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Pre-service Teachers' Perceptions of Motion-based Video Gaming in Physical Education

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A mixed-methods research design, utilizing qualitative open response questions and a quantitative Likert scale questionnaire and survey, was used to explore physical education pre-service teachers' perceptions of motion-based video gaming (MBVG). It was perceived that: (a) MBVGs are fun and enjoyable and would increase student motivation, (b) MBVGs are a way to increase student physical activity, and (c) MBVGs do not always mirror the same fundamental concepts or motor movements of the actual sport. In addition, the amount of time spent playing video games increases the perception of the usefulness of MBVGs in physical education.

Keywords: motion-based video gaming, exergaming, video games, active video gaming.

INTRODUCTION AND LITERATURE BACKGROUND

There is little doubt that video games pervade American youth culture. 83% of 8 to 18 year old American children have one or more video game consoles at home with 49% having one in their own bedroom (Rideout, Roberts, & Foehr, 2005). According to a nationally representative survey, approximately half of parents or guardians reported that their kid(s) aged 2 to 17 played video games 6 to 16 or more hours per week (Riley, 2007).

Furthermore, sedentary video gaming may be promoting the American obesity epidemic. It is no secret that American youth are becoming increasingly overweight. According to the Department of Health and Human Services' 2007 National Survey of Children's Health over 34% of American children aged 10 to 17 are overweight or obese. In addition, regarding physical inactivity, less than 30% of children aged 6 to 17 partake in daily vigorous physical activity of at least 20 minutes that makes the child breath heavy or

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sweat (Department of Health and Human Services, 2007). A study investigating a connection between obesity and physical activity levels with television and video game use concluded that a strong relationship was evident between video game use and increased weight status for children aged 12 and under, whereas television viewing was not, indicating time spent with video games replaced physical activity while television did not (Vandewater, Shim, & Caplovitz, 2004).

Recent research has investigated using motion-based video gaming (MBVG) to increase youth activity levels and counter the obesity epidemic. In the literature MBVG is also referred to as active video gaming (Dixon, Maddison, Mhurchu, et al., 2010; Biddiss & Irwin, 2010; Graf, Pratt, Hester, & Short, 2009), interactive video technology (Shoemaker, 2009; Epstein, Beecher, Graf, & Roemmich,, 2007), or the more corporate term "exergaming" (Bonetti, Drury, Danoff, & Miller, 2010; Daley, 2009; Klein & Simmers, 2009; Russell, 2009; Nadler, 2008). Game systems such as the Wii Fit (Nintendo, Minamiku Kyoto, Japan) and the X-box 360 Kinect (Microsoft, Redmond, WA) employs MBVG technology where the player utilizes physical movements to play the game.

Much of the early and current research concerning MBVG has investigated energy expenditure (EE) during MBVG play. In a study comparing sedentary hand held video gaming and MBVG with children aged 8 to 12 years it was found that EE more than doubles when sedentary screen time is converted to active MBVG screen time (Lanningham-Foster, Jensen, Foster, & Redmond, 2006). The researchers concluded that MBVG might be useful for treatment and prevention of childhood obesity. Moreover, MBVG has been shown to produce training heart rate levels and caloric expenditure during 30-minute sessions well within the American College of Sports Medicine guidelines for daily physical activity with college students (Siegel, Haddock, Dubois, & Wilkin, 2009) and EE consistent with moderate-intensity walking with children aged 10 to 13 years (Graf et al., 2009). Finally, results of an analysis of 14 studies involving children aged 18 years and younger revealed that MBVG clearly produces greater EE than sedentary gaming and rest, but is considerably lower than authentic versions of the sport or physical activity questioning MBVG as a valid EE substitute (Daley, 2009).

Studies have also investigated choice and the motivation to use motion-based video games (MBVGs). One study tested the activity levels and reinforcing value of bicycle and dance MBVGs with 8 to 12 year old children (Epstein et al., 2007). The study included the following four options for the children for both dancing and bicycling: playing the hand held video game version, participating alone, participating while watching a video, or playing the MBVG version. Results showed that the dancing MBVG Dance Dance Revolution (Konami, Redwood City, CA) was more reinforcing than dancing alone or while watching a video, but there were no differences across bicycling conditions, suggesting that, when given the chance to play MBVG dance games, children may be motivated to be physically active. Another study in the United Kingdom researched preferences within unstructured play of 7 to 11 year old children providing them with three stations: (a) physical activity; (b) sedentary games; and (c) MBVG. The physical activity station included a child-specific stationary bike and stair stepper. The sedentary gaming station was comprised of children's games and magazines atop a table with chairs. The MBVG station replicated the exercise station, but was interfaced with a MBVG console. Results suggested that without a MBVG option, the children were observed to be three times more likely to choose sedentary games over physical activity (Fleming Park Leisure Centre, 2007).

More recent research has investigated MBVG in P-12 physical education programs. Implementing new activities that encourage development of knowledge and skills while also enhancing motivation to become physically active for a lifetime are primary goals of

physical education. To some, MBVGs are seen as one avenue to achieve this. Improvements in the video game industry have made it possible for physical education classes to include MBVG activities in school curriculum.

One of the oldest and most popular MBVGs, Dance Dance Revolution (Konami, Redwood City, CA) has staked its claim in the physical education classroom. A new version of the game called "Dance Dance Revolution: Classroom Edition" premiered at the 2012 California Association for Health, Physical Education, Recreation & Dance State Conference. This version allows up to 48 different students to play at the same time through wireless dance mats interfaced with the primary game console (Hawkins, 2012). While there are many pros and cons to implementing MBVG in physical education (e.g., see Wilson, Darden, & Meyler, 2010 and Shoemaker, 2009) the majority of advocates feel that MBVGs should not replace traditional physical activity, but compliment programs to assist in meeting curricular standards and objectives (Nadler 2008; Wilson, Darden, & Meyler, 2010).

Past studies investigating user acceptance to information technology have underpinned the research with the Technology Acceptance Model (TAM). The TAM postulates causal relationships between the external stimuli (i.e., system design features) to the cognitive responses of perceived ease of use and usefulness to the affective response of attitude toward using to, finally, the behavioral response of actual system use (Davis, 1993). One area that is lacking in MBVG research concerns the empirical investigation of how MBVGs are perceived by physical educators (i.e., their cognitive and affective responses toward MBVG).

PURPOSES AND RESEARCH QUESTIONS

The purpose of this study was to investigate physical education pre-service teachers' perceptions of MBVG. Specific topics we hoped to explore were the perceptions of whether and how pre-service physical education teachers believe MBVGs affects student motor skill acquisition, knowledge of sports, and student motivation for physical activity inside and out of physical education classrooms. The guiding research questions for this study included:

1) What are pre-service physical education teachers' perceptions of using MBVG in educational settings?
2) Are there any differences in the perceptions of MBVG among pre-service physical education teachers who are non- video game players (0 hours), frequent video game players (1 to 4 hours per day), and habitual video game players (over 5 hours per day)?

METHOD

DESIGN AND PARTICIPANTS

A mixed-methods research design using qualitative open response questions and a quantitative Likert scale questionnaire and survey were employed. Participants were 23 (12 female, average age $M = 24.5$ years, $SD = 10.2$) physical education teacher education (PETE) undergraduate students. 81% of the students reported being in their first year of the PETE program while 19% reported being in their second year. All participants were enrolled in a course entitled Teaching Fitness Concepts at a large state university in the mountain-west region of the United States. The sample included 36.4%=White, 31.9% = Hispanic, 4.5%=African American, 4.5%=Asian American, 4.5%=Native American,

9.1%=Other, and 9.1%=No report. Participation in this study fulfilled requirements in their course work. See Table 1 for the demographics.

Table 1. Participant demographics

Gender	Average Age	Years in PETE Program	Ethnicity
12 Female	24.5 years	81% = 1st Year	36.4% White 31.9% Hispanic 4.5% African American 4.5% Asian American 4.5% Native American 9.1% Other 9.1% No report
11 Male		19% = 2nd Year	

Note. PETE = physical education teacher education. Age range of 19 to 29 years includes one outlier at 64 years.

INSTRUMENTS

Questionnaire. The questionnaire used in the study collected demographic information from the sample concerning gender, ethnicity, age, and number of years in the PETE program. In addition, data was collected regarding the participant's general interest in video games and how often they currently play video games. The first question, "What best describes your interest in playing video games?", included Likert-based responses from 1-"Don't like it at all" to 5-"Really like." The second question, "How many hours a week do you estimate you play video games?", included Likert-based responses from 1-"0 hours" to 5-"Over 10 hours."

Survey. A ten item Likert scale survey was used to assist in determining perceptions of usefulness of MBVG in physical education. Responses ranged from 1-"Strongly Disagree" to 5-"Strongly Agree." Scores of each participant's survey were calculated by adding up the response score (1 to 5) for each of the 10 items (50 possible points) and then dividing by 10, resulting in an average perception of usefulness of MBVGs in physical education. The highest possible score a participant could achieve was five with higher scores representing higher levels of perceived usefulness.

Example survey questions included: "I believe motion-based video games would enhance students' acquisition of motor skills and movement fundamentals that could apply to real sport activities," "I believe motion-based video games would enhance student motivation to participate in physical education class during school hours," "I believe students that enjoy motion-based video games in physical education would be more likely to invest in motion-based video games at home instead of traditional handheld video games," "I believe a unit in motion-based video games in physical education would be able to meet NASPE [National Association of Sport and Physical Education] standards," "I believe motion-based video games and other forms of technology will be daily activities in physical education in the next 10 years," and "I personally enjoy playing video games so I would likely incorporate a motion-based video game unit into my physical education curriculum." The reliability of the results of the survey was evaluated and confirmed using Cronbach's α=.79 – assuring all items were measuring the same construct (i.e., usefulness of MBVG in physical education).

Open-response questions. Qualitative data was also collected through the use of four open-response questions. The four open-response questions included:

1. In what ways do you feel motion-based video games could help students acquire motor skills in physical education?

2. What limitations do you see may arise using MBVG systems in a physical education setting?
3. What benefits do believe a motion-based video game system would bring to a physical education setting?
4. What is your general opinion of motion-based video gaming and traditional hand-held video games?

MATERIALS

Motion-based video gaming device. MBVG was performed by using the X-box 360 Kinect game system (Microsoft, Redmond, WA). Without a handheld controller, the system uses a motion detection sensor and software to mimic physical movements made by the player and displays them on the screen. The sensor should be visible and mounted on the television or table. According to the X-box 360 Kinect: Kinect Sports game manual (Microsoft, 2010) the play space should be clear of all furniture or obstacles with a designated playing area about six feet from the sensor for single players and approximately seven to ten feet from the sensor for simultaneous two player play. In addition, it is recommended that loose or baggy clothes may affect the performance of the system. Three different X-box 360 Kinect games were utilized during the study: Kinect Sports Bowling, Kinect Sports Track and Field, and Kinect Dance Central.

Kinect Sports Bowling. The game manual states that the Kinect Sports Bowling game is "the most fluid and intuitive Bowling experience since… well… Bowling" (Microsoft, 2010, p. 4). In a traditional bowling scoring format (i.e., 10 frames with 2 rolls per frame if needed, except on the tenth frame) the game Kinect Sports Bowling requires the player to move their arm in an underhand motion within the sensor area in order to bowl. To start, players virtually pick up a ball by either reaching out their preferred left or right hand. Then, players swing their bowling arm back and then forward to release the ball. Altering the direction of the swing influences where the ball rolls on the virtual screen. Moreover, a player can attempt to add spin to the ball by bringing their arm across their body as the arm is swung forward and the ball is released.

Kinect Sports Track and Field. The Kinect Sports Track and Field game utilizes motion detection technology for the following events: sprint (100 meters), javelin, long jump, discus, and hurdles. In the first event, the sprint, players vigorously run in place lifting their knees high to elicit sprinting until the finish line with their virtual on-screen avatar. In the two player setting, players "sprint" side-by-side against each other and other virtual computer-generated players in the adjacent lanes of the track. The second event is the javelin. In this event players reach out to the left or right with their preferred throwing hand to grasp the javelin. Next, players run in place (as in the sprint event described above) and then throw as they approach a green throwing zone (i.e., the end of the runway) by using an overarm throwing motion to release the javelin. In the third event, the long jump, players run in place (as described in the sprinting event) to build up speed and then jump two-footed straight up as they approach the end of the runway and the virtual green jump zone. In both the javelin and long jump, if the player does not throw or jump in a timely manner as they approach the end of the runway a foul is incurred.

The discus is the fourth event. In this event players reach out left or right with their preferred throwing hand to pick up the discus. Then the discus is launched using a powerful non-rotational throwing motion from a standing position. The throwing motion is comprised of bringing the arm back while the player's core area twists so that the non-throwing shoulder is perpendicular to the gaming system and then the throwing arm is rapidly brought across the body for release of the discus. Finally, the fifth event is the hurdles. The distance of this event is not specified, but it appears to be a 200 meter distance

as it starts on the opposite corner of the track from the finish line. In this event players run in place (as described in the sprinting event) until they approach a hurdle. Hurdles turn green when it is time to jump. Jumping occurs after the player jumps two-footed straight up and directly after hurdle clearance running in place (i.e., sprinting) commences again.

Kinect Dance Central. The Kinect Dance Central game employs the use of an avatar in which the game player must mimic dance moves – similar to the popular Konami game Dance Dance Revolution. Dance Central's official Xbox website states: "take your moves to the next level in the first controller-free, body tracking, fully-immersive dance video game" (Microsoft/MTV Games, 2010). Dance Central's choreography includes step-by-step routines in which the game player attempts to accurately mirror the game avatar (Crewdson, 2011). Over 90 dance routines and 650 dance moves offer beginner to expert-level choreography accompanied by present-day R&B, pop, and hip-hop music. The game includes five different modes: (a) *Perform It* – normal single-player mode where the individual attempts to complete the dance moves to attain a high score; (b) *Workout Mode* – similar to *Perform It* mode, but workout time and estimated calories burned are tracked; (c) Dance Battle – one at a time and taking turns throughout the song, two players compete head-to-head attempting to score more points than the other player; (d) *Challenge Mode* - an increased difficulty mode where dance moves are combined from different songs after being unlocked through four stars being earned for each song in the same difficulty category; and (e) *Break it Down* – a step-by-step mode which allows beginners to practice more difficult dance moves (Microsoft/MTV Games, 2010).

Of note, the Entertainment Software Rating Board has rated Dance Central "T" for *Teen*. Video games rated "T" include content that may be suitable for ages 13 and older. Games of this classification "may contain violence, suggestive themes, crude humor, minimal blood, simulated gambling, and/or infrequent use of strong language" (Microsoft/MTV Games, 2010). This may be due to "suggestive" dance moves included in the game. Dance Central 2, a sequel to Dance Central, was released in late 2011.

PROCEDURES

After each subject completed a written informed consent form, the lead investigator performed one demonstration of the five-step bowling approach and then encouraged the students to utilize this approach. The demonstrated approach consisted of keeping the eyes on the target, a push and drop of the ball while initiating the steps, a backward swing and finally release and follow-through. No other sport-specific instructions were provided by the investigator for any of the games throughout the remainder of the study.

Students were arranged in the classroom seated around the perimeter with all desks against the wall. The X-box 360 Kinect game system was connected to a digital projector displaying MBVG device on a screen on the front wall. All game play occurred in one large classroom with the game system set up in the center of the room.

Kinect Sports Bowling game play occurred first. One at a time, participants each took a turn playing one frame (two rolls) in the two-player setting while the other participants observed until one entire game (ten frames each) was completed. Next, the Kinect Sports Track and Field game was played in the same fashion where each participant, one-by-one, played one event as all participants rotated in the two player setting. The javelin, long jump, and discus events were individual in nature while the (100 meter) sprint and hurdle events were designed for concurrent two player action. In the sprint and hurdle events two study participants were put head-to-head against each other as well as against other virtual game system players.

The gaming session concluded with a "Dance Battle" between two participants with the game Kinect Dance Central. To the music of Lady Gaga "Poker Face," the participants

each took turns following their on-screen avatar in an attempt to accurately mimic dance moves which adds to their point total. Throughout the game, a scrolling "helper frame" cued upcoming dance moves to the participants to help the players prepare for the next dance move.

Throughout the gaming session, those not engaged in game play sat around the perimeter of the room observing and conversing about MBVG when it was not their turn to play. In addition, qualitative field observation notes were taken by the lead investigator noting behaviors and comments made by the participants and observers. To end the study session, participants completed the questionnaire, survey and open-response questions assessing their perceptions to MBVG and their use in physical education. The entire session lasted one hour and fifteen minutes.

DATA ANALYSIS

Research question 1. Qualitative methods were employed to explore the open-responses of the pre-service physical education teachers' perceptions of using MBVG in educational settings. Qualitative inquiry was informed through grounded theory. Grounded theory analysis is inductive in that meaning is derived from the data and a theory is grounded in the views of the participants (Merriam, 2009). The qualitative grounded theory data analysis strategy used included open coding, axial coding, and then selective coding as prescribed by Creswell (2007). All coding was performed through the use of the qualitative data analysis software *Atlas.ti version 6.2* (Scientific Software Development, Gmbh, Germany). First, the open responses were analyzed through open coding where the data was coded for its primary categories and themes. Next, axial coding commenced where open coding categories were identified as the core phenomena across each question and then the data was re-analyzed around these core phenomena. A minimum of three subjects must have mentioned this theme to qualify as a recurring theme. Finally, selective coding occurred where hypotheses were generated through the interrelationships of the major coded categories.

Research question 2. In order to determine if there were any differences in the perception of MBVG among pre-service physical education teachers with varying experience with video games a one-way Analysis of Variance (ANOVA) was used. To determine if difference existed the question "How many hours a week do you estimate you play video games?" taken in the questionnaire was used as the independent variable and participants' responses were grouped into three categories: (a) non- video game players (0 hours), (b) frequent video game players (1 to 4 hours per day) and (c) habitual video game players (over 5 hours per day). Participants' average perception of MBGV was used as the dependent variable. Prior to conducting this analysis, the assumptions associated with an ANOVA were tested and met. Cohen's *d* is reported for statistically significant differences.

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RESULTS AND FINDINGS

RESEARCH QUESTION 1. WHAT ARE PRE-SERVICE PHYSICAL EDUCATION TEACHERS' PERCEPTIONS OF USING MBVG IN EDUCATIONAL SETTINGS?

Qualitative findings, as listed in Table 2, indicated several themes which emerged for each open-response question exploring pre-service physical education teachers' perceptions of using MBVG in educational settings. Subsequent findings will detail each generated theme divided amongst the four open-response questions. A discussion of the overarching themes across all open-response questions is then detailed in the discussion section.

Open-response question 1. Three themes emerged concerning the ways in which the participants felt MBVGs could help students acquire motor skills in physical education. First, several of the participants felt that MBVGs could help students learn the rules and fundamentals of the activity. Participants wrote that MBVGs can give students an "idea of what the real game is about" and "can help students get the basic motion down of the sports played." It was felt by these participants that students could learn the rules and fundamental movement patterns of the sport or activity in a MBVG environment. Another participant listed that MBVGs "force you to do at least the most fundamental of movements."

Table 2. Pre-service physical education teachers' perceptions of motion-based video games: Summary of open-response findings

	Open-response Questions			
	In what ways do you feel MBVGs could help students acquire motor skills in PE?	What limitations do you see may arise using MBVG systems in a PE setting?	What benefits do you believe a MBVG system would bring to a PE setting?	What is your general opinion of MBVGs and traditional hand-held video games?
Major Themes Generated per Question:	MBVGs help students learn the rules and fundamentals of the activity.	MBVGs do not require the same motor movements as the "real" sport.	MBVGs increase student motivation.	MBVGs are enjoyable and fun.
	MBVGs help with assessing and correcting form.	MBVGs require a less amount of physical activity as the "real" sport.	MBVGs are enjoyable and fun.	MBVGs are a way to increase physical activity.
	MBVGs motivate students to participate.	MBVGs do not involve the entire class (i.e., time on task issues).	MBVGs increase physical activity and heart rate.	
	Overall Primary Themes Generated			
	MBVGs are fun and enjoyable and would increase student motivation.	MBVGs are a way to increase student physical activity.	MBVGs do not always mirror the same fundamental concepts or motor movements of the actual sport.	

Secondly, some participants believed that MBVGs can help with assessing and correcting form. "I feel like it can help students break down the motor skills needed in

certain PE activities." It is "easier to watch students' movements and assess" with MBVGs. One participant combined the ideas of the first two themes by writing, "After trying the bowling Kinect game I felt that it could help implement the rules and fundamentals of the game such as lining up in order to correcting [sic] their form to have a successful bowling experience."

Lastly, a few participants believed that MBVGs could help students acquire motor skills in physical education by motivating the students to participate. MBVGs "would help because the kids will actually enjoy doing the activity." As an extension, some of the participants felt that utilizing MBVGs in physical education class would nurture practice outside of school at home. "It gets them up and motivated to perform the skill. If they enjoy the activity they might want to do it outside of the classroom." Additional practice could assist the student acquiring the skills required in the MBVG. Overall, nearly one-third of the participants specifically mentioned that they felt MBVGs could assist students in learning gross motor skills in their responses. One participant stated: MBVGs "force students to move which would naturally allow them to acquire motor skills."

Open-response question 2. Participants listed many perceived limitations when using MBVG systems in physical education settings. Three categories were mentioned most frequently. First, many participants felt that MBVGs did not require the same motor movements as the "real" activity or sport. One participant depicted this theme by writing: "the movements are not completely accurate with the real life sports." Another participant perceived that "the motion-based video game doesn't do the whole movement." One participant described this theme further by writing: "There are certain aspects of the video games that are not the same in the actual sport or game…such as throwing and running aren't the same as if a person was really throwing or running."

Some participants cited reasons as to why they felt that MBVG movements did not correlate accurately to the actual sporting activities. These comments included that students "would find cheater movements instead of doing [the] full motion," students "are not using real [bowling] balls so they don't feel what it is like to play for real," "glitches in the game can make results unreal and cannot correlate with student movement," and some MBVGs incorporate rule violations of the sport (e.g., "rule infringement") which do not teach proper motor skills required of that sport.

The second theme generated from the responses concerning the perceived limitations of MBVGs was that MBVGs require a less amount of physical activity as the "real" sport. "Limitations could exist when it comes to cardio" and "there is not a lot of physical activity" were participant responses to this question.

Several comments to question two related to the first two themes of not promoting proper motor skill technique or the same amount of physical activity. "It doesn't promote proper technique or cardiovascular endurance" wrote one participant while another felt that a MBVG "is not very physical" and "does not require proper form." One participant noted that "you can only move so far away from screen/sensor until it won't register you." This could facilitate the perception that the limited movement area MBVGs provide can affect both the amount of physical activity and the actual motor movements that can be performed during MBVG play compared to the authentic version of the sport or physical activity.

The final major limitation cited by the participants was the perception that MBVGs would not involve the entire class. This could reduce the amount of time on task during physical education class. One participant wrote: "I see that there is a limitation to the use of [MBVGs in physical education] and may cause a lot of waiting and very little use of involving the entire class." Another participant cited time on task with MBVGs "would be my big problem especially with a large class." An additional participant perceived that the major limitation of MBVGs in physical education was that there would be "not enough class participation because there would be a lot of students sitting around watching others

play. There would need to be a lot of game consoles and space." Expense and resources appears to be an additional limiting factor which ties into the perception of limited participation by all students. These pre-service teachers felt that MBVGs do not involve the entire class and would require a lot of wait time or the expense of many game systems and the space to use them.

Open-response Question 3. Three themes emerged relating the perceived benefits the participants believed a MBVG system would bring to a physical education setting. First, nearly half of the participants felt MBVGs would increase student motivation. "Students will be very interested in playing them and it will be a great motivator," commented a participant. Another participant wrote: "It can motivate and change up what students feel about physical education." It appears MBVGs may contribute to the recent paradigm shift of the "new" physical education where instruction is individualized to meet the needs of all students. Technological gadgets such as heart rate monitors and pedometers also have been utilized to assist with paradigm shift.

Fun and enjoyment was another main perceived benefit of MBVGs by the participants. "[MBVGs are] fun and students would enjoy playing it," noted a participant. Many times comments mentioned motivation in concert with fun and enjoyment. One participant noted that MBVGs "would really motivate the students and they would really enjoy doing this activity." One participant highlighted that because many students already like video games it would make physical activity more pleasurable for them. "A lot of students love video game which would make exercise more enjoyable for them," commented the participant.

The final major perceived benefit of MBVGs was that they increase physical activity and heart rate. Participants noted that MBVGs would facilitate "more class participation" and "some of the games increase heart rate (T&F game)." Oftentimes this increased physical activity perception was in reference to a comparison with sedentary gaming or rest. One participant felt MBVGs "would force students to move" while another cited that they "will get the student to get involved and may get them motivated to be active." It was also mentioned that "kids can bring it home to involve family" which would nurture physical activity at the home setting as well. Conversely, one participant responded: MBVGs "would be fun for gamers, but I don't think it would be an effective workout because too many people would be watching and not participating." This brings up the perception that with limited MBVG systems the physical educator would not provide an effective time on task for each student. Also, this participant felt that students with video game experience (i.e., "gamers") may enjoy MBVGs more than students with little video game experience.

Open-response Question 4. Two primary themes were most commonly cited regarding the participants' general opinion of MBVGs and traditional hand held video games. First, MBVGs were perceived as enjoyable and fun. MBVGs were thought to be "enjoyable, relaxing, and stimulating." One participant felt MBVGs could improve the classroom environment because "[MBVGs] helps break a lot of tension if any uneasiness within a classroom and makes it enjoyable."

Many participants also felt that overall, MBVGs "are a way to increase physical activity." They noted that using MBVGs is better than being sedentary. Many of the open-responses to question four combined fun and physical activity. For example, one student wrote: "[MBVGs] are a lot of fun and I think can be beneficial because you're up and moving rather than sitting in one place."

RESEARCH QUESTION 2. ARE THERE ANY DIFFERENCES IN THE PERCEPTIONS OF MBVG AMONG PRE-SERVICE PHYSICAL EDUCATION TEACHERS WHO ARE NON- VIDEO GAME PLAYERS, FREQUENT VIDEO GAME PLAYERS, AND HABITUAL VIDEO GAME PLAYERS?

Quantitative analysis was used to investigate whether the amount of time spent playing video games would make differences in the perceptions of the usefulness of MBVGs by pre-service physical education teachers. The results are listed in Table 3. Statistically significant differences were revealed in participants' average perception due to their self-reported time playing video games, $F(2,14) = 4.46$, $p = .032$. With pairwise comparisons revealing that participants who were categorized as non-player and frequent video game players ($M = 3.5$, $SD = 0.31$ and $M = 3.7$, $SD = 0.46$, respectfully) had a statistically lower mean perception of MBVG than those who categorized as habitual video game players ($M = 4.7$, $SD = 0.31$). However, the difference between non-players and frequent players was not statistically significant. Homogeneity of variance was met using Levene's test of equality of error variances ($p = .444$). Cohen's d for the difference between non-players and habitual players was $d = 3.00$ and $d = 2.17$ for the difference between frequent and habitual players.

Table 3. Differences among participants' average perception of MBVGs in physical education and their self-reported time playing video games per week

	1 NVGP (n=9)	*2 FVGP (n=7)*	*3 HVGP (n=7)*						
	M (SD)	*M (SD)*	*M (SD)*	*SS*	*DF*	*MS*	*F*	*p*	*Post-hoc*
Avg. Perception	3.500 (.312)	3.714 (.467)	4.700 (.310)	1.333	2	.666	4.466	.032	3 > 1 3 > 2

Note. NVGP = Non-video game players (0 hours); FVGP = frequent video game players (1 to 4 hours); HVGP = habitual video game players (over 5 hours).

DISCUSSION

The purpose of this study was to explore the perceptions of pre-service physical education teachers regarding the use of MBVGs in physical education. Results from the quantitative analysis indicated that there was a statistically difference in how participants' perceived MBVG whereas the qualitative analysis provided insight into why the participants' may have different perceptions of MBVG. For the qualitative data, three overall primary themes were discovered. It was perceived that MBVGs: (a) are fun and enjoyable and would increase student motivation, (b) are a way to increase student physical activity, and (c) do not always mirror the same fundamental concepts or motor movements of the actual sport.

MBVGS MOTIVATE AND ARE FUN AND ENJOYABLE

In this study, it was found that many of these pre-service teachers felt that MBVGs are fun and enjoyable and may increase student motivation. The aim of physical education, as promoted by the National Association for Sport and Physical Education (NASPE, 2004a), is to develop students who have the understanding, abilities, and self-efficacy to enjoy physical activity across their lifespan. Sheehan and Katz (2010) call this "physical literacy" – the motivation, confidence, physical competence, knowledge and understanding to maintain physical activity throughout life. Because these MBVGs were perceived to be fun and enjoyable it may motivate students to perform this form of physical activity outside of class – a primary goal of physical education. Many of these pre-service teachers felt

MBVGs may motivate students to be active at school and at home: "It will help the student get motivated to do the motion-based video games at school and at home." Nadler (2008) quoted one child who was able to healthfully lose weight using a boxing MBVG after unsuccessful attempts at traditional gym activity because of boredom and repetitiveness exclaimed that MBVGs are "entertaining…They make you feel like you are not working out. But you are" (p. 28). However, Vander Schee and Boyles (2010) feel that a potential drawback with MBVGs in promoting physical activity is that they use deception to promote physical activity and this may inhibit children in creating their own ways novel ways to be active.

In a paper which ties Hinson's (1995) five "c"-word characteristics essential in intrinsically motivating children to be physically active with common MBVG attributes, Sheehan and Katz (2010) note that MBVGs provide: "control" (through the individualized nature in which a child participates in MBVGs), "challenge" (a necessary aspect of any quality MBVG), "curiosity" and uncertainty (about the next MBVG level or entirely new MBVG game), "creativity" **(**how a child plays the MBVG can often be an expression of their personality), and "constant feedback" (apparent throughout a MBVG experience). Sheehan and Katz added "competition" to this list, an underlying premise of many MBVGs where the participant can choose the difficulty level to ensure the experience is rewarding and demanding which may increase the individual's chance for success, thus increasing self-confidence and motivation. Many of these characteristics were evident in the Kinect Sports Bowling, Kinect Sports Track and Field, and Kinect Dance Central MBVGs utilized in this study. It was perceived that MBVGs may increase time on task during physical education class through this increased motivation. Open-responses included that MBVGs may increase student "motivation and more class participation…" "…as well as keeping them interested and engaged." Using modalities which may increase student motivation and engagement is desirable of any teacher. Inclusive of NASPE's (2004a) sixth national standard of physical education, it is hoped that individuals value physical activity for its potential for enjoyment, challenge, and self-expression – paralleling possible outcomes of MBVG play.

MBVGS ARE A WAY TO INCREASE PHYSICAL ACTIVITY

A second major theme which emerged from the data was that it was perceived that MBVGs are a way to increase physical activity. In particular, many open-responses supported a superiority of MBVGs over traditional sedentary video games. For example, it was perceived that, "traditional video games can cause people to become more lazy and not want to workout." Several responses parallel the opinion that "motion-based gaming is better than [traditional] held video games because it gets them up, moving and off the couch. These perceptions mirror Wilson, Darden, and Meyler's (2010) observation that MBVGs "turns otherwise sedentary kids (couch potato video gamers) on to physical activity and increases their health and fitness" (p. 12).

In addition, it was perceived that some of the MBVGs are more active than others. One pre-service teacher wrote: "I would pick the motion-based gaming over the traditional hand held video games because [you're] being somewhat active and when you do the dance game that's when you are really being active." It was perceived that compared to the Kinect Sports Bowling and Kinect Sports Track and Field games, the Kinect Dance Central MBVG involved the most physical activity. Similarly, Graf et al. (2009) compared energy expenditure rates in children playing various MBVGs in relation to treadmill walking and found that Dance Dance Revolution (DDR) level 2 and Nintendo's Wii Sport Boxing expended more energy than DDR beginner level and Nintendo's Wii Sport Bowling. Thus,

the amount of physical activity and energy expended is specific to the MBVG attributes and levels utilized during game play.

However, many of these pre-service physical education teachers did not feel MBVG physical activity was the most effective form of activity. Comments included that "[MBVGs] are great but do not involve physical activity" and "[MBVGs are] fun and may not be the hardest workout but [they do] make you move." In sum, it was perceived that MBVGs are not necessary the most effective way to increase physical activity. NASPE (2004b) recommends that children should accumulate at least 60 minutes (and up to several hours) of physical activity daily, with the majority being moderate-to-vigorous intermittent activity lasting 15 minutes or more. According to the American College of Sports Medicine (ACSM, 2011), the 60 minutes should include 30 minutes of moderate exercise (defined as *noticeable* increases in breathing, sweating, and heart rate) and 30 minutes of vigorous exercise (defined as *substantial* increases in breathing, sweating, and heart rate). However, it is inconclusive whether MBVGs elicit moderate-to-vigorous physical activity. Graves et al. (2010) concluded that the MBVG activities comprised within Nintendo Wii Fit (yoga, muscle conditioning, balance, aerobics) stimulate light-to-moderate physical activity, with the game of aerobics eliciting heart rate measures below the recommended intensity for maintaining cardiovascular fitness. Similarly, Graf et al., (2009) concluded that energy expenditure during MBVGs is comparable to moderate-intensity walking.

However, in a study which evaluated the effects of MBVGs on physical activity among "inactive" fifth grade children in a physical education classroom, Fogel, Miltenberger, Graves, and Kohler (2010) found that MBVGs produced substantially more minutes of physical activity and more minutes of opportunity to engage in physical activity than did the standard physical education program. NASPE (2004a) national standards for physical education three and four state that a physically educated person habitually participates in physical activity which leads to achieving and maintaining a health-enhancing level of fitness. The perception (and much of the early empirical data on MBVGs) promote that MBVGs are better than being sedentary, but do not always elicit the recommended moderate-to-vigorous physical activity levels to achieve the recommended levels of healthy fitness.

MBVGS DO NOT ALWAYS MIMIC ACTUAL SPORT CONCEPTS AND MOVEMENTS

The final primary theme which emerged from the data was that MBVGs were perceived not to accurately parallel the concepts and movements of the true sport. NASPE (2004a) standards one and two state that a physically educated person must demonstrate motor competency and an understanding of movement concepts required to learn and perform physical activities. One student wrote: "Students would not gain the full concept of the sport/activity simply through video games. It's just fun. Good for a free day." Motor movements and rules required to be successful in the MBVGs were oftentimes perceived to not accurately mimic the actual sport. For example, in Kinect Sports Track and Field game, players were instructed to jump off of two feet to clear a hurdle when proper form would require a one foot lead-leg take off with an accompanying trail leg in true hurdling fashion.

Vander Schee and Boyles (2010) warn that MBVGs may de-skill or de-professionalize physical educators through pre-packaged curriculums in scripted environments. They state that physical education pedagogical content knowledge could become unnecessary, transforming physical educators into mere technicians with little need for understanding of motor competency. On the other hand, Nadler (2008) notes that many MBVG supporters feel that MBVGs are "made to supplement – not replace – traditional physical activity in times (i.e., winter) or in places (i.e., schools hemmed-in by dangerous urban environments

in which there are few safe places to exercise and play outdoors) that are not conducive to physical activity" (p. 28). However, little to no evidence exists regarding whether motor skills and movement patterns are correctly learned while using MBVGs.

CONCLUSION

In this study, it was found that the amount of time spent playing video games increases the perception of the usefulness of MBVGs in physical education. Additionally, it was perceived by the participant group of physical education pre-service teachers that MBVGs are fun and enjoyable and would increase student motivation and physical activity, but MBVGs do not always mirror the same fundamental concepts or motor movements of the actual sport. In summary, one participant wrote: "[MBVGs] are a good way to get kids moving. Though they shouldn't substitute these games for real physical activity, the video games pose as great motivation for students in a physical education setting."

In the previous three decades, video games have been primarily a sedentary recreational outlet for adolescents and adults. However, forms of technology that were once used for entertainment purposes are now entering the educational environment at an exponential rate. Therefore, understanding how video games can be used to encourage learning will be a topic of conversation among leaders of education for many years to come.

This study suggests that while MBVGs are infantile in nature, pre-service physical education teachers believe they show some promise to enhancing the educational experience for students. Moreover, this study's findings indicated that pre-service physical education teachers believe MBVGs may increase students' motivation to participate in sports and physical activity outside of the educational setting. As technology continues to advance the ability for humans to interface both physically and mentally with video games, it can be assumed there will be an even greater impact of MBVGs on the educational environment.

LIMITATIONS AND FUTURE RESEARCH

Limitations of this study include a lack of strong generalizability as all of the participants were selected from one undergraduate level class. Due to this convenience sampling procedure bias was introduced. Fun, enjoyment, and thus motivation may have influenced the results because all of the students knew each other well as they were all a part of the same physical education teacher education undergraduate student cohort. However, one could argue this environment is similar to many physical education and sport coaching settings. Another limitation is that the sample size is considered small.

Directions for future research concerning MBVGs in physical education might include: (a) exploring if self-efficacy to participate in specific sports is enhanced by first practicing the sport in a virtual MBVG environment, (b) exploring how instructor feedback impacts learning and motivation when learning sports through a virtual MBVG environment, (c) measuring student learning within psychomotor, cognitive, and affective domains as it relates to participation in MBVG units in physical education, (d) determining if skill acquisition in sport specific activities is enhanced by participation in MBVG environments, and (e) exploring how implementing MBVGs with special needs populations may enhance levels of physical activity.

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