in the literature, users with more experience and exposure to D&RE tend to elicit higher levels of physical activity (Huang & Gao, 2013), and by the end of the 3-week intervention it would seem that most students had attained adequate levels of competence to achieve vigorous levels of physical activity. "I think everybody at the end was doing advanced" (EM2), the term advanced refers to the second hardest level of difficulty within the gameplay. Interviewees also offered options when the dancing became too tiresome, "if it got too hard, kids could just switch to medium" (EM1), or, "if you just got way too tired you could just go to a lower level"(EF).

Stories comparing the D&RE to other forms of physical activity were also expressed during the interviews. In one instance a participant explained how one of her friends reacted after using the multiplayer exergame.

> JrHF: I had one friend and she's active and she's in roller derby and everything. But, going to gym class, she does not like it. But once she did DDR, after class she's like oh my goodness I really liked it because, it made you actually exercise, like a lot.
> Interviewer: Right, okay.
> JrHF: And she's like that's better than a treadmill.

While most students did not compare the use of the D&RE to a treadmill, the result is an activity that promoted the movement of large muscle groups in the lower body.

**Safety.** Although, not a primary concern when creating this study, nor was it a relevant matter when looking at the quantitative data, the topic merits consideration as it did emerge as a discussion point during the interviews. It may pose some concern that one student admitted, "I actually fell off the mat a couple times and hit the plastic edge and hurt my ankle" (JrHF). Perhaps not an extremely serious injury, but it is foreseeable that other individuals who use the device could easily repeat this incident. On a more serious note one of the interviewees had previously suffered a concussion playing football, and when he was asked if using the D&RE device affected his participation in PE, he stated, "I had to sit out a few times because it was too much stimulation for my brain (EM1). Perhaps not a typical scenario, as most students would not have had a concussion prior to using the D&RE, but the concern for students' physical safety and wellbeing should always be a top priority.

Additionally, the extended period of time participants were required to stay focused on a projected screen was mentioned as a negative factor when using the device.

> JrHF: The first thing you do is look up at a screen and your eyes don't like it, they would start to water.
> Interviewer: Right.
> JrHM2: Especially if you're at the front, you had to be looking straight up, it would really hurt your neck sometimes, but maybe it's just our projector.

Interviewer: Okay, so how it's set up.
JrHM1: Yea that did hurt your eyes a little bit.
JrHM2: They're just like little things.

Despite being considered a minor problem when using the D&RE, this is something practitioners need to consider when deciding whether or not to include these devices within a PE setting. Furthermore, given the propensity of screen based devices within the daily lives of modern-day children, we may find ourselves asking if our students need yet another device that has school-aged youth focus on a screen for a set amount of time.

**Summary.** Overall the qualitative data provided useful insights about the ways students interacted with the D&RE device while it was housed within a school. Participation by individuals as well as each class as a whole, was a large part of the conversation; interviewees felt the multiplayer exergaming device offered a good variety of gameplay options while promoting a great deal of friendly competition without eliminating individuals from the experience. The use of the device was appreciated, and provided opportunities for students, who do not usually participate, an alternative avenue to feel success in a PE setting. Lastly, the issue of physical safety should not be overlooked as serious injuries such as concussions could have a direct impact on individuals when using these types of devices.

**Section Summary**

Within the quantitative portion of the study it became evident that overall participation, enjoyment, attitude, and motivation towards the use of multiplayer dance exergames within a school setting was very high. However, there were some groups who enjoyed using the devices more than others. As the survey responses were pivoted it was evident that both elementary-aged students and females had the highest efficacy levels towards the use of D&RE within a PE setting. Although finding interventions to engage elementary-aged participants is not a forefront concern for PE practitioners and scholars (Deacon, 2000), encouraging females to have a positive

attitude towards PE and find enjoyable methods of physical activity is. Congruently, the qualitative portion gave several students the ability to voice their opinions about the use of a D&RE within their PE class. During these conversations, the opportunity to include an electronic interface was welcomed by students as a break from the traditional games and dances typically offered within PE. The exergame allowed users a marked level of success while playing the game, as well as opportunities to progress in their skill level and compete with classmates. Perhaps not an immediate concern but all prudent PE practitioners need to consider the aspect of safety when introducing a new concept to students as interview participants made several mentions of discomfort while using the device. Overall, these student-generated results will launch a discussion based on the use of D&RE within a PE setting and connect the themes and original insights to the literature that already exists within the field.

# Section Six: Discussion

## Section Introduction

This section is primarily concerned with answering the research questions this study originally set out to investigate. First, by revisiting the research questions, the context in which this study has taken place provides an understanding of the events that have unfolded over the past year. Qualitative and quantitative data will also help to establish links within the body of literature surrounding D&RE, as well as provide original insights and analysis of the questions. Finally, as the scholarship concerned with the use of exergames within a school setting continues to grow, developments made within this study has confirmed what we already know from the results of previous studies. Together a comprehensive and succinct understanding of the topic will be revealed and a direction for future research was attained.

## Revisiting the Research Questions

Returning to the original research questions, it becomes easier to highlight the significance of the study in a manner that allows for a better understanding of the topic. Collecting data using two different methodological practices is not always an easy or predictable path as the information was not always, but often was, harmonious. The research questions were:

1. How do students perceive the use of a multiplayer dance and rhythm exergame within a physical education setting?
2. Are multiplayer dance and rhythm exergames suitable for sustained use within a physical education classroom?

**The device.** When considering the inclusion of an exergame device within a school setting there are a variety of factors that must be accounted for when making what can be a very expensive purchase. Initially, the research team debated whether the dance interface would

unintentionally harm students who were unable to reach a certain level or mastery within the gameplay, or embarrass individuals who may appear awkward while using the device. However, it was finally agreed that this form of instruction would not put students at risk more than any other PE unit. Concurrently, interview participants initially reported wishing to be placed at the back of the class when doing the activity, but soon came to the conclusion that the exergaming interface limited opportunities to comment on the way others used the game, because "you just look at the screen, you're not looking at anyone else" (JrHF). Another participant insisted, "nobody had time to laugh at anyone cause they were too focused on the game" (JrHM2). Perhaps this is also why survey responses indicated that participants felt overwhelmingly safe, either emotionally or physically, when using the D&RE within a school setting, giving it the highest mean score (Mean = 4.55) when comparing responses from all participants (see Table 2). The feeling of safety coupled with high scores related to participation and motivation while the device was in use allowed for the vast majority of students to genuinely enjoy their PE class while the D&RE was in use. Moreover, participant concerns were not based on emotional safety, ridicule or teasing from peers, but rather physical safety. For instance, one boy felt dizzy while he was playing due to a concussion he had received playing football several weeks prior, while another student admitted she hurt her ankle after she lost her balance while on the dance mat.

Comparable to other videogame consoles the DDRCE provided synchronous feedback for each individual dancer; hence students were given immediate and personal feedback based on their performance and had the option of choosing at which pace to engage the game. Not only were there several difficulty levels from which each student could choose, but individual results also enabled participants to track their progress and gauge their skill improvement. The formative assessment is meaningful to students and offers further insights to the very high mean scores for

elementary (Mean = 4.48) and junior high students (Mean = 4.33) who expressed having a positive attitude towards PE while the D&RE was in use (see Table 3). As an individual received feedback from the exergame, s/he was able to respond by trying to improve his or her performance and attain a greater level of mastery within the game. Typically, formal and objective feedback with regards to skill improvement is a difficult and time consuming outcome to deliver within a PE setting and it is most likely left up to the student to gauge whether or not he or she had made any progress.

During D&RE sessions students tracked their score via a pseudonym their dance mat was assigned, these names would alternate among dance mats on a daily basis and therefore rarely be given to the same student twice (unless that individual sought out a specific name). Hence, students were afforded a layer of anonymity, as only individuals who played in close proximity of each other would be able to make an immediate connection between a person and his/her gameplay pseudonym. This may have aided in the development of "friendly competition" (JrHM2) while the exergame was in use. If students choose to use dance mats that were located amongst their friends or people they feel comfortable with, as indicated by the qualitative results, they would often engage in competitive behaviors to see who could attain the highest score. Concurrently, competitive spirits within the classroom would only promote higher levels of physical activity while the multiplayer D&RE was in use.

**Age difference.** Throughout this study participants were separated into two age categories, indicating whether or not a participant was in an elementary or junior high classroom. It has been well documented that as students age, females lose the motivation to participate in PE (Robinson, 2009). It was speculated that this intervention could potentially curb some of those

feelings or perhaps engage a portion of the student population that normally did not participate, or typically did not enjoy PE.

The quantitative results suggested that students in both elementary and junior high settings had high levels of efficacy towards the use of a multiplayer D&RE within a PE setting. On average the elementary students preferred using these devices more than their junior high counterparts (see Table 3), providing higher mean scores than the junior high cohort within every surveyed category except previous experience. Again, one may assume, similar to findings already made within the scholarship surrounding attitudes in PE, as students get older they lose interest in the subject. However, the margins between the two age categories were slim and when each of the school sites was assessed individually it posed further questions within the research findings.

As it was noted in Table 5, sites with higher participant numbers typically provided larger mean scores for survey responses regardless of the age. In many instances these differences were minor but the quantitative results lead to speculation about additional factors that may have influenced the decisions of participants at each individual site. As is often the case in PE and most other courses, a large part of student outlook on the subject matter is the amount of care and attention provided by the teacher leading the activity. Although difficult to quantify, it is reasonable to suggest that a teacher's attitude towards the intervention could have affected the responses within the surveys.

Having the ability to coax additional information directly related to the research questions is a major asset of mixed methods research. Due to the inductive design of this research there were no specific questions that compared student responses from one age cohort to the next, however there were inherent differences between the conversations of elementary and junior high

aged participants. For example, when referring to the exergaming system, the elementary interviewees expressed great zeal and excitement toward its use within their school, claiming "[DDRCE] was probably the best game, or one of the best games" (EF). This general enthusiasm was a staple of the elementary interview and was reiterated by the other members of the group.

> EM1: It was so much fun!
> EM2: Awesome!
> EM1: You can't really explain it in words.
> EM2: I loved it. You can really explain it cause it was… it was really fun. I loved it.
> EM1: Yea, it was it was a good experience.

These statements were similar to ones made within the junior high interview, however the older participants comments occasionally accompanied criticisms related to the use of a D&RE in PE. "I found at first it was really fun to do it, but then at the last couple of days it kind of got boring" (JrHM1). Due to the fact surveys were completed after the intervention had run its course and students were not questioned when their efficacy levels were at their highest, perhaps provides insight as to why the mean scores for the junior high cohort were slightly lower than the elementary cohort (see Table 3). While elementary-aged groups had little issue with the amount of time the D&RE spent at their school site the older age group may have preferred a shorter time frame with which to use the multiplayer exergame.

**Linking curriculum.** The multiplayer D&RE exergame creates obvious links within the dance component of the program of studies, and offers the additional bonus of adding enjoyment to this particular aspect of a PE program. Due to beliefs and prejudices of both teachers and students, dance is a subject that often receives minimal attention in PE due to the importance placed on sport and other recreational activities (Vlasic, Oreb & Katovic, 2012). Dance is often considered an activity that is best suited for young children and females, and as a result is often deemed a bottom priority and little attention is given to the creation and delivery of the topic (Sanderson, 2001). As it was noted in the results section, both interview cohorts had compared

the use of the D&RE to traditional dance units they had participated in previous years. In both elementary-aged and junior high interviews previous dance units were considered to be an activity that was boring and unsavory. Students felt a traditional dance unit "was really awkward" (JrHM2), or just "wasn't very fun" (EM1).

Compared with a PE unit that used a DDRCE as its main curricular instruction tool, students' attitudes seemed to move in a positive direction in support of the device. For instance, when interviewees were asked if they enjoyed using the device as part of PE one participant said, "lots, it was awesome," congruently another interviewee from the junior high cohort explained, "I thought it was really fun and it did add a lot to our class" (JrHM2). Pairing these comments with the surveys of both elementary and junior high participants in Table 3, it was evident that a much more *positive attitude* is accredited to the D&RE intervention than a traditional dance unit.

Whether the positive responses were due to the a lack of quality planning in previous dance units, the novelty of using an exergame within a PE setting, or a combination of additional factors would be difficult to ascertain. However, according to the quantitative and qualitative results students would be willing to swap out or use in conjunction with, perhaps only for a brief period of time, their current dance program and continue using the D&RE.

Additionally, as a side note, if educators were looking for alternative ways to incorporate these devices into PE, a case could be made for the use of a D&RE pertaining to lessons on physical fitness. As motioned in the literature review, sustained use of these devices whether in a multiplayer or individual format contributed to increased heart rate, cardiovascular health, and an active lifestyle. Given the physical inactivity levels of today's youth and the implications of premature morbidity and mortality, it would seem logical to give students the opportunity to use these devices in an effort to promote health and wellness. It would seem like a missed

opportunity if students were not at least exposed to these devices so they could decide for themselves whether or not to incorporate exergaming into their daily living. Nowhere is this truer that when comparing females to males.

**Females and DDRCE.** Due to low enrollment rates in female elective PE classes, many researchers have found reason to investigate the attitudes and perceptions of female students (Robinson, 2009). In fact, females enrolled in elective PE classes consistently produced higher levels of physical activity than girls who are not (Pate, Ward, O'Neill, & Dowda, 2007). However, the solution should not be to force students to become physically active, instead we are tasked to produce intrinsically motivated pupils who choose to participate in activities that promote a physically active lifestyle. In the case of females and the multiplayer D&RE, these results look promising. As indicated in Table 4 females have a very high efficacy and almost always participated in PE classes that included the use of a D&RE. Results indicated that females not only had a positive attitude towards PE (Mean = 4.55), but also felt physically or emotionally safe while using the multiplayer exergaming tool (Mean = 4.78). These results were duplicated within the qualitative portion of the study as both of the females interviewed spoke about the D&RE in a positive light. In the case of the junior high female who was interviewed, the multiplayer exergame allowed her an avenue of participation previously unavailable. "I'm sorry. I do not like gym class, I'm not a person who's very active, I trip on flat ground. Yea, very bad, but DDR for some reason I really like, cause [I like] rhythm gaming" (JrHF).

Often female students consider physical education to be fun when noncompetitive and nontraditional activities were used in conjunction with individualized assessment techniques. Specifically, girls were most interested in cooperative activities, fitness, and dance (Couturier, Chepko, & Coughlin, 2007). The DDRCE is congruent with all of these categories except for

being noncompetitive. In fact, many instances were recorded during the qualitative interviews that suggested competitive elements were fixtures within the gameplay and between friends. However, as mentioned earlier, the gameplay used within this study used pseudonyms offering the students a layer of anonymity. Therefore, an individual would have been able to select his/her own level of competition by either choosing to remain anonymous, participate with a select group of friends, or engaging the entire class. Many times physical education is associated with negative feelings of exclusion for both boys and girls when the focus shifts toward a competitive environment, especially for those individuals who perceive themselves as less talented than their classmates. Competitive settings allow the upper echelon of talented players to enjoy the activity while less skilled players are often left struggling to keep up, the structure does not allow for all students to attain the motor skills necessary to participate and appreciate the activity (Bernstein, Phillips, & Silverman, 2011). However, DDRCE's multiple difficulty levels allowed everyone the opportunity to engage the gameplay at his or her own level. Hence, the competition moves from isolating individuals to allowing everyone to compete if they choose to do so.

Overall, both males and females enjoy unit and lesson planning based on ample opportunities for participation, skill development, optimal environmental challenge, and constant feedback (Dismore & Baily, 2010). All of which were offered by the DDRCE.

**One more song.** Regardless of age or gender participants agreed they would like to see a D&RE in some capacity within their PE classes in the future. In fact the lowest difference between mean scores, despite how the data stratified, was attributed to the final question on the survey (see *Appendix B)*. Of the 121 students surveyed 112 rated how often they would like to see the D&RE device in PE a three or higher. Based on this statistical support for continuing the intervention and comments such as, "I want it back in our school" (EF), made within each of the

interviews, it is reasonable to suggest students view the device as a natural component in a PE program. Provided that PE practitioners are able to link the D&RE to curriculum in a worthwhile manner, students can expect an enjoyable experience relevant to their everyday health and wellness.

Unfortunately, there was not a high school demographic that accompanied this study as the extra information could have been useful to help determine long-term recommendations for use of a multiplayer D&RE. Overall, the categories related to student efficacies within this study were relatively high and the vast majority of students viewed the device as a positive experience within their PE class.

**Confirming What We Already Know**

**Physical activity.** As it was mentioned in the literature review most studies concerned with the use of a D&RE were aimed at discovering whether or not these devices led to higher physical activity levels. The majority of these inquiries took place within a laboratory setting and indicated that a D&RE did indeed raise metabolic levels while aiding in the promotion of a healthy active lifestyle (Lanningham-Foster et al., 2006; Tan et al., 2002; Unnithan, Houser, & Fernhall, 2006). Despite not being a primary concern of this research project the topic did emerge within the qualitative portions. On several occasions interviewees mentioned they had marked amounts of perspiration, compared the device to using a treadmill, built up their stamina while using the DDRCE, and noticed others sit while using the device as a result of overexertion.

Mentioned in previous scholarship, school-aged children typically overcompensated when self-assessing their physical activity levels (Gao, 2012). However, this study did not include a measure for physical activity levels, rather the topic emerged numerous times within the group interviews. During the course of this 3-week intervention the D&RE was used during regularly

scheduled PE classes, consequently students engaged the multiplayer exergame anywhere from three to five times a week, in 30- to 55-minute sessions. Previous scholarship noted that when participants were prescribed amounts of time with which to use the device, opposed to using it freely and on their own terms, it resulted in greater levels of physical activity. Furthermore, given the high statistical rates of participation throughout the study it is reasonable to assume that many students were engaged in moderate to vigorous physical activity during this time (Madsen et al., 2007; Murphy et al., 2009).

**Increased exposure.** Also promoting greater levels of physical activity is the amount of experience an individual had using the exergaming device. Like any other sport or game an individual tends to get better at the activity if they are given time to practice, and the D&RE was no different (Fawkner et al., 2010; Huang & Gao, 2013). As stated within the qualitative interviews, participants felt they and their classmates had reached an advanced level within the gameplay, indicating that over the 3-week period they had developed the skills necessary to play the second hardest level of difficulty within the gameplay. Whether the device mastery was a result of a competitive peer dynamic, enticing gameplay, multiple difficulty levels, or a combination of these factors is difficult to determine. In any case the outcome is clear, as students were given greater opportunity to use the D&RE they became better equipped to handle the challenges offered within the gameplay leading to greater totals in step counts and higher levels of physical activity.

**Interpersonal element.** Not a prominent theme within the literature, but perhaps one of the most compelling and relevant discoveries was the impact of peer participation. Paw et al. (2008) indicated that a D&RE had a much higher motivational capacity when it shifted from a solitary pursuit to a shared experience. Whereas this study did not compare single and

multiplayer experiences, when students played the exergame within a group setting the motivation levels were very high (Mean = 4.15, see Table 2). Concurrently, interviewees also spoke about how fun the game was when they were able to participate simultaneously with their classmates. A common occurrence was the influence competition had while the DDRCE was in use, and unlike some traditional games that aim to reduce the number of participants as a game progresses, the D&RE allowed all participants to experience the game at their own level of difficulty within a larger group setting. Further confirmation of Paez's et al. (2009) statement, that the role of peers is vital to the sustained use of DDR.

**Familiar activity.** Perhaps not a theme of great importance, nevertheless the fact that exergaming is a part of youth culture had surfaced in the related literature. O' Loughlin et al. (2012) estimated that 25 percent of all school-aged children could be classified as exergamers, meaning these individuals played for an average of 50 minutes, mostly at moderate or vigorous intensity, at least two times per week. Concurrently, when participants were asked how often they played D&REs before they were introduced in their school. It was indicated that both elementary (Mean = 2.85) and junior high students (Mean = 2.91) had previous experiences using a D&RE, confirming their existence within youth culture (see Table 3).

**Song selection.** It is important to pay careful attention to D&RE studies that take place within a school setting as they are rare and provide relevant insights to this niche within the literature. For instance, Gao (2012) speculated that a student centered DDR unit would produce higher levels of motivation if students were able to select a wider variety of songs and play at different difficulty levels. Both of these reasons were supported, as noted earlier in this section, having three different difficulty levels presented simultaneously allowed students both feelings of accomplishment and challenge. Also, both interview groups echoed the need for greater song

selection within the DDRCE system. “Maybe if you added more songs it would be better” (JrHM1). Hence, Gao’s suspicions related to song variety and difficulty level were confirmed within the context of this research and should continue to be investigated as this body of literature continues to grow.

**Section Summary**

Revisiting the research questions provided the necessary guidance and context to further generate discussions based on the results of this study. These results connected to both the literature surrounding D&RE, as well as the mixing of data. Generally, students had a positive perception of the multiplayer exergame DDRCE within the 3-week time frame it was housed within a school. The device offered ample opportunities for skill development, choice during gameplay, and formative assessment, all of which were attributed to higher levels of efficacy in PE regardless of age or gender. Also, as students mature, their intrinsic motivation towards PE declines and similar trends were witnessed while the D&RE device was in use, but it should also be noted that teachers do still have a role to play when promoting dance and other activities within their PE classrooms. Perhaps one of the most important revelations was the female perception while the D&RE is in use within a PE setting. Girls in both elementary and junior high settings viewed the device as a worthwhile contribution to their interactions with curricular instruction because the game balanced their need for individualized assessment, peer interaction, and enjoyment for all. Moreover, the legitimacy of this study is furthered as it relates, on numerous occasions, to the greater body of literature surrounding the topic. Not only did the interpersonal element add to the overall enjoyment of the activity, but also as students practiced and played with the device on a regular basis they became more familiar with the activity and they expended more energy.

## Section Seven: Conclusions

It often seems a difficult task to fully understand the complexities and pressures that make up the life of modern-day school-aged youth, the ease and convenience of the nanotechnology era offers luxuries and opportunities that could have only seemed like science fiction a decade ago. However, within this age of information, developed nations have struggled with a duty that has previously been taken for granted. Giving our children ample opportunities to participate in activities that will promote optimal growth and development, if this objective is not achieved the quality of life for future generations will suffer and the implications of chronic illness will continue to place great strains on our publicly funded healthcare system.

Recently a body of literature has emerged pertaining to the use and energy expenditure of videogame interfaces that promote physical activity both at home and at school. Specifically, the use of a mat-style D&RE has become a focal point of this discussion. Not only have these devices shown they can increase a user's physical activity to a moderate or vigorous level, but the devices are also culturally relevant to school-aged youth, leading some within the educational field to speculate whether or not these devices are a sustainable method of instruction within a PE classroom. Traditionally, exergames have been solitary pursuits, yet currently there are large multiplayer interfaces available for purchase and investigation.

One multiplayer exergame is the DDRCE, which was used in this study to better understand how students would perceive a multiplayer D&RE within a PE setting and whether or not the device is a sustainable worthwhile investment. The following are conclusions and recommendations based on this concurrent mixed methods intervention study.

### Conclusions

1. The use of a multiplayer D&RE within a PE setting was a safe and enjoyable experience for the majority of participants.

While not every single individual thoroughly enjoyed using the DDRCE, both the qualitative and quantitative data sets echoed responses of enjoyment and a positive attitude towards the use of this exergaming device.

2. A novelty effect did exist among participants when using the multiplayer D&RE.

While the DDRCE was in use participants noted high levels of curiosity and intrigue related to the device. While the elementary cohort approached the activity much like an arcade or an exciting specialty item, the junior high group may have been "put off" at first but after using the device seemed to enjoy themselves.

> JrHM2: Yea, like I had a lot of friends that were talking smack about it, like oh this is so stupid why are we doing this? Why can't we do something that's actually fun. But then they got in and then after the class they were like I want to do that again, that was so fun!

3. Students would welcome a multiplayer D&RE within their PE classroom in the future.

Interview participants indicated they would like to continue using the device as part of their PE program, and survey respondents reported strong interest levels towards using a D&RE in upcoming PE classes.

4. Females had a higher level of efficacy towards a multiplayer D&RE than males.

Perhaps only by a slight statistical margin, females consistently logged higher mean scores on the survey than their male counterparts. This may be due to the fact that dancing is an activity that females typically enjoy, and/or the unique social dynamic that emerged within the classroom as a result of the multiplayer experience.

5. Elementary cohorts had higher efficacy levels toward the intervention than their junior high counterparts.

Although the differences were small and varied from one site to the next, the elementary group did not change in their enthusiasm when speaking about the use of DDRCE.

6. A teacher's attitude and enthusiasm level may impact student perception of the D&RE.

The plug in and play approach provided educators the opportunity to step back and take a hands off approach when the device was in use. However, like any other introductory activity the amount of zeal and effort expended by the teacher leading the activity may have had an impact on the students receiving the instruction.

7. Students will participate in PE class when a D&RE is in use.

When asking students how often they participated in PE class while the D&RE was in use the overwhelming response was *always*.

**Recommendations**

Given the results, discussion, and conclusions of this study, some practitioners may be looking to include a multiplayer D&RE in their PE programs, however when planning similar activities it would be helpful to take into account these recommendations.

1. Investigate the cost of an exergaming system.

An obvious roadblock to anyone wishing to use a multiplayer D&RE would be the cost associated with purchasing one of these devices. The 48-player device used in this study cost approximately twenty-five thousand dollars and although there are lower cost alternatives available one should take into account how, when, and by whom the exergame will be used by. Additionally, schools may wish to pool funds and share expensive equipment on a rotational basis, much like the model this study implemented. Often these decisions will come down to a balance between system features and the cost of the device. However, when purchasing this type of equipment it is strongly recommended the device carry features similar to the DDRCE spoken

about in this paper (i.e. multiple difficulty levels, various gameplay modes, and large multiplayer features).

2. Make curricular ties with the exergame.

Mentioned several times throughout this study, the purpose of PE is to give our students the knowledge, skills, and attitudes they need to live a healthy active lifestyle. Unfortunately, PE often accompanies an unsavory reputation of just "rolling out the balls" and playing. Before implementing a unit plan that utilizes the powerful motivational attributes of exergaming it is necessary to establish links in curriculum and assessment strategies before instruction begins. One suggestion would be to have students bring a logbook to PE class to document their scores and progress as they move through the unit.

3. Consideration of an appropriate timeline.

As was the case in this study, the junior high cohort grew tiresome of the activity after a 3-week period; it is recommended that the time a group of students interacts with the device remain within the 2- to 4-week period. This will ensure students receive an adequate amount of time for skill development while avoiding repetitious feelings associated with the activity.

4. Find ideal storage.

Often these systems are bulky and require large amounts of storage area. Before spending a large sum of money on commercial exergaming equipment a mutually agreeable storage area that serves everyone's needs should be agreed upon.

5. Speak about safety.

Although it was a relatively small factor, it should be mentioned to students that if they ever feel dizzy or nauseous during gameplay to act accordingly and remove themselves from the playing

area. Always be aware of surroundings and avoid tripping or falling by looking down at the dance mat if feeling disorientated.

6. Durability.

Of the 48 mats originally purchased, 16 needed replacing. Although we were not charged for the replacement mats, this could become an issue of contention between the purchaser and the company providing the equipment. Not only should purchasers deal with companies and sales representatives they feel comfortable with, but they should also familiarize themselves with the warranty of the devices they intend to purchase.

**Future Research**

Overall, large scale multiplayer exergaming devices are still in their infancy and more time is required to consider the long-term sustainability of these devices before spending large sums of money to purchase the equipment. However, based on the results of this study it is clear that students view a multiplayer D&RE as a natural accompaniment to a PE program and wish to see it used throughout their PE classes. Therefore, future research should focus on and continue to develop the following topics.

1. Large multiplayer exergames within a school setting.
2. Attitudes and perceptions of high school students when a multiplayer D&RE is in use.
3. Repeating high efficacy levels when D&REs are in use within a school setting.
4. Repeating high participation rates while a D&RE is in use, and discovering what impact these devices have on capable nonparticipants in PE.
5. Further understanding the impact a D&RE has on female participants.
6. Comparing traditional dance units to the use of a multiplayer D&RE.

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# APPENDIX A: Student Information Letter and Survey Consent Form

**INFORMATION LETTER and SURVEY CONSENT FORM**

**Study Title: Dance Simulation Games in Physical Education**

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***Background***

In recent years the popularity of screen technologies such as smart phones, computers, tablet devices and televisions have changed our lives. However, often these technologies have been viewed as negative influences, which reduce the amount of time Canadian youth spend being physically active.

Your child is invited to participate in a research project about the effects a dance videogame has on the participation levels of students in physical education. The data will be used to complete a project that will be submitted to the University of Alberta in partial fulfilment of the requirements for a Master's Degree in Education and for research articles and presentations.

***Purpose***

The project will use a dance simulation videogame as part of regular instruction within a physical education unit of instruction that focuses on dance movement and rhythm. This project will (1) identify if dance videogames have an effect on student participation within a physical education program, and (2) determine if dance videogames are a suitable instruction tool for a physical education setting.

***Study Procedures***

Participation in this study will consist of four parts. First, your child will be given a short survey that will help determine your son or daughter's thoughts and feelings about physical education. Some of the questions in the survey include:

1. Do you look forward to participating in physical education?
2. Are you motivated to participate in physical education class?
3. Do you have a positive attitude towards physical education class?

Next, your child will be introduced to Dance Dance Revolution Classroom Edition (DDRCE). For approximately three weeks students within your son or daughter's school will use DDRCE as part of regular instruction within physical education. DDRCE requires participants to synchronize rhythmic movements on a dance pad to directions scrolled onto a projected screen or wall. The platform allows up to forty-eight students to participate simultaneously and continuously at their own level of difficulty (beginner, intermediate, or advanced). Many studies have shown that even in very short doses this dance videogame can help individuals sustain

moderate to vigorous activity levels while maintaining an enjoyable atmosphere within a group setting.

Although we cannot guarantee students will not feel anxious or embarrassed about using this new equipment various measures will be taken to ensure a comfortable classroom climate is established while playing DDRCE. Not only will your son or daughter's teacher always be present during instruction, but teachers will also receive specific instruction on the programing and features of DDRCE to best utilize the equipment within their individual classrooms.

After your son or daughter has used the DDRCE with the rest of the student body at his/her school they will be asked to fill out a second survey that will help determine their thoughts and feelings about using a dance and rhythm exergame within physical education. Some of the questions in the survey include:

1. Were you motivated to use the dance and rhythm exergame?
2. Did you look forward to using the dance and rhythm exergame in physical education?
3. Did you have a positive attitude towards physical education while using DDRCE?

Both of these surveys will be done anonymously. Students will be given the surveys in class and their teachers will assign them an alphanumeric code, this code will be used in place of your son or daughters name. The short surveys will be completed during class-time. Upon completion, your son or daughter will then place their survey into an envelope at the front of the classroom; the last student to complete the survey will seal the envelope and hand it to their teacher.

In the event you or your child does not wish to participate in the study we invite him/her to fill in a placebo survey, which will later be withdrawn from the study.

Finally, we will be inviting approximately nine students to take part in a follow up group interview. Children will be actively selected by their teachers between October 15th, 2013 and February 28th 2014 and contacted by phone or email to participate in the group interview. At that time you will be asked to sign a separate consent form allowing your child to participate in the group interview. If your child is not selected no further contact will be made between the research team and you.

***Benefits***

Although there may not be any immediate benefit for your son or daughter for their participation in this study, the information from this project will be used to help improve our understanding of how best to use dance and rhythm exergames within a physical education setting.

***Risk***

We do acknowledge there might be emotional, physical, or psychological impact on students as a result of using dance and rhythm videogames during physical education class. We cannot guarantee individuals will not be physically hurt, embarrassed, anxious, or distressed as a result of using this new curriculum instruction tool. However, these stresses

are not more than students might experience in their everyday lives. Additionally, the device is programed specifically for classroom instruction and all teachers will receive in-servicing on how to best use the device in their classroom. Furthermore the use of this device is not limited to you son or daughters classroom, it is a school wide event and coincides with the Alberta curriculum for Health and Physical Education.

If teachers are noticing an unreasonable amount of stress and undue harm to their students while using the device they are free to suspend or end the use of the device in their classroom.

***Voluntary Participation***

Completing both the pre and post survey is strictly voluntary. You and your child are free to refuse participation at any point before or during the surveys completion. Additionally, once a survey is submitted you and your child will be given a twenty-four hour grace period to change or withdraw any or all of the information you have provided. However, after the twenty-four hour period you will not be able to retrieve the survey, as it will become a part of the data set for this study.

***Confidentiality & Anonymity***

Choosing or not choosing to participate in the study is a personal and private matter. Because of the social nature of schools and the close proximity with which students conduct their day-to-day interactions we cannot be certain that other classmates or teachers will know of you and your child's decision to participate. However, the information your son or daughter provides on the survey will not be shown to any other classmate, teacher, or administrator. Additionally, participation, nonparticipation, or withdrawal from participation, will not influence grading or academic scores in physical education or any other subjects.

In the analysis of the data and resulting papers or presentations your child's identity will remain anonymous. Also, the school's name and district will not be used in reporting the findings. All documents will be handled exclusively by the researcher and stored in Dr. Chorney's office at the UofA for five years.

***Participation Agreement***

I have read and understood the above information about the study Dance Simulation Games in Physical Education conducted by Brett Barron and agree to have my child participate in the study.

(Circle one)

I have received a copy of this consent form for my own personal records. **YES NO**

I agree to being contacted if my child is selected to be part of the group interview. **YES NO**

_____ _____ _____

Participant's Name (printed) Signature Date

_____ _____ _____

Parent or Guardian's Name (printed) Signature Date

Phone number and email to be contacted with regard to the group interview.

_____ _____

Phone Number Email Address

**The plan for this study has been reviewed for its adherence to ethical guidelines by a Research Ethics Board at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Research Ethics Office at (780) 492-2615.**

# APPENDIX B: Student Survey

# Student Survey

The following is a brief survey to determine your attitudes and thoughts about physical education while using the dance and rhythm exergame, Dance Dance Revolution Classroom Edition. The answers you provide will give valuable insight about the use of these types of activities within a school setting. There are no right or wrong answers and the survey should only take a few minutes.

## Survey Instruction

1. Please **don't** write your name on this survey, instead write down the code your teacher has provided you.

2. Turn over the page and answer all of the questions to the best of your ability.

3. Circle the best possible answer.

4. When you are finished, place the survey into the envelope at the front of the classroom. If you are the last person to complete the survey you may seal the envelope and return it to your teacher.

**CODE # _____**

1) Are you female or male?

Female Male

2) Which category includes your age?

8-11 12-14 15 or older

3) How often did you play dance and rhythm exergames before they were introduced to your school?

| Never | | Sometimes | | Always |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

4) How often did you enjoy physical education while using the dance and rhythm exergame?

| Never | | Sometimes | | Always |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

5) Did you look forward to using the dance and rhythm exergame in physical education?

| Never | | Sometimes | | Always |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

6) How often did you participate in physical education when the dance and rhythm exergame was in use?

| Never | | Sometimes | | Always |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

7) Were you motivated to use the dance and rhythm exergame?

| Never | | Sometimes | | Always |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

8) Did you feel safe when using the dance and rhythm exergame during physical education?

| Never | | Sometimes | | Always |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

9) Did you have a positive attitude towards physical education while using the dance and rhythm exergame?

| Never | | Sometimes | | Always |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

10) How often would you like to see a dance and rhythm exergame as a part of your physical education class?

| Never | | Sometimes | | Always |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

# APPENDIX C: Student Information Letter and Interview Consent Form

**INFORMATION LETTER and INTERVIEW CONSENT FORM**

**Study Title: Dance Simulation Games in Physical Education**

**Researcher (Primary Contact)**
Brett Barron
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Edmonton, AB T6G 2G5
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Room 347 Education South
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780-437-6022

**Supervisor:**
Dr. David Chorney
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Edmonton, AB T6G 2G5
11310 - 87 Avenue
Department of Secondary Education
Room 448 Education South
dchorney@ualberta.ca
780-492-0916

***Background***

As you may recall your son or daughter has already been asked to participate in a study based on the effects a dance and rhythm exergame has on the participation levels of students within a physical education classroom.

By completing two surveys your child has already participated in this research project. The data will be used to complete a project that will be submitted to the University of Alberta in partial fulfilment of the requirements for a Master's Degree in Education.

***Purpose***

So far over 100 student participants have provided data identifying (1) if dance videogames have an effect on student participation within a physical education program, and (2) if dance videogames are a suitable instruction tool for a physical education setting. Now during the forth and final phase of the project we are inviting your son or daughter to help elaborate on the data that has already been provided.

***Study Procedures***

During the beginning phases of this study your child completed two short surveys. The first survey occurred before using a dance and rhythm exergame within regularly scheduled physical education classes, and the second after your child had used the dance videogame.

Finally, we are inviting approximately nine students to take part in one of three follow-up group interviews. The first interview will consist of three students ages 8-11; the second interview will consist of three students ages 12-14; and the third interview will consist of three students ages 15 and older. These students will be individually selected by their teacher, from the outset participants will be chosen based on their ability to demonstrate competent understanding of the English language and their ability to proficiently articulate their thoughts and feelings.

If you have not already been made aware, a member of the research team via email or phone will contact you to arrange a time your son or daughter can participate in the group interview between October 15th, 2013 and January 31st 2014. The interview will take place on school grounds outside regular instructional hours, and is expected to run approximately 30-45 minutes. The interview will consist of six open-ended questions:

1. What did you think when you first learned that you were going to be playing a video game within a school setting?
2. Explain some of the experiences you've had with the dance simulation exergame while it was at your school?
3. Did the dance simulation game affect your participation in physical education?
4. Did you enjoy the experience of using the dance simulation exergame?
5. Did the dance simulation game improve your physical education class, why or why not?
6. Would you like to see the dance exergame at your school again, why or why not?

As the parent(s)/guardian(s) you are welcome to attend this group interview.

The interview will be audio recorded and transcribed. A summary of the interview will be emailed to all of the parents whose children have participated within the interview. This will be done to give both the parents and the students an opportunity to respond or clarify some of the points made within the interview.

***Benefits***

Although there may not be any immediate benefit for your son or daughter for their participation in this group interview, the information from this project will be used to help improve our understanding of how best to use dance and rhythm exergames within a physical education setting.

***Risk***

There may be risks to being in this study that are not known. If we learn anything during the research that may affect your willingness to continue being in the study, we will tell you right away.

***Voluntary Participation***

Participating in the group interview is strictly voluntary; you and your child are free to refuse participation within this portion of the study or individual questions within the group interview. Shortly after the group interview has taken place you will receive a summary of the interview, where you, and your son or daughter may clarify or change anything said. However, because we are conducting a group interview your son or daughters comments will be interwoven with the data of other participants. This means, once a question has been answered you will not be able to withdraw a single persons comments as it would be extremely difficult to do accurately.

***Confidentiality & Anonymity***

In this case confidentiality and anonymity is sought but not guaranteed. We do ask that students and their parents who attend the group interview keep the information and the names of the participants confidential, however we cannot guarantee that someone in the group interview will not divulge information.

In the analysis of the data and resulting papers or presentations your son or daughters identity will remain completely anonymous. Pseudonyms will be used to guarantee

anonymity and any means of identifying participant names, the school's name or the school district's name will not be used in reporting the findings. All documents will be handled exclusively by the researcher and stored in a secure location for five years.

Additionally, participation, nonparticipation, or withdrawal from participation, will not influence grading or academic scores in physical education or any other subjects.

***Participation Agreement***

I have read and understood the above information about the study Dance Simulation Games in Physical Education conducted by Brett Barron and agree to have my child participate in the group interview portion of the study.

(Circle one)

I have received a copy of this consent form for my own personal records. **YES** **NO**

I agree to my child being part of the group interview. **YES** **NO**

| _____ | _____ | _____ |
|---|---|---|
| Participant's Name (printed) | Signature | Date |

| _____ | _____ | _____ |
|---|---|---|
| Parent or Guardian's Name (printed) | Signature | Date |

**The plan for this study has been reviewed for its adherence to ethical guidelines by a Research Ethics Board at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Research Ethics Office at (780) 492-2615.**

# APPENDIX D: Student Interview Protocol

**Student Interview Protocol**

Thank you for agreeing to participate in this focus group interview about the affects a dance simulation videogame has on the participation levels of students within a physical education program.

This is a semi-structured interview, which means I will be asking you six questions, but after you answer the question I may ask for clarification on things you have mentioned, or ask more questions to get a better understanding of what you are trying to say. These questions will help me determine your thoughts about dance and rhythm exergames in physical education. Remember, you have the right to refuse an answer or skip any of the questions; you or your parent/guardian may also end the interview at any time if you don't feel comfortable.

Your parent/guardian is allowed to listen in on the interviews and we will probably need about 30-45 minutes to finish. After we are done I will email a summary of what was said to your parent/guardian so you both have an opportunity to respond or clarify some of the points made within our interview.

We have taken measures to ensure this interview is confidential, meaning no other student, teacher or administrator will be made aware of your decision to participate in this interview, however we cannot guarantee this will be the case. At this point I would like you to agree to keep the things we discuss and the people involved in this discussion confidential. Do you agree?

Your participation or withdrawal from this project will not influence your grades in any subjects, this year or in the future, nor will it affect the relationship you have with your teacher.

When I summarize our interview and write papers or do presentations based on this project your identity will remain completely hidden. False names will be used for you and all the other participants. All documents will be handled exclusively by me and stored in a secure location for five years.

This interview will be audiotaped but I will be the only one who listens to the contents of the tape. Do you have any questions?

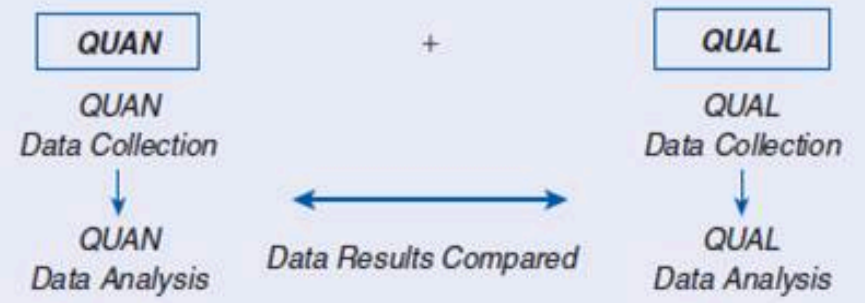
Let's begin…

1. What did you think when you first learned that you were going to be playing a video game within a school setting?
2. Explain some of the experiences you've had with the dance simulation exergame while it was at your school?
3. Did the dance simulation game affect your participation in physical education?
4. Did you enjoy the experience of using the dance simulation exergame?
5. Did the dance simulation game improve your physical education class, why or why not?
6. Would you like to see the dance exergame at your school again, why or why not?

Again thanks for your time and effort in this interview. I'll be sending your parent/guardian a summary of our interview within a week or so, you may read over what we talked about and change anything you don't agree with.

## List of Figures

***Figure 1.*** Concurrent Triangulation Design.



# List of Tables

## Table 1

*Participation Rates by Site*

| Site | School type | Participants | Eligible Participants | Rate |
|---|---|---|---|---|
| 1 | Elementary | 28 | 29 | 97% |
| 2 | Elementary | 20 | 20 | 100% |
| 3 | Elementary | 18 | 22 | 82% |
| 4 | Junior High | 14 | 26 | 54% |
| 5 | Junior High | 16 | 25 | 64% |
| 6 | Junior High | 25 | 49 | 51% |
| Total | Elem./Jr. High | 121 | 171 | 71% |

## Table 2

*Survey Responses of All Participants*

| | Mean | SD | N |
|---|---|---|---|
| *How often did you play D&REs before they were introduced to your school?* | 2.88 | 1.152 | 121 |
| *How often did you enjoy PE while using the D&RE?* | 4.26 | .911 | 121 |
| *Did you look forward to using the D&RE in PE?* | 4.22 | .953 | 121 |
| *How often did you participate in PE when the D&RE was in use?* | 4.52 | .788 | 120 |
| *Where you motivated to use the D&RE?* | 4.15 | .950 | 120 |
| *Did you feel safe when using the D&RE in PE?* | 4.55 | .796 | 121 |
| *Did you have a positive attitude towards PE while using the D&RE?* | 4.41 | .833 | 121 |
| *How often would you like to see a D&RE as a part of your PE class?* | 4.03 | 1.032 | 121 |

*Note*. Survey results based on a five-point Likert-type scale. SD = Standard Deviation; N = Number of responses.

**Table 3**

*Survey Results by Age*

| | Elementary | | Junior High | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| *How often did you play D&REs before they were introduced to your school?* | 2.85 | 1.113 | 2.91 | 1.206 |
| *How often did you enjoy PE while using the D&RE?* | 4.48 | .808 | 4.00 | .962 |
| *Did you look forward to using the D&RE in PE?* | 4.50 | .809 | 3.89 | 1.012 |
| *How often did you participate in PE when the D&RE was in use?* | 4.65 | .672 | 4.36 | .890 |
| *Were you motivated to use the D&RE?* | 4.51 | .850 | 3.73 | .891 |
| *Did you feel safe when using the D&RE during PE?* | 4.61 | .762 | 4.47 | .836 |
| *Did you have a positive attitude towards PE while using the D&RE?* | 4.48 | .881 | 4.33 | .771 |
| *How often would you like to see the D&RE as a part of your PE class?* | 4.08 | 1.057 | 3.98 | 1.009 |

*Note.* Survey results based on a five-point Likert-type scale. SD = Standard Deviation.

**Table 4**

*Survey Responses by Gender*

| | Female | | Male | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| *How often did you play D&REs before they were introduced to your school?* | 2.83 | 1.047 | 2.93 | 1.266 |
| *How often did you enjoy PE while using the D&RE?* | 4.36 | .880 | 4.16 | .941 |
| *Did you look forward to using the D&RE in PE?* | 4.45 | .890 | 3.96 | .963 |
| *How often did you participate in PE while the D&RE was in use?* | 4.64 | .627 | 4.38 | .926 |
| *Were you motivated to use the D&RE in PE?* | 4.23 | .938 | 4.05 | .961 |
| *Did you feel safe when using the D&RE?* | 4.78 | .519 | 4.28 | .959 |
| *Did you have a positive attitude towards PE while using the D&RE?* | 4.55 | .688 | 4.26 | .955 |
| *How often would you like to see a D&RE as a part of your PE class?* | 4.19 | .906 | 3.86 | 1.141 |

*Note*. Survey results based on a five-point Likert-type scale. SD = Standard Deviation.

**Table 5**

*Mean Survey Results for All Sites*

| | Elementary | | | Junior High | | |
|---|---|---|---|---|---|---|
| | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 |
| *How often did you play D&REs before they were introduced to your school?* | 2.68 | 3.35 | 2.56 | 2.60 | 2.81 | 3.17 |
| *How often did you enjoy physical education while using the D&RE?* | 4.64 | 4.55 | 4.17 | 3.80 | 3.81 | 4.25 |
| *Did you look forward to using the D&RE in PE?* | 4.75 | 4.45 | 4.17 | 3.67 | 3.94 | 4.00 |
| *How often did you participate in PE when the D&RE was in use?* | 4.74 | 4.85 | 4.28 | 4.07 | 4.31 | 4.58 |
| *Were you motivated to use the D&RE?* | 4.59 | 4.80 | 4.06 | 3.93 | 3.19 | 3.96 |
| *Did you feel safe when using the D&RE during PE?* | 4.57 | 4.95 | 4.28 | 4.40 | 4.69 | 4.38 |
| *Did you have a positive attitude towards PE while using the D&RE?* | 4.71 | 4.60 | 4.00 | 4.20 | 4.31 | 4.42 |
| *How often would you like to see a D&RE as a part of your PE class?* | 4.46 | 3.65 | 3.94 | 4.13 | 3.88 | 3.96 |
| Number of participants surveyed | 28 | 20 | 18 | 14 | 16 | 25 |

**Table 6**

*Respondent Abbreviations for Qualitative Analysis*

| Respondent | Abbreviation |
|---|---|
| *Elementary Male Number One* | EM1 |
| *Elementary Male Number Two* | EM2 |
| *Elementary Female* | EF |
| *Junior High Male Number One* | JrHM1 |
| *Junior High Male Number Two* | JrHM2 |
| *Junior High Female* | JrHF |