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Nintendo Wii: Opportunities to Put the Education Back into Physical Education

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Abstract: Movement-based gaming technologies, such as the Nintendo Wii, are becoming more visible within the physical education. As research on movement-based technologies develops, an aspect that has gained interest is the potential educational value for the physical education student. The purpose of this study was to examine movement-based sport games and the potential learning opportunities (i.e. game performance elements) for physical education students. Using qualitative measures, experts in the field of physical education teacher education analyzed the game performance opportunities across multiple sport-based games. Findings indicated that movement-based games provide opportunities to develop and work on the cognitive understanding of sport and games

Introduction

Movement-based gaming technologies, such as the Nintendo Wii, are becoming more visible within the physical education setting (Hayes & Silberman, 2007). A major reason why teachers may elect to use such technologies could be attributed to students finding them fun, motivating (Dickey, 2005) and provide opportunities to engage in physical activity (Fogel, Miltenberger, Graves & Koehler, 2010; Krisberg, 2012). While the aforementioned concepts can be considered relevant psychological (*enjoyment*) and health-enhancing (*physical activity*) factors within education, an area of limited inquiry has been focused on the educative value of gaming technologies within physical education. Therefore, the aim of this study was to gain insight into the educational opportunities that movement-based video games provide within physical education.

Movement-Based Gaming Technologies in Physical Education

The infusion of video games within the educational setting is not a new concept within the general education setting (Aldrich, 2005). However in physical education the adoption and implementation of video games has been initially met with resistance due to the perceived association with inactive behaviours (Sanders & Hansen, 2008). Some physical educators may feel that using video games may take away from time students could engage in physical activity (Fogel et al., 2010). With the development of movement-based consoles and games, such as the Nintendo Wii, physical education programs are now starting to infuse such technologies within their program (Fiorentino & Castelli, 2005).

Much of the literature on video gaming within physical education is broken into either practitioner articles on potential uses for students (Cai & Kornspan, 2012; Hayes & Silberman, 2007; Pill, 2010) or empirical evidence focused on the influence of gaming technologies on students fitness related components (Fogel et al., 2010; Lager & Bremberg,

2005; Marshall, Biddle, Gorely, Cameron & Murdey, 2004). Using practitioner-based articles, movement-based technologies possess the potential to enable classes to spend time more efficiently, as well as support the broader goal of encouraging students to become more knowledgeable, confident and enthusiastic about engaging in movement activities (Hayes & Silberman, 2007). Furthermore, Cai and Kornspan (2012) suggested that movement-based games posses the potential to enhance the psychomotor and cognitive learning of sports for students with developmental disabilities. From a fitness perspective, gaming technologies provided students with opportunities engage in behaviours that positively influence their overall level of fitness, such as increased level of physical activity (Fogel et al., 2010; Lager & Bremberg, 2005; Marshall et al., 2004; Krisberg, 2012). For example, Fogel et al. (2010) studied the effects of exercise-based games on inactive fifth grade students. Using an experimental design, student's physical activity was measured while engagement in both a traditional and video games based lesson (e.g. Sport games using the Nintendo Wii). Results illustrated that students spent more time being physical activity in the movement-based gaming lesson compared with the traditional physical education class.

Each of the aforementioned research-based studies indicated that using gaming technologies within physical education provides students with opportunities to enhance diverse aspects of individual fitness, yet there seems to be a gap within the research. Specifically, all empirical studies have been focused in the area of fitness that is a minor component of what physical education espouses to teach students. As fitness is only one aspect of a physical education program, more research is needed to examine the broader educational potential of movement-based technologies. Specifically, there is a clear lack of empirical studies on the influence of video gaming in physical education on relevant skills that will enhance students potential to play.

Conceptual Framework - Game Play Concepts

This study was conceptually grounded within the game performance elements espoused by Oslin, Mitchell and Griffin (1998). Oslin et al. (1998) suggested that all sports provide students opportunities to demonstrate learning through seven key concepts: (a) base, (b) adjust, (c) decision-making, (d) skill execution, (e) support, (f) cover and (g) mark. Table 1 provides a definition and example of each key concept.

Concept	Definition	Example
Base	Returning to a home, neutral or recovery position	A player would move back to the middle of the baseline after hitting an out wide forehand.
Adjust	Moving in a manner to maintain the flow of the game.	A player will move to an open space on the court so that a pass can be made.
Decision-Making	Making the correct choice of what to do with the ball	Hitting the tennis ball into a location that is difficult to return.
Skill Execution	Performance of isolated sport-specific skills	Performance of a soccer pass or baseball swing.
Support	Moving into a position that supports teammates when on offense	A player that backs-up the throw in baseball.
Cover	Defensive support for player making a play on-the-ball or moving to the ball" (Oslin, et al., 1998, pg. 233).	Moving to help a defensive player that has attempted to steal the ball and has left their player open.
Mark	Properly defending an opponent	Standing in a position between the person you are defending and the player with the ball.

Table 1: Game Performance Components, Definitions and Example

Notes: Modified from Oslin, Mitchell and Griffin (1998).

Game performance elements have been applied as a measure of student learning within a variety of sports that cut across the spectrum of games classifications (Memmert & Harvey, 2008). Games and sports fall under four main categories or classifications: target, striking/fielding, net/court, and invasion (Almond, 1986; Mitchell, Oslin & Griffin, 2006). Games classifications are based on the idea that sports housed under a category possess similar tactical aspects (Mitchell et al., 2006). The first game category is target, where a team or individual aim to get an object as close as possible to a target in an uncontested (e.g. golf, ten pin bowling) or contested format (lawn bowls, bocce). One clear element associated with target games is that they are generally self-paced: there is a play action (*initiation of play*), a consideration of the play action and then another action. In team or oppositional target games, certain play actions may be forced upon you by the opposition but you still have time to consider and process the situation in a cognitive manner before determining your next play action. The second striking fielding where, in a contest of two teams, one aims to score as many runs as possible off the bat and not off the bat while the fielding team tries to minimize this (e.g. cricket, softball and baseball). In essence, these sports are a contest between a player with the bat and the fielding team. There is initial play action between a pitcher / bowler and a batter which results in a certain play element, a miss, a hit, a foul, a sundry. Play then stops, the situation is considered and then play action is repeated. As with target games, there is time to consider the state of play between each play action sequence but as there is now a more oppositional element, the play is less self-paced. The third category is net / court, where an individual or team in possession tries to place the object in a location where it cannot be returned (e.g squash, tennis, volleyball). These sequences of play, which begin with a serve, can continue for as little as one shot or be maintained for many shots, during which time there is a dynamic interaction between the players / teams. Play is less predictable during this time and more elements of game play are involved throughout the play action

sequences. The fourth and final category is the field territory or invasion category where teams try to move into other teams territory to score. These games and sports create very fluid and dynamic game play sequences in environments that are unpredictable and complex. These sequences continue until there is a stoppage in play or a break and can be single play actions with a wide number of options (e.g. American football) to complex, multilayered sequences (e.g. basketball, football). Thus, while the game performance concepts can be used to examine different elements of game play in relation to each of the categories, it is important to note, that not all of the aforementioned elements can be observed within each and every sport (Memmert & Harvey, 2008; Mitchell et al., 2006). For instance, when playing a game of tennis, the elements of decision making, base and skill execution will be present in a singles match while support and cover will be present in a doubles match. However, marking an opponent will not be present. The usability and importance is that researchers are provided the opportunity to pick relevant concepts within specific sports to assess a student's level of learning (Mitchell et al., 2006). Within this study the game performance elements provided a useful lens by which to examine movement-based sport video games and the potential learning opportunities for use within physical education. Therefore, the purpose of this study was to examine movement-based sport games (i.e. bowling, tennis, golf and baseball) and the potential learning opportunities (i.e. game performance elements) for physical education students.

Method

This study utilized a case study approach (Merriam, 1998), grounded in the game performance framework (Oslin, et al., 1998). In order to examine the purpose of this study, data were collected using individual and focus group interviews and researcher field notes. Ethics approval and informed consent was obtained before all data collection. Data were analyzed using a constant comparative qualitative analysis to examine the degree by which movement-based video games provided students with opportunities to demonstrate and engage in concepts of game performance and verified through triangulation, peer debriefing and member checks.

Individual and Focus Group Interviews

Interviews were conducted to examine participant perceptions of game performance while playing a variety of sports based video games. All interviews were conducted and audio recorded within the Pedagogical Laboratory for Physical Education and Sport and lasted between 10 - 20 minutes. To ensure participant confidentiality, pseudonyms were used. Individual interviews were ongoing throughout the study and conducted weekly throughout the length of the study. Focus group interviews were conducted three times (weeks 1, 7 and 13) throughout the study. Collection of participant interview data utilized a semi-structured and informal method with probing statements (Merriam, 1998). Questions were initially open-ended focusing on elements of game performance (Oslin, et al., 1998).

Field Notes

Field notes were recorded during every game play session and used to identify game participant behaviours reflective of game performance concepts. Researcher field notes followed the guidelines of recording the setting, sport, participant behaviour and documenting game play elements (Lofland & Lofland, 1984). Game play elements were recorded using a modified version of the Game Performance Assessment Instrument (GPAI; Oslin, Mitchell & Griffin, 1998). The modified GPAI listed all game play components (base, adjust, decision-making, skill execution, support, cover and mark) with a short definition of each. Each observer was asked to document observed behaviour that aligned with each game performance component: (a) whether the action was initiated by the participant or automatic and (b) general comments. See Table 2 for an example of the modified GPAI observation form section of the researchers field notes.

Concept	Definition	Behaviour Observed	Comments
Base	Returning to a home, neutral or recovery position		
Adjust	Moving in a manner to maintain the flow of the game.		
Decision-Making	Making the correct choice of what to do with the ball		
Skill Execution	Performance of isolated sport-specific skills		
Support	Moving into a position that supports teammates when on offense		
Cover	Defensive support for player making a play on-the-ball or moving to the ball" (Oslin, et al., 1998, pg. 233).		
Mark	Properly defending an opponent		

Table 2: Game Performance Assessment Instrument Observation Form

Notes: X = behaviour is initiated by the player; A = behaviour is dictated or controlled by the video game.

Trustworthiness

Trustworthiness was achieved through triangulation of data sources, peer debrief and member checks (Creswell, 1998; Lincoln & Guba, 1998). Triangulation of data was ensured through the use of individual interviews, focus group interviews and field notes. Peer debrief utilized a researcher well versed in qualitative methodologies to review data, themes, and

interpretations (Lincoln & Guba, 1998). Interpretation of interview data was double-checked with participants to ensure that interpretations of data were conducted in an appropriate manner (Creswell, 1998).

Data Analysis

Analysis of data utilized a constant comparative method espoused by Strauss and Corbin (1998). Before beginning analysis of data all individual and focus group interviews and field notes were transcribed. Copies of all transcriptions were provided to two researchers who independently used open coding within all data sets (Strauss & Corbin, 1998). Coding forms for each data collection method (e.g. interviews, field notes) were compared, analyzed and combined into primary codes. Comparisons across codes were conducted until themes emerged. Consistency of analysis was achieved through systematic cross checking of codes and themes and was concluded when a level of saturation was established (Strauss & Corbin, 1998).

Participants and Settings

Participants within this study were five experts in the field of physical education pedagogy. Classification of experts were individuals with a postgraduate degree in physical education or sport pedagogy, taught a minimum of three years of school physical education and 10 years in a tertiary physical education teacher education program.

Participants were required to engage in a weekly 45-minute game play session for a total of 14 weeks using the Nintendo Wii gaming console. Initially, each participant was provided an introductory session focused on learning how to use the game console, remotes and a practice session with each of the sports being used within the study. Games utilized within the study were bowling, tennis, golf and baseball housed within the Nintendo Wii Sports video game. Each game play session required participants to play 10-minute games of each sport (40 minutes) with 5 minutes being provided for a break and transition between games. The order of sports rotated weekly to alleviate issues such as participant fatigue. In addition, game play sessions were conducted individually on even weeks (2, 4, 6, etc…) and in pairs on odd weeks (1, 3, 5, etc…). All gaming sessions were conducted within the consultation room of the Pedagogical Laboratory for Physical Education and Sport.

Results

Analysis of data saw three themes emerge: opportunities to make decisions, skill execution dissonance and automaticity of video games. To ensure participant confidentiality the use of pseudonyms were applied.

Opportunities to Make Decisions

Throughout each of the games (i.e. sports), participants indicated that they were provided opportunities to make game play and sport specific decisions. For instance, “in golf I spent most of my time figuring out which club to use and how to play the wind” (Xavier, Week 1). Katelyn stated “the ball was moving slow enough on the easy level [of tennis] that I had time to see where my opponent was and wasn’t.” “I liked that fact that you could adjust

the angle and direction of the bowler so that I could decide where to stand." (Isabella, Week 3).

Researcher field notes supported the notion that players were able to make influential game decisions within each sport (bowling, tennis, baseball and golf) that manipulated the flow and outcome of the game. (Field Notes, Week 3). It is important to note that not all decision-making aspects of game play were evidence. For example, when playing baseball participants indicated that a player "couldn't steal a base" or "intentionally walk a batter". In tennis, players "couldn't set-up an attack where I ended with a volley, my player kept to the baseline". Target games (i.e. bowling and golf) seemed to be more encompassing of major decision-making aspect, such as club selection, playing the wind, topography of the green. The concept of decision-making is a critical element of game play and allows students the opportunity to demonstrate their cognitive abilities within a physically oriented activity (Mitchell & Oslin, 1999).

Skill Execution Dissonance

The dissonance between execution of sport specific skills between authentic (e.g. playing tennis at the local courts) and virtual games (e.g. Nintendo Wii tennis) were perceived. As participants began to play each sport execution of skill was observed as being consistent with the authentic or "real sport".

"I was worried that I would ruin the controls [remote] with my [backhand] follow-through." (Xavier, Week 1)

"I'm glad the [Pedagogy Lab.] was long enough for my run-up [in bowling]." (Saxon, Week 2)

"The wrist band was too tight and it made it hard to control my golf swing" (Isabella, Week 1)

As participants gain experience and competency within each sport, the movement skills were modified. "The worst thing to do within golf, tennis and bowling is to make your movement as real as possible. The less the movement the better." (Saxon, Week 6)

"Look…I started out using the regulation golf swing for golf and by the time I ended the 14 weeks, I would just flick my wrist in a short, quick movement…The ball went straighter, I had more control and seemed to hit my targets better." (Katelyn, Week 10)

"I found it frustrating in that I struggled to replicate the swing and shot. However, it was similar to me playing golf. I don't play much now and this is a source of frustration for me as well. So it is quite authentic in that sense." (Xavier, Week 9)

Interestingly, the ability to play certain shots that were above and beyond their own movement skill level gave a new sense of understanding for the players.

"I got a sense of what it is like for an elite golfer. I could perform a draw or hook shot with a flick of the wrist, a skill I simply don't have the time to develop. And I found that I could get a feel of the green, even though I was not on one. I could read them better than in real life but I suspect that it was because I had played golf. But the terms that are used on golf commentary also made more sense to me, like swales and shelves and I knew what to do when faced with them on the green." (Indiana, Week 8)

"I observed that while people are playing there tends to be a more sedentary feel, as participants are sitting in a chair leaning against a wall before the bowl, swing or pitch. It is important to note, that game play [scores and rallies] are improving." (Field Notes, Week 11).

Automaticity of Video Games

Video games provide players with a virtual context whereby specific aspects need to be controlled for due to either game rules or limitations of current technologies. Within each of the sports the video game technologies controlled certain movement of the players with little involvement of the participant. It seemed that the sports of baseball and tennis were limited by the aforementioned concepts. For instance within tennis the player who struck the ball would automatically return to a neutral or base position while the net player would adjust based on the ball placement and teammate. There tended to be an underlying notion that "too many things were taken care of" as illustrated with the interview statements for each baseball and tennis:

"I never had to worry about getting back into the court to play the ball…it was done for me". (Saxon, Week 13)

"There was no need to have a person back-up a throw or provide a relay. The ball was hit and the game told you whether it was a single, double, triple or out. I guess the play at the plate will never happen." (Katelyn, Week 5)

However, data analysis suggested that the automated aspects did not impact on the elements of play as much as the other categories. Specifically, target games (bowling and golf) were generally self-paced and the elements of game play that could be measured were still quite authentic or consistent with those measured in the game performance assessment, apart from movement skill.

"The great thing about the golf was that it was still all of my play, my errors, my read of the green or the wing, my decision on where to place the ball. The game just gave me the parameters to operate in." (Indiana, Week 13)

"Target games seemed to be the most authentic games. I would say that this is do to the less dynamic environment that the video game programmers could capture." (Field Notes, Week 12).

Discussions and Conclusions

As Sawyer (cited in Krisberg, 2012) stated: "Video games are not going away. Computers are going to get more powerful and games are going to take advantage of those powers to do incredible things. We can't just shame this stuff away…we've got to better understand it" (p.10). One of the challenges that face physical education is providing students with educationally and developmentally appropriate learning experiences. In particular, this study focused on the potential use of video games in meeting the aforementioned challenges. Key findings from this study provide data informed support for the practical or conceptually-grounded literature on using gaming technologies in physical education (Cai & Kornspan, 2012; Hayes & Silberman, 2007; Pill, 2010). Data from individual and focus group interviews, as well as researcher field notes, suggest that gaming technologies provide students with increased opportunities to develop cognitive understanding (i.e. decision-making). In addition, data suggests a unique experience associated within the psychomotor domain (i.e. execution of skill) and a degree of restrictiveness of current gaming technologies.

These findings suggest that it is possible for students to learn relevant game play elements using the Nintendo Wii by providing students with opportunities to make game play decisions that are (a) relevant to each game/sport and (b) less relied upon by the complex execution of sport specific skills. In addition, the unique aspect associated with executing sport skills could be viewed as advantageous for those students who excel at fine motor skills (*effective use of the gaming controller*) and/or those students whom struggle to competently performance in an authentic context (*hitting a driver off the tee*). Finally, as the complexity

and dynamics of the sporting environment increased there tended to be a level of automaticity programmed into each sport.

The unique contribution that video games add within a physical education setting is the focus on the cognitive learning of students. As findings illustrate a student could be provided the opportunity to develop their cognitive understanding in regards to decision-making elements. Decision-making within an authentic or real world environment can be influenced by the individual's ability to execute sport specific skills and their physical performance. In addition, the speed of game play can be slowed down in a virtual or gaming environment so the individual is provided more time to see and process the gaming context. For instance, an elite player will move at a faster rate when compared with a novice player. In a heterogeneous class of students it would allow the elite player an advantage. In a virtual setting the influence of an opponent in regards to rate of speed and performance can be limited by the gaming technology. On the contrary, the elite player may be provided the opportunity to develop his/her decision-making skills as more time to read the field or upcoming play is provided.

A common compliant for students can be that they do not possess adequate sport specific skills to play the game. Using video games focuses attention away from the aforementioned movements, such as properly executing a topspin forehand in tennis. This may be seen as both a positive and negative aspect for students. From a learning to play the authentic game perspective, students may not be developing the psychomotor performance needed to play a weekend game of tennis. On the contrary, the simplicity and forgiveness of movement provided within a movement-based video game can downplay the aforementioned fears and dissonance toward engaging in movement and sport.

As gaming technologies develop, so will the ability of games to match the real world setting. At this moment, teachers should be aware that elements of game play within video games could not be manipulated directly by the student. Thus the student's ability to demonstrate specific elements, such as off the ball movement is limited. As a teacher, it is critical to understand the limitations of video games and their application within a school setting. Alignment of video games within physical education should be viewed as a value-add resources and not an alternative.

What is clear from the study is that there is great potential for exploration in the use of game in virtual environments as tools for both learning and observation in the games and sports field and in physical education. While research has been focused on the activity levels of children and how these tools are seen as ways of engaging a new generation in activity in a variety of environments, some of the findings here represent a reduction in activity levels but an increase in the cognitive understanding and appreciation associated with game play. Future studies may need to examine the influence of gaming technologies on actual game performance. In addition, video games may provide a valuable lens for teachers to enhance their level of cognitive knowledge across a wide array of sports and games.

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