PEDAGOGY - ELEMENTARY
PHYSICAL EDUCATION

Xbox Kinect Gaming Systems as a Supplemental Tool Within a Physical Education Setting: Third and Fourth Grade Students' Perspectives

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Abstract

Literature indicates that technology, including exergaming, is popular among adolescents and can be used as a supplemental tool in the physical education classroom. Therefore, the purpose of this study was to examine third and fourth grade students' perceived enjoyment and exertion levels toward exergaming in relation to traditional physical education. The participants included 148 third and fourth grade elementary students. Each student completed two surveys (10 items each): one after a traditional PE lesson (gym) and one after participating in a lesson taught in an exergaming lab (MKR). Each survey consisted of two parts: seven enjoyment questions and three perceived exertion questions. Using a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree), students marked responses to reflect their enjoyment toward and perceived exertion levels for each setting of physical education. The results indicate students enjoyed the MKR (Mean Rank = 75.75) significantly more than the traditional gym (Mean Rank = 49.15) setting,

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z = −4.53, p < .001. However, the students felt they worked harder in the gym (Mean Rank = 73.21) compared to the MKR (Mean Rank = 51.15), z = −4.11, p < .001. With this study, physical educators will be exposed to the implications of integrating exergaming into a physical education environment.

The impact of technology on society, and more specifically children, is prodigious. The child of the 21st century was born into a world immersed in technology and all its advantages and disadvantages. The copious amounts of day-to-day technologies to which school-aged children have access and routinely consume are astounding. Children are instinctively drawn to multiuse technologies such as smartphones that include text messaging, FaceTime, social networking and media, music, and GPS. Furthermore, tablets and e-readers, interactive television with Internet capabilities, personal computers, SMART Boards, video gaming systems, and the relatively new genre of exergaming have inundated the technology markets.

Children are becoming unhealthier throughout each generation. Over the last three decades, the obesity rate has nearly tripled, rising to over 9 million obese children and adolescents (Ogden & Carroll, 2010). Russell and Newton (2008) found that the disconcerting U.S. obesity epidemic trends point toward children's lack of activity. Additionally, the societal issue of technology overuse among children is concerning for most. Researchers have suggested that screen time, which includes television, computer, and video game usage, is another perpetrator of the obesity epidemic (Russell & Newton, 2008). Not long ago parents had to step outside on the porch to call their children in for dinner, whereas today parents step into the other room to find their children sitting in front of the television or the computer. A sedentary lifestyle, compounded with the attractiveness of video games, creates a perfect storm for the ongoing battle against obesity. This can be problematic for physical education (PE) teachers as the main goal of PE is to get students physically active.

The video game industry has been gathering momentum through the popularity of interactive video game technology or IVGT. Video gaming has been an entertainment staple for years, especially among the younger generations. The "iGeneration" (Rosen, 2011), the children entering today's elementary schools, is more conversant with technology than any previous generation. At a TED Conference in 2010 Jane McGonigal reported that an average adolescent will spend 10,000 hr playing video games before turning 21. This is the

same amount of time an adolescent will spend in class from middle school to high school combined. With technology becoming more prevalent in the world, physical educators need to use any and all resources to reach students and encourage physically active lifestyles. Infusing technology into the gyms of today is a necessity to reach the learners of the future.

Recent advancements in the technology field have produced a new genre dubbed exergaming, which has burst on the scene, permeating homes and schools. As defined by Staiano and Calvert (2011), "Exergames interpret a player's bodily movements as inputs associated with specific meanings for game play, translating movement in three-dimensional space onto the two-dimensional screen" (p. 93). Since the 1980s, physical educators have used primitive technological tools such as stationary bikes connected to video game consoles, requiring the player to pedal while playing the game (Staiano & Calvert, 2011). However, video games have not been traditionally used in the PE profession because of the sedentary element. This sedentary factor is not present in exergaming as the user is required to be up and active. This new exergaming technology promotes a healthy, active lifestyle (Silverstone & Teatum, 2011) and is attributed to debunking negative connotations closely associated with video gaming and the obesity epidemic, and the tech-savvy child may relate better to physical activity through the use of exergaming as a fun and interactive medium.

There are multiple benefits to physical educators incorporating exergaming into their classrooms. In 2008, Russell and Newton discovered that by using IVGT, exercise could be beneficial for students' extracurricular activities and boost student participation. Although exergaming is a relatively new tool for the PE profession, it seems to be gathering steam and could be helpful in the goal of becoming more active as a society. If used appropriately, exergaming could benefit students' physical, socioemotional, and cognitive health (Exner, 2010). Fogel, Miltenberger, Graves, and Koehler (2010) revealed that exergaming demonstrates potential as a PE tool because it is simple to apply, it is easy for the PE teacher to incorporate, and children start to engage in physical activity immediately. Exergaming can also provide students with exposure to nontraditional activities such as adventure racing, white-water rafting, golf, or tennis to which they may not otherwise be privy (Daley, 2009). With exergaming, PE teachers can get students up and engaged with these virtual movement activities.

Being marketed for its enjoyment factor, exergaming has affective benefits (Russell & Newton, 2008). Therefore, it is important to explore students' perceptions in PE as perceptions are a determinant to children choosing certain physical activities. Children find challenging activities to be interesting and enjoyable, which in turn leads to more participation. Students will find an activity enjoyable by either previous experience or perceived experience of the activity. The more success students experience during a given activity, the more likely they are to enjoy the activity. Enjoyment then plays a vital role in long-term participation in physical activity. Thus, students will need to experience success with an activity, really enjoy the activity, or both to continue with future engagement (Cairney et al., 2012). Combining the best of both worlds, play and technology can foster enjoyment that usually results in the student working hard, tiring out, and expending lots of energy during PE. Even when some students perceive physical activity as a negative, exergaming allows teachers to safely monitor and develop the physical fitness of students while infusing technology they enjoy (Medina, 2008). Additionally, there is the possibility for student behavior and attendance to improve (Castelli, Hillman, Buck, & Erwin, 2007). Therefore, if the use of exergames can improve aspects of PE such as discipline, attentiveness, rowdiness, or attendance, it should be seriously considered for adoption into a school's PE curriculum.

How teachers perceive video games as an instructional tool is another factor to consider when exploring the use of exergaming. Professionals in the field of PE could seize the opportunity to enhance the depth of their toolbox by using technology trends that are popular with youth today. Zimmerman and Fortungo (2005) suggested teachers who are unfamiliar with or do not appreciate video games will not use them to benefit their classroom. Additionally, Kenny and McDaniel (2011) affirmed that teachers who perceive video games as irrelevant are less likely to implement them into their classroom. If teachers do not see the importance of technology, specifically exergaming within an educational setting, technology will not be effectively implemented into a school's curriculum. However, Fogel et al. (2010) found teachers strongly agree that students can benefit from exergaming, that there is an opportunity to develop skills, and that behavior problems are reduced.

Investigation of the advantages and disadvantages of exergaming compared with traditional exercise is warranted. There is a need for further investigation into the attitudes and perceptions of children on exergaming as a physical activity (Witherspoon-Hansen,

2009). Therefore, the purpose of this study was to examine students' perceptions regarding exergaming in the PE setting at their school. More specifically, students' perceptions of PE were compared in the traditional setting (gym) versus an exergaming lab (Microsoft Kinect room or MKR).

Methods

Two PE settings were used in the study: a traditional gym setting and an exergaming lab (MKR). A survey was given following each setting to examine enjoyment and perceived exertion differences between the settings. A Wilcoxon test was used to analyze the differences in student responses to the surveys.

Participants

The participants for this study included 148 third and fourth grade students from a rural elementary school in Northwest Arkansas. The student participants included 71 third graders (34 female, 37 male) and 77 fourth graders (36 female, 41 male). The sample was drawn from a K–4 elementary school with a population of 649 students, 96% of whom were Caucasian and 27% of whom were enrolled in free and/or reduced-price lunch. A consent form, approved by the school district's administrators and by the researchers' university institutional review board, was sent home to the parents and returned back to school with one parent signature of consent to participate.

Procedure

Students entered each 30-min PE setting and then sat down for a brief introduction of the lesson objectives for the day. While in the MKR, students competed in track and field activities of the Kinect Sports video game. Two students were assigned to one of the 12 Microsoft Kinect gaming consoles in the MKR, and the students started the game after they arrived at their station. While in the traditional gym setting, students participated in obstacle course relays consisting of running, jumping, and hurdling activities. The activities between the settings were carefully aligned to help alleviate bias toward activities on the students' part. During the class, the teacher stopped individual students occasionally to provide assistance or feedback.

Participants were given paper surveys during the last 5 min of a traditional gym setting and the MKR. The surveys were administered on two occasions during the same week and as close to the

previous setting as possible. The schedules were random, allowing some students to be in the gym first and others to be in the MKR first.

Instruments

A survey developed by faculty from our institution for a separate study was used as a guide in creating the survey for this study. As a result, a survey was created with questions about enjoyment and exertion levels of students while in a traditional gym setting. The same survey was used for the MKR, but the word *gym* was replaced with the words *Kinect room* for the MKR survey. Each student survey consisted of 10 statements. The first seven statements were designed to measure student enjoyment of the PE setting, and the last three statements were designed to measure student perceived exertion level. The survey questions used can be found in Table 1. Finally, the surveys included a 5-point response scale from 1 (*strongly disagree*) to 5 (*strongly agree*).

The 10 survey statements were randomly mixed and sent to a panel of five experts. The experts, averaging 18 years of experience in the field of PE, were asked to group like questions to ensure validity of the survey instrument. The panel of experts found the survey instrument to have sufficient validity. Four of the five PE experts grouped the three perceived exertion statements together (with the fifth expert excluding only one of those three statements), thus leaving the remaining seven statements to form the perceived enjoyment group.

A Cronbach's alpha was used to assess the internal consistency of the survey instrument. A Cronbach's alpha of .79 was found for the seven enjoyment questions of the survey. For the three perceived exertion questions of the student survey, a Cronbach's alpha of .60 was found, resulting in acceptable internal consistency.

Statistical Analysis

SPSS Statistics 20 software was used to analyze the data. Because the assumption of normality was violated, a nonparametric test was selected for this study. Consequently, a Wilcoxon test was employed to distinguish group differences in the enjoyment statements following the MKR and the gym. Likewise, the group differences from the perceived exertion statements were assessed using the same procedure. Surveys from students who did not participate in both settings were not considered in the analysis.

Results

A Wilcoxon test was conducted to evaluate the mean rank differences of student perceived enjoyment and exertion levels while participating in the gym versus the MKR. The students enjoyed the MKR (*Mean Rank* = 75.75) significantly more than the traditional gym (*Mean Rank* = 49.15) setting, $z = -4.53$, $p < .001$. However, the students felt they worked harder in the gym (*Mean Rank* = 73.21) compared with the MKR (*Mean Rank* = 51.15), $z = -4.11$, $p < .001$. Statistics for comparing individual questions between the two settings—z-scores, significant differences, positive ranks, mean ranks, means, and standard deviations—are displayed in Table 1.

Discussion

Minimal research was found concerning the *affective* benefits of exergaming. Therefore, students' perceptions of PE in the traditional PE setting (gym) versus the MKR were compared in this study. There are some notable items in Table 1. First, elementary students enjoy PE no matter the setting. Those who have been around an elementary school setting can identify with this fact. Furthermore, this study reveals students like the MKR, they look forward to PE days in the MKR, and they feel their friends enjoy the MKR more than the gym. As previously discussed, youth today are engrained in technology and video games. It stands to reason, when given the choice of physical activity with or without technology, they choose with technology. There are additional findings to consider in Table 1. Students believed they worked equally hard in the two settings. However, students felt more fatigued while in the gym. When people enjoy an activity, they may not mind, or even realize they are, working hard. The findings of this study may be applicable to that phenomenon. Consequently, it would be interesting for future researchers to explore aerobic benefits of an MKR setting compared with those of the traditional gym. This would include exploring physiological data, such as heart rate, as it relates to technology in PE. Investigation into such an experience could add relevance to using such technology within elementary PE. Furthermore, as a result of the homogeneous sample of the study, the affective benefits of exergaming among ethnic, socioeconomic, and age (e.g., secondary schools) populations is warranted. Last, prior to conducting the study, students with disabilities were informally observed interacting with a Microsoft Kinect gaming system. Thus, exploring an MKR setting within adapted PE could be beneficial as well.

Table 1

Differences in Individual Questions Comparing Settings (MKR vs. Gym)

Question	*M* (N)	*SD*	Mean Rank (P.R.)	Ties	*z*	*p*
I enjoy PE in the MKR	4.60 (148)	.603	44.11 (56)	62	−2.67	0.008*
I enjoy PE in the gym	4.32 (148)	.941	42.37 (30)			
I am good at PE in the MKR	4.60 (148)	.603	41.19 (54)	68	−3.91	< .001*
I am good at PE in the gym	4.30 (145)	.828	33.85 (23)			
I have good sportsmanship in the MKR	4.70 (148)	.635	34.05 (40)	83	−2.02	0.044*
I have good sportsmanship in the gym	4.55 (148)	.722	31.32 (25)			
I think my friends like PE in the MKR	4.61 (146)	.614	43.91 (64)	61	−5.61	< .001*
I think my friends like PE in the gym	4.05 (144)	.903	30.03 (17)			
I look forward to PE days in the MKR	4.37 (145)	.942	48.22 (56)	53	−3.16	0.013*
I look forward to PE days in the gym	3.97 (144)	1.158	37.98 (32)			
I would rather go to PE in the MKR instead of the gym	2.47 (147)	1.356	45.38 (45)	4	−1.22	0.222
I would rather go to PE in the gym instead of the MKR	2.65 (147)	1.428	52.13 (52)			
I want to participate in PE when in the MKR	4.60 (146)	.819	36.54 (36)	75	−0.22	0.824
I want to participate in PE when in the gym	4.59 (148)	.764	35.44 (35)			
I get tired in PE when in the MKR	3.20 (148)	1.378	55.30 (47)	30	−2.48	0.013*
I get tired in PE when in the gym	3.63 (148)	1.285	62.28 (71)			
I usually sweat in PE when in the MKR	3.64 (148)	1.315	41.65 (31)	42	−4.74	< .001*
I usually sweat in PE when in the gym	4.32 (146)	1.023	57.11 (73)			
I work hard in PE when in the MKR	4.76 (146)	.542	24.50 (24)	97	0.00	1.00
I work hard in PE when in the gym	4.76 (147)	.544	24.50 (24)			

Note. MKR = Microsoft Kinect room; P.R. = number of positive ranks. Adding together the number of positive ranks for each setting with the number of ties equals the total (*N*) for the paired statements.

*p < .05.

This study had several noteworthy characteristics. The study had a sufficient sample size, a good internal consistency for the seven enjoyment questions, an acceptable internal consistency for the three exertion questions, and good validity within the field. However, the results for the exertion portion of the survey were on the lower end of the acceptable range for internal consistency. After the final data set was investigated, the distributions showed symmetry but were negatively skewed, violating the assumption of normality for a distribution. This was because few questions were answered strongly disagree or disagree for either setting. Last, replicating identical movements between the settings can be difficult. However, the activities used in the gym and MKR fell within the same state standards.

"Old school" PE is just that, old. No more dodgeball or climbing the rope in front of the entire class. The majority of children still appreciate PE in all settings. Similarly, children enjoy video games. Thus, incorporating technology into PE is essential in connecting with today's children. Ultimately, this study indicates exergaming can be used in the PE profession with positive results as it taps into the interest of the current generation of students.

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