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Motivation to Move with Exergaming in Online Physical Education

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ABSTRACT: Motivation to move is critical in online physical education (OLPE). This study looked at the motivational aspect of remote exergaming versus another student versus proximally against a console generated non-player character (NPC). Research shows that students in grades 4-12 are motivated to play exergames because they are native gamers. The entertainment value of the exergame garners more effort from the students than they realize they are expending. This research showed that exergames are motivating for students (N=124) aged 11-18 in grades 6-12. The subjects reported high motivation to participate while playing both a computer generated NPC and a remote human opponent over the internet. Scores for motivation were highest when subjects played another student over the internet but were also high for proximal NPC play. This research positions exergaming as a potential piece of OLPE curriculum that can help students access the emotional aspect of physical education curriculum.

Keywords: Virtual; Gaming; Emotional; e-learning; Activity

INTRODUCTION

Physical education seeks to help students grow into healthy life long movers [1]. This is accomplished through the acquisition of knowledge, skills and confidence developed during exposure to the curriculum [2]. The ultimate goal of the curriculum is to equip each student with the desire, knowledge, skills, and social experience essential for healthy movement choices. Students who view physical activity in a positive light are more likely to become lifelong movers [3]. Learning that is engaging and interactive can help students become intrinsically motivated to participate in movement activities [4]. Choice or the perception of control helps to stimulate intrinsic motivation in students [3-4]. Intrinsic motivation, free choice and pleasure are all determined by the level of student exertion which is a response to the amount of volition they are given [5].

Teachers who emphasize mastery learning over achievement can foster situational learning which helps to increase intrinsic motivation [6]. When mastery is the goal of an activity it can actually reduce the need for choice to motivate [7]. Children and adolescents who enjoy physical activity will incorporate movement into their daily lives. Students will choose activities they find enjoyable and entertaining [5]. Youth express themselves through

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play because it is fun and exercises the mind and the spirit [8]. state that intrinsically motivated children participate in activities because they enjoy the activity while children who pursue extrinsic rewards expend only the amount of energy needed to get the reward [9]. Put another way extrinsically motivated students will lose interest in the activity once they have reached their goal while intrinsically motivated students continue to engage the behavior because they enjoy the activity [10].

1. LITERATURE REVIEW

1.1 The Exergaming Advantage.

Students who engage in exergames work harder without even realizing it [11]. Exergaming is chosen by both boys and girls and keeps them engaged resulting in a desire to continue playing [12]. Exergaming allows participants to engage the game at different skill levels. Students who lack confidence can start at easier levels and work up to higher levels as their skills increase. The success achieved with this approach helps to increase student self-efficacy which leads to an upturn in the amount of exercise the student engages in [10].

One alarming trend is that during the transition from adolescence to young adulthood there is a measureable decline in vigorous movement and strengthening activities amongst girls when compared to boys [13]. This may be because girls view themselves as less capable on physical tasks which are competitive in nature which unfortunately are often the core of the activities being offered in physical education classes [14]. This low view of self has been linked to an increase in the amount of excess weight put on by young women [15]. Studies of girls and exergames indicate that girls are motivated more by relationship than boys in video game play [16]. Girls respond with increased effort on task oriented activities. Boys, on the other hand, gravitate towards more vigorous activities which require an elevated sense of self [13]. While gender differences are noted in the literature for traditional games there appears to be no gender bias or gamer bias when using exergames as both sexes and gamers and non-gamers select exergames fairly equally [17]. Exergames can be adjusted and selected to account for the propensity of girls to seek out task oriented activities by selecting cooperative games or changing the level of game play to a lower level to help orient girls to the activity. Additionally, both girls and boys are drawn to exergame play [12]. Once they have experienced success girls and less inclined boys will be more inclined to put a greater effort into the activity which in turn will lead to greater energy expenditures [11]. Age, ability level, degree of mastery and student perceptions of ability level should all be taken into consideration when selecting motivating activities for physical education classes as well as exergames for inclusion in a PE curriculum [18]. Research into the use of exergames in online physical education (OLPE) either proximally between the student and a console generated non-player character (NPC) or remotely with or against another student over the internet is minimal or does not exist.

Exergaming provides students with a motivational activity because the elements of mastery and choice are easily integrated within them. Mastery has proven to be more influential than encouragement in motivating students to continue [19]. One study found that children (7-11) are 82% more likely to choose exergames over traditional games [20]. Exergames provide those who play them with instant performance feedback in the form of the sounds and visuals of their screen avatars movements and activities [21]. Performance feedback is a key to the enjoyment experienced by exergamers. This link to enjoyment is so strong that it transforms the exergame activity into a form of entertainment which leads to greater physical intensity for less perceived effort [10-20-11].

One possible reason for the increased motivation to play an exergame is that students are found to be „in the flow‟ while playing [22-23-9]. The flow theory relates to a student‟s persistence to play. Persistence to play is directly related to the enjoyment levels of the participants. This enjoyment can be gauged by a voluntary desire to play and continued desire to engage in physical activities that are driven by technology [21-9]. Students who are intrinsically motivated continue to play because of the pleasure they obtain from the activity and not from achievement which points back to the exergamers entrance into the flow of the game leading to physical benefits [10].

Persistence to learn in an online environment is linked to the motivation of the student. Students who are motivated to learn choose tasks based upon the effect it will have on their learning and ability to work. The proper selection of tasks, by an educator, leads to a persistence of effort [24]. Boredom seldom exists when students are given the choice to play an exergame [22]. Exergames are uniquely positioned to help avert the decline in motivation prevalent in adolescents [25]. This decline in motivation has been linked to lower persistence and effort. When self-efficacy (autonomy, competence and relatedness) is built into a lesson replete with interesting activities that require strategy then motivation and persistence to play increase [25].

1.2 Targeting Exergames.

The acronym TARGET refers to six terms which may help to focus the discussion of motivation in PE [3].

T = Task
A = Authority
R = Recognition
G = Grouping
E = Evaluations
T = Time

Instructors need to consider the *Task* and select one which provides for variety, control and appropriate challenge levels. When students are given an opportunity to make choices the *Authority* has been shared resulting in increased student self-efficacy. *Recognition* needs to be on individual progress not the achievement of other students. *Grouping* of students should be

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rearranged often to allow for diverse experiences. Careful *Evaluations* should avoid normative standards and comparisons and focus on authentic assessment. The *Time* spent on each activity should be tailored to each student [3]. Exergaming can provide OLPE students all of the components of *TARGET*. In a remote setting even more flexibility is added to the equation since more potential participants exist in the online setting than at any single location.

Hayes & Silberman (2007) suggest that one of the problems with traditional PE is that not all students are motivated by sports and activity instruction [26]. Adults seldom participate in team sports once out of school providing further evidence for the need for new activities [1]. Students of all ages may prefer exergame play because it is less threatening and builds on their native gaming experiences. Exergames lend themselves well to differentiated instruction making it easy to meet individual student needs [26]. Depending upon the game chosen exergames can be adjusted for competitive play, cooperative play, different levels of intensity (sometimes between players), duration of play, audio/video intensity, mechanism of interaction (controller or body parts) and/or cognitive requirements. The games also allow for practice and repeated attempts and can be played in groups of up to eight students. Another advantage of exergames lies in their familiarity to k-12 students since most students‟ positively associate exergaming with video games which they are familiar with and have no anxiety over playing on a gaming console [26].

Students who engage in video games will either play in a relaxed manner or for achievement [27]. Relaxed players engage the game for fun and enjoyment and their bodies are „one‟ with the game as they explore the full range of movement involved with the activity because their main pleasure is encapsulated in the movements and not the score. Achievement oriented players only move to increase their chance for success and their body movements do not approximate that of the actual sport [27]. Instructors who assign exergames in OLPE should prompt the students towards a relaxed gameplay which will allow them to use realistic body movements because this type of movement results in greater engagement and a broader deeper learning experience [28-29]. The types of movement which exergames make available are partly responsible for the immersive experience of an exergame [27]. Additionally, the on screen avatar adds to the transferal of movement mimicry, proprioception, and a feeling of physical change while exergaming [27].

1.3 Online Physical Education.

Online physical education may seem to be an oxymoron but it does not have to be [30-31]. OLPE can potentially help learners access all of the national content standards in physical education [32]. Online courses are gaining in popularity. Some states are even requiring that their students take at least one such class before graduating from high school [33]. Many public entities across the United States have begun to offer online courses. Researchers have just begun to study the viability of using exergames to help students‟ access physical education. Educational institutions offering an online course in PE aim to provide a program which meets the needs of the students. One of the benefits of exergames is realized in their ability to provide students with new opportunities for

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movement which connects that movement to physical activity. A curriculum based entirely on sports does not offer enough opportunities for students who have a low level of fitness and/or do not feel capable and can be amotivating [34]. Sports and games can also be accessed through exergames but the gaming format allows for different levels of intensity which may encourage all students to participate. Research shows that group play helps to motivate lower level group members feel they are needed, others will help them and they can make a contribution [19]. In a remote exergame experience between students over the internet and proximally between a student and an NPC students can play competitively or cooperatively. The instructor will need to identify which format will work best for each student.

State standards for physical education (PE) in California indicate that students are to participate in interesting and challenging physical activities [35]. The standards of most states and countries are similar. Many of the standards for PE in California, around the United States and throughout the world can be addressed with technology in the form of exergames. Indeed, California teachers and teachers worldwide are evaluated on their ability to integrate technology into their curriculum as well as make real life interesting connections to the world [36]. This study endeavors to add to the literature on OLPE and show that exergames can help elicit a positive emotional response within students while playing each other remotely over the internet and proximally with or against an NPC.

User motivation to move is improved following exergame play [37-38]. A student‟s emotional makeup affects their motivation to move as well as the selection of exergames which are engaging and enjoyable [37-39]. Those who are motivated by physical challenges find exergames more motivating when there is a competitive aspect [40]. This same competitive advantage can be lost on students who lack the confidence to compete [41]. When setting up a remote exergame experience it is best to select a competitive or cooperative gaming format involving games which are interesting and engaging so that emotional benefits to the learner are maximized. This type of purposeful game play can help to ameliorate problems that occur when students play without a thought as to why and what they are doing [42].

Motivation to move was greater within all age groups while participating in Wii Fitness versus handheld games or treadmill work [43]. Young adolescents, young adults and older adults can all reach a moderate level of physical intensity which is also engaging and interesting while exergaming [43]. In order for remote exergaming to be a valuable part of an OLPE curriculum research needs to show that remote exergaming can also produce an increased desire to move within the participants who play online with or against another student or proximally with or against an NPC.

Weaving physical activity into all aspects of an elementary school program has positive effects on the motivation and confidence of the students [44]. Exergames interlaced into a complete educational program can produce an increase in participant motivation to engage in physical activity and performance in other subjects. Exergames typically last for only seven to ten minutes. The placement of shorter bursts of physical activity into a student‟s day shows promise for the use of exergames which lend themselves to activity periods of shorter duration.

Children who participate in multiplayer exergames are more motivated to play [45]. Multiplayer games which allow for heterogeneous supportive groups are suggested [14]. Additionally, students who participate in an exergame program exhibit increased enjoyment [46]. This same effect is not noted for subjects who have a low body image when they are allowed to view their body while participating [47]. Educators will need to account for this effect when setting up an exergame curriculum. The combined effect of increased motivation and increased enjoyment may lead to positive emotional growth in students who participate in exergaming as part of their OLPE curriculum. Researchers will need to show that remote exergame play between students over the internet and proximally with an NPC can produce similar results.

Students are positively motivated by the sense of autonomy they derive from having choices in the curriculum being presented [34]. Exergame sessions which enable the user to make choices and customize their experience may lead to greater satisfaction and motivation to play. Students who access exergames through a gaming portal will have a variety of choices for the type of exergame they engage in. Educators who wish to integrate remote exergame play into OLPE will find that multiple activity choices are already built into the exergame genre.

2. THEORETICAL FRAMEWORK

The self-determination theory helps to explain the relationship between exergaming and student motivation to play [14]. Exergaming helps to fulfill a student‟s need for autonomy, competence and relatedness. This results in greater intrinsic and extrinsic motivation towards exergaming. A greater sense of autonomy, competence and relatedness correlates with an increased view of the value of physical education [14]. Self- determination theory posits that subjects who experience self-determined forms of motivation experience increased enjoyment, perseverance, performance and well-being [48]. Educationally, the self-determination theory highlights the need to help learners suppress extrinsic motivators in order to move from amotivation to intrinsic motivation [49].

Student leisure-time activity can be a good gauge of their intrinsic desire to engage in physical activity. Further, leisure-time activities are linked to the competence, autonomy, enjoyment and relatedness experienced or perceived by the student [50]. High levels of self-reported autonomy, competence, and relatedness have been connected to a greater propensity for the selection of optional PE activities in the future [51-52]. Lessons which focus on mastery goals instead of performance goals can increase student self-determined motivation [53]. Both the PE teacher and the environment are capable of promoting autonomous motivation [54]. Scoring students based upon performance mediates extrinsic motivation while scoring based upon mastery mediates intrinsic motivation. Additionally, there is a strong association between performance assessment and amotivated subjects who do not participate or who participate with ambivalence [6]. For a variety of reasons girls are less

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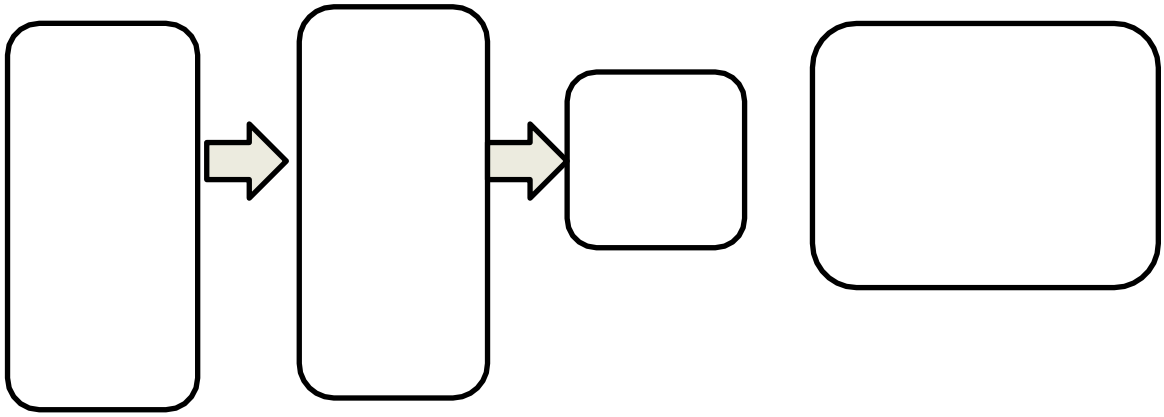
motivated to participate in PE than boys [55]. Gender motivation can be leveled with environments and lessons which facilitate autonomy [7]. The SDT is a good fit for exergaming because it helps to explain the types of motivation that students who engage in exergaming exhibit.

Meyen et al. (2002) propose a theory specifically for a project in virtual learning [56]. They referenced their theory as a programmatic research construct. In it they provide a methodical approach to performing, assessing and evaluating studies in e-learning. Their paper states that the three main types of variables are independent, in situ (covariates & confounding) and outcome (dependent) variables. In situ variables are influenced by the learners attributes such as gender, exergame experience, age and school type. Independent variables are controlled by the researcher and dependent (outcome) variables respond to the direct changes caused by the independent variables and indirectly by the covariates.

In this study the variables in the theory proposed by Meyen et al. (2002) can be identified as follows: Remote exergame play against a human opponent served as one condition of the independent variable (remote condition) [56]. Participating individually versus a computer opponent served as the other condition of the independent variable (NPC condition). The covariates of age, gender, exergame experience and school type will be studied for their overall effect on the dependent variables. Student motivation is identified as the dependent variable. Figure one uses the Meyen et al. (2002) conceptual framework as a starting point while adding in the pertinent parameters of the current study [56].

Figure 1 Conceptual Framework



When combined these two theories suggest that the challenges of OLPE may be addressed with a blended theory which acknowledges the distinctive elements of an online course in physical education using exergames to access the emotional aspect of physical education. The amalgamation of the previously mentioned theories can help to integrate the emotional (motivational) aspect of a PE curriculum into a study of how best to offer an online course in physical education.

3. RESEARCH QUESTION AND HYPOTHESIS

1) Will student motivation to participate in an exergame be higher when they compete against another student over the internet or against a proximally played NPC?

This question extend the research which has shown that students who engage in exergame play with each other are more motivated to move than those who use handheld games or treadmills [38-41]. Students who take an OLPE course often engage in activities individually at home. Exergames allow for OLPE students to engage in physical activity while at home versus a console generated NPC or over the internet versus another student. Since exergames allow for both types of engagement measurements of both can help position exergames as relevant for OLPE courses.

Investigators have also shown that subjects who enjoy a physical challenge are more motivated by competitive exergames [40]. Although competitive games disadvantage subjects who are not competitive emphasizing the need for the selection of games which balance competition with other gaming aspects [41]. These studies helped fashion the research question which addressed the ability of exergames to increase student motivation when competing over a distance and proximally as part of an OLPE curriculum.

Another potential benefit of exergames is that they have shown to increase the effort of the participants over their perceived effort [11]. The addition of sound and video while engaging in physical activity has an effect which causes the participant to work harder while viewing themselves as not putting as much effort into the activity as is actually expended [57]. This indicates that an increase in motivation and effort may exist without the participant even perceiving the extra effort while engaged in an exergame. This effect correlates well with intrinsic motivation research for exergaming as "children who enjoy being involved in activity for the simple satisfaction of playing are considered to be intrinsically motivated" [9]. The following two hypotheses will be addressed in this study.

H Null: A student playing an exergame against another student over the internet will not exhibit more within subject motivation to participate in an exergame than while playing against a NPC.

H Alt: A student playing an exergame against another student over the internet will exhibit more within subject motivation to participate in an exergame than while playing against a NPC.

4. METHODS

A within subjects design was followed for this investigation. This design allowed the same group of subjects to experience both of the conditions meaning each participant played both games. Students were randomly assigned to a test group. In one condition the subjects bowled versus an NPC and played table tennis against a remote human. In the second condition they played table tennis against an NPC and bowled against a remote human. The first sport was played individually versus an NPC and the second game was versus a remote human subject. This allowed statistical analysis that helped to factor out unforeseen effects because of the reciprocalness of the design.

Each subject attended three sessions. In the first session they were welcomed to the investigation and briefed on the purpose of the study. Following this each participant was introduced to the equipment to be used and the games that they would be playing (see figure

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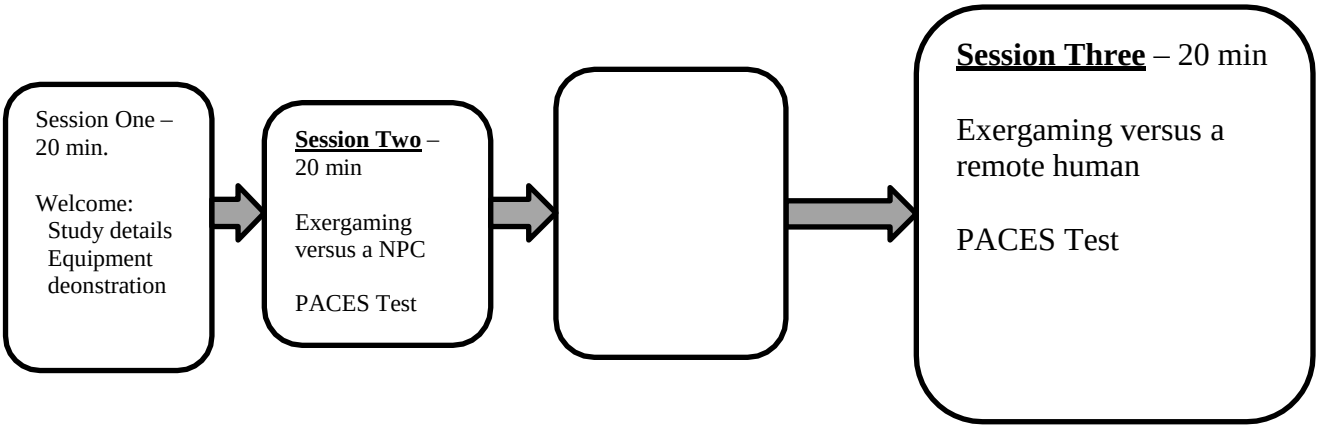
three).In the second session each participant played an exergame versus a NPC. Once complete they sat down and completed the Physical Activity Enjoyment Scale (PACES). The exergame took the first ten minutes of the session and the test accounted for the remaining time. The third session was like the second except each subject played their exergame against another subject located in a different room. The third session culminated in the completion of the PACES (see figure one).

Figure 1 Research Protocols – Subjects



The investigation took place at each of the three school systems following approval of the study by the selected school sites, dissertation committee, program director, the dean of Trident University International and its institutional review board. Once these check points were crossed the researcher introduced the study to the school site teachers and scheduled a time for the dissemination of information to the students. At the agreed upon recruitment meeting the subjects were introduced to the researcher and his assistant. During this first meeting „help wanted‟ flyers were passed out to recruit subjects. These flyers provided details which explained the parameters of the study (who, what, when and why). Consent and assent forms were also given to each student to take home. Students were given two school days to return the consent and assent forms.

Students who returned with parental permission and who signed the student assent form were randomly assigned to one of the two conditions (group A or B) and completed session one as detailed earlier. Next, the researcher and his assistant returned to the school site so the selected subjects could participate in session two. In this session each participant played either the bowling or table tennis exergame versus a NPC. After the game was completed the participant was given the PACES test.

In the third session each subject played the remaining exergame against another subject in a different location. Once the game was complete the researchers prompted the subjects to take the PACES test. The information gathered for each participant was compiled in a database and analyzed using statistical software to garner the descriptive and inferential statistics that provided insight into the results of the experiment (see figure two).

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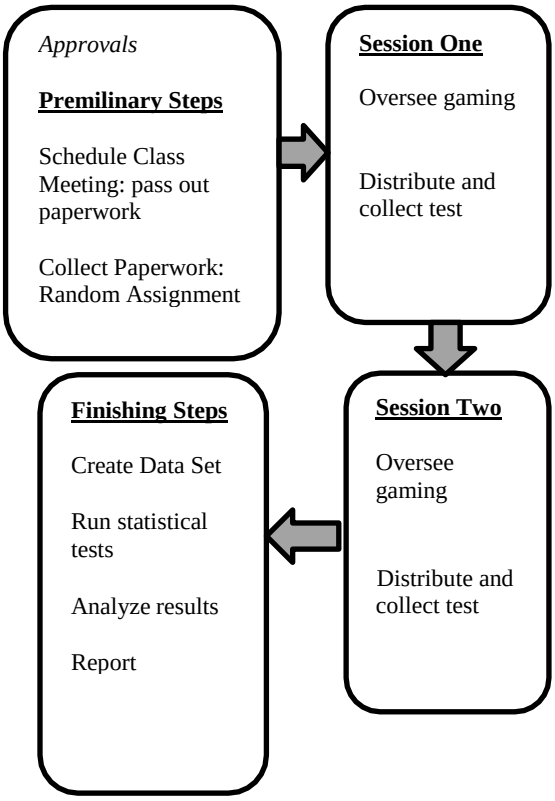
Figure 2 Research Protocols – Investigators



Each participant was given the Physical Activity Enjoyment Scale (PACES) questionnaire at the completion of a session against a human player in a different location and after a session of play versus a NPC [58]. The PACES is a common scale for assessing participant enjoyment of physical activity [46-59-60-61-62]. Participants who enjoy what they are doing exhibit a higher degree of motivation to participate than those who do not and so motivation to play will be used to determine increases in participant emotional growth. The Cronbach‟s alpha score for this test is,
α = .93 [58]. The PACES questions have proven to be valid across genders in older adolescents [63]. For this study an eight question modified version first proposed by Raedeke (2007) was used [64]. Kendzierski recommends this version until lingering questions first identified by Crocker, Bouffard and Gessaroli (1995) about the structure of the PACES are cleared up [58-65]. The reliability of the modified version was found to be correlated to the full PACES scale at a high level of significance (= .94) [64]. Item adjustment would not have affected the ability of the scale to portray subject response to the exergame as the scale retained a high reliability factor (r= .92) with the original scale [64].

Participants completed a seven point Likert scale for the eight PACES questions. The items were rated on a two part scale where the number four represented a point of subject neutrality towards the exergame. Data from the PACES was input into statistical software and statistical tests provided analysis of the measurements. This data was used to determine the effect an exergame has on the students‟ motivation to play while in the settings under investigation.

5. RESULTS

This study involved secondary students (N=124) in grades 6-12 aged 11-18 enrolled in a public traditional, public charter and private schools in Southern California. The choice of this age group is partly due to the proclivity of these students to engage in video game play and partly due to the need for relevant research for this study population. Recruitment started with a query to the school system leader to see if they were amenable to the scope and nature of the study [66]. If so, they were allowed to select classes which met the study criteria to use in the study. The teachers and parents of all these students were provided with information relevant to the inclusion of subjects in this study. Previous to the selection of the participants the university procedures for approval for research and the complete review of the project took place. Institutional review board approval was also obtained

This investigation included participants from a statistically balanced sample of the student population which met the study criteria. An A priori power analysis to determine sample size was completed using G*Power 3.1.5 software [67]. The Type I alpha (error level) was set a priori at 5%, corresponding to a Type II beta (error level) of 20% (or a power of 80%). This analysis showed that for the large effect size of .40 and an error probability of .05 with four covariates and a power of .80 the sample size would need to be N=111. Thus, the target size of the random sample recruited for this study was greater than 111 students. A sample of this size will provide the study with the requisite power needed to provide valid results [68].

Subjects were selected from those who returned to class with parental permission forms and student assent forms. In an effort to avoid sampling bias selection of the classrooms was left to the site leader. The investigator kept track of the gender and ages of the subjects and worked to balance the covariates of gender and age by requesting proportionate numbers of subjects to work with.

Of the three gaming systems which met the study parameters the Microsoft Kinect system was used. Xbox 360 live internet connections also provide the best remote multiplayer exergaming experience. This system allowed the participants to engage the game without holding any equipment. This was less distracting than systems which require the participant to hold a piece of equipment. It did require each participant to get used to the virtual nature and „feel‟ of the game. Of all the games available for this system Microsoft Kinect Sports was used. This game was voted as the best home exergame of 2010 by The Exergame Network. With an Entertainment Software Rating Board (ESRB) rating of E for everyone it was also suitable for use in an educational setting. Bowling, table tennis, boxing, track and field, soccer, and beach volleyball are contained on the Kinect Sports game disk. Of these bowling and table tennis were chosen. These games along with boxing received the highest marks for

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usability and for enjoyment among the six in the package . Two pairs of Xbox 360 gaming consoles were connected using an internet connection for remote student cometition.

Measurements were made to identify if the hypothesis was supported by the investigation or falsified. A pilot study of the PACES Likert format was run and all subjects (n=5) were able to successfully demonstrate understanding of the format. Each subject participated in an exergame versus an NPC and versus another student over the internet. One group completed a bowling session versus an NPC and a remote table tennis session versus a human. The other group completed a table tennis session versus an NPC and bowling session versus a remote human. In this way all participants were exposed to both conditions but in an inverse order.

The hypothesis addressed the emotional impact of the two conditions on the motivation to participate reported by the participants. A one-way within subjects ANCOVA was conducted to equate the effect of exergaming with motivation. Data was analyzed with a within-subjects factor of subscale (NPC PACES, remote PACES) and the covariates of age, school type, exergame experience, and gender. Mauchly‟s Test of Sphericity indicated that the assumption for sphericity had not been violated, $\chi 2$ (2) = .001, p = .001. Therefore, no corrections were needed.

The predicted main effect on PACES scores increased significantly following exergaming, F (1, 119) = 5.158, p = .001, $\eta 2$ = .042. The interaction between PACES scores and age was also significant, F (1, 119) = 77.608, p = .001, $\eta 2$ = .129. The final three interactions were not significant; PACES scores and school type, F (1, 119) = 1.139, p = .288, $\eta 2$ = .009; PACES scores and exergame experience, F (1, 119) = .904, p = .344, $\eta 2$ = .008; PACES and gender, F (1, 119) = 2.778, p = .098, $\eta 2$ = .023. Since PACES scores showed a significant change we can reject the null hypothesis and accept the alternate hypothesis.

Each of these conditions did contain outliers. This would preclude the use of Paired Samples t-tests on the individual items in the two PACES conditions. To see if there was a remedy for these outliers‟ non-parametric tests were run. In these tests the remote PACES condition showed a statistically significant increase in motivation to play exergames over the NPC PACES score on a Wilcoxon Signed Rank Test, Z = 3.210, p < .001 and a Friedman test, $\chi 2$ (2) = 10.782, p < .001. Both non-parametric tests showed that the outliers are not a problem in the model. If the results from the nonparametric tests used above had showed that the outliers were an issue it would have been possible to use them to establish the significance of the results [69]. This was not the case and so the additional information made available with the parametric Paired Samples t-test can be used to correct for the outliers in the data set.

A Paired Samples t-test was performed on all eight of the PACES items from both the NPC and the remote conditions. Table one clarifies the significance of these relationships. Items one, four, five, seven, and eight show statistically significant results while items two and six are worth considering with a low significance value (p = .064; p = .065). If items two and six are included then two more of the eight items on the PACES showed possible significant correlations with the overall motivation of the students. None of the items were scored at lower than 5.371 out of 7 on the Likert scale. In the final analysis, at least half of the eight PACES items resulted in statistically significant results and all items resulted in a mean positive score

indicating that the students were positively motivated to engage in physical activity while playing an exergame.

Table 1 Correlation between PACES Items

	NPC Condition	Remote Condition	Correlation Results	Sig. Change:
1	*M* = 6.460, *SD* = .859	*M* = 6.654, *SD* = .746	*t* (123) = 2.019, *p* = .046, *d* = .181	YES
2	*M* = 6.105, *SD* = 1.174	*M* = 6.359, *SD* = .973	*t* (123) = 1.868, *p* = .064, *d* = .391	Probable
3	*M* = 6.403, *SD* = 1.066	*M* = 6.411, *SD* = 1.015	*t* (123) = .061, *p* = .952, *d* = .008	NO
4	*M* = 6.137, *SD* = .893	*M* = 6.347, *SD* = .893	*t* (123) = 1.983, *p* = .050, *d* = .178	YES
5	*M* = 6.241, *SD* = 1.039	*M* = 6.315, *SD* = .932	*t* (123) = .703, *p* = .403, *d* = .063	No
6	*M* = 6.073, *SD* = 1.013	*M* = 6.250, *SD* = .898	*t* (123) = 1.865, *p* = .065, *d* = .167	Probable
7	*M* = 5.371, *SD* = 1.252	*M* = 5.726, *SD* = 1.321	*t* (123) = 2.495, *p* = .014, *d* = .224	YES
8	*M* = 6.048, *SD* = 1.058	M = 6.290, SD = .952	*t* (123) = 2.273, *p* = .025, *d* = .204	YES

(Item 3 displays equal *M* and *SD*‟s) (Item 2 & 6 show probable significance)

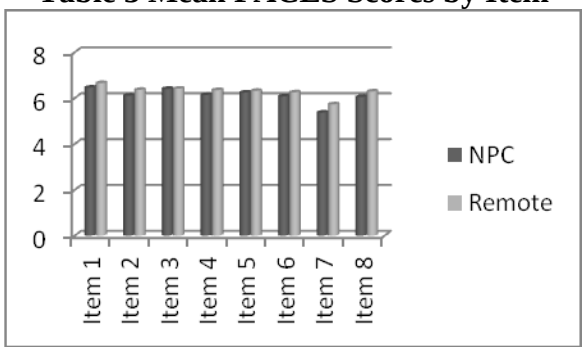
The PACES scale is set up with pairs of positive and negative questions (see table two). The pairings can be identified with labels for each pair that describe the aspect they are designed to assess. Items one and three could be labeled enjoyment, two and seven can be labeled interest, items four and six may be labeled pleasure and five and eight could be labeled as fun. Remote exergaming can increase the subjects‟ motivation to participate in both conditions as indicated by high scores the PACES (see table three).

Table 2 PACES Paired Questions

Positive Questions	Negative Questions	Topic Label
I enjoyed it	I hated it	Engagement
I felt interested	I felt bored	Interest
I liked it	I disliked it	Engagement
I found it pleasurable	I found it unpleasurable	Pleasure
It was a lot of fun	It was no fun at all	Fun
It was very pleasant	It was very unpleasant	Pleasure

I felt as though there was nothing else I would rather be doing	I felt as though I would rather be doing something else	Interest
I was very absorbed in this activity	I was not at all absorbed in this activity	Fun

Table 3 Mean PACES Scores by Item



The null hypothesis is rejected and the alternate is accepted (see table four). Age interacted significantly with PACES scores. Subjects were more motivated to play in the remote condition than in the NPC condition.

Table 4 PACES Scores

Source		df	F	Sig.	Partial Eta Squared
PACES	Sphericity Assumed	1	5.158	.001	.042
PACES * School	Sphericity Assumed	1	1.139	.288	.009
PACES * Age	Sphericity Assumed	1	77.608	.001	.129
PACES * Exp	Sphericity Assumed	1	.904	.344	.008
PACES * Gender	Sphericity Assumed	1	2.778	.098	.023
Error(PACES)	Sphericity Assumed	119			

6. DISCUSSION

Subject motivation to play was measured by the PACES scale. Motivation for exergaming was high for both conditions. Only 1.5 points separated the two summative condition means. Additionally, the overall response for each item on the scale was a score of over six on a seven point Likert scale (NPC: $M = 48.839 \div 8 = 6.105$, Remote: $M = 50.338 \div 8 = 6.292$). These high scores point to a strong connection between exergames and motivation to play and correlate with the results of past studies [46-45-37-43-38]. This motivation displays a strong relationship to the mode of game delivery. The music and video which accompany an exergame actually compel participants to put more effort into the activity than activities which lack these elements [57].

It is worth noting that while the difference between the two conditions is small the larger sample size did produce a statistically significant difference between the means, $t\ (123) = 2.664$, $p = .009$. Remote exergaming was more motivating than exergaming against an NPC. Additionally, exergaming appears to be a very motivating activity for use in a secondary PE curriculum regardless of which type is available (remote or NPC). This is good news for educators who wish to add exergaming as a curricular piece in an e-course in PE as they can now do so with confidence that the activity is motivating for the participants. This shows that exergames can address the emotional standards for physical education.

The PACES summative scores were correlated with age but not gender, exergame experience or school type. This is not entirely surprising as the pre-teen to early teen age group favors the video game genre [66]. What is interesting is that remote exergaming between students over the internet is more motivating than proximal play with an NPC. When all the data is put together this study has shown that exergaming is a good choice for educators wishing to expose 11-18 year old students to the emotional standards of physical education in an OLPE course.

It is important to note that in using Likert scales to evaluate emotional motivation certain distortions and strengths may exist. In some cases respondents may have chosen to avoid selecting the highest and lowest numbers on the scale (central tendency bias). To alleviate this bias the researcher prompted the subjects to respond with the number they felt best indicated their experience. Second, Likert scales may also display an acquiescence bias which manifests itself in subject agreement with statements to attain what they believe is a favorable position. This bias was reduced by scale construction which included positive and negative statements resulting in a balance of acquiescence between the two types of questions [70].

7. SIGNIFICANCE OF THE RESEARCH

Once an educational oddity, online learning is now becoming so mainstream that school districts and states across the United States are not just offering online courses but, in some cases, requiring that students take them before graduation [33]. Students in online courses will benefit from non-traditional choices for their physical education. Recent improvements to exergames have placed them at the forefront of viable options for students enrolled in an e-course in physical education. This research indicates that exergames can help students access the cognitive, physical, emotional and social parts of the PE curriculum.

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Exergames can help students engage in a comprehensive curriculum while enrolled in an OLPE course. Participating with other players remotely may also help to increase the social value and benefit of participation. The use of exergames allows the students to take part in an activity of high interest which addresses their emotional needs by helping with overall participant motivation. When teachers are comfortable and confident in their use of exergames they become an effective tool for OLPE. As with all physical activity steps need to be taken to reduce the risk of injury to the students. When used to enhance OLPE course exergames can help students access the emotional standards of physical education curriculum.

8. LIMITATIONS/DELIMITATIONS

The sample used in this study may not generalize to other cultures and localities. The literature shows that participants in western countries, like North America, tend to work best when challenged with an independent exercise goal. Conversely East Asian and Latin American countries respond well to interdependent exercise goals [71]. This may mean that the use of exergames in divergent cultures will require different instructional techniques which meet the needs of the population taking the e-course. Fortunately, exergames are easily adaptable through game settings and lessons can be structured for the differing needs of the students taking the class.

The use of exergames in education can be considered a novelty. Novel teaching approaches can increase student enthusiasm for the content of the course [72-73-74-75]. Unfortunately, this same newness can also create apprehension within both the instructors and students. If the stakeholders were not confident using the equipment required for successful use of exergames then the results could have been skewed. To avert this potential problem steps were taken to assure that both the researcher and his assistant had the equipment and training to use the equipment successfully during the experiment. This required both of them to engage in two hours of training to become proficient in the use of the equipment. It may be that the use of exergames did not create the same apprehension in the students as other new techniques because these games are found in 83% of American homes already [66]. Hence, the greater probability of concern for the use of exergames was for the educator who directed the study. The research assistant may not have suffered from this same problem as she was a native gamer.

This study is not designed to determine if exergames are effective as a standalone curriculum in OLPE. Many different exergames exist making this a possibility but the addition of this variable would have distracted from the first question which is the question of the feasibility of remote exergames for use in OLPE. Additionally, this experiment did not uncover the effect of exergames for students with disabilities. This intriguing use of exergaming will be tabled for a future study. Indeed, a recent science panel from the American Heart Association states that exergames have the potential to reach a large audience including those who have limitations which affect their participation in physical activities [17]. In closing, the changes noted in this paper are measures of short term changes to motivation and should not be construed to reflect changes which would remain over a longer term.

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9. IMPLICATIONS

Scholarly research helped identify best practice which led to a theoretical framework that helped to inform and shape this study. Information from the investigations which precede this study was used to theorize that the null hypothesis could be falsified at the conclusion of this research. Indeed, this research supports the rejection of the null hypothesis. Scores on the PACES showed that student motivation for physical activity increased as a result of participating in an exergame against a human opponent in a different location and against a proximally played NPC. This increase was evidenced by increased scores on the PACES signifying enthusiasm for physical activity as evidenced by improved motivation. Similar enthusiasm is noted by Lyons et al. (2011) for other less active types of active video games. Increases in adolescent activity levels have also been linked to exergaming [76-77].

Future studies should look at other exergames and gaming systems to see if there is continuity across hardware systems and games played. Investigators will also need to establish the viability of using exergames as a featured part of the curriculum and the effect availability of equipment, games, and internet connections have on the success of exergames as an assigned part of student learning in OLPE. More study is needed to determine if exergame participants continue to choose this type of physical exercise over time [78]. A longitudinal study which looks at the effect of exergames on student physical activity choices is needed to reveal the long term effects of using exergames in the curriculum of OLPE. A study similar to this one for elementary OLPE curriculum may also be valuable in the future.

Exergames will change as newer more portable technologies are introduced. At present these future devices take the form of smart phones, handheld GPS hardware and other devices that are able to connect the natural world with that of the virtual world through some sort of online game [79-17-80]. Recent news of a new Xbox system named the Xbox One shows that continued innovation will affect this genre as each new advance in technology strives to make the game play more engaging, challenging, and lifelike. This, after all, is the purpose of those who market the systems because in doing so they will have created a product those consumers will purchase.

A future study which compares exergames to their real life counterparts also seems warranted. In this study subjects would play table tennis on the exergame and then play the actual game with real equipment. The same four measures could be recorded to see how effective exergames are when compared to their real life counterparts. Even if such a study were to show that there are many similarities between exergames and the real sport exergames should not be seen as a primary piece of a secondary PE curriculum. The positive effects of exergaming cannot and should not take the place of face to face play. Participation in an exergame is not the same as participation in the actual activity. In the real world there are multiple factors which add to and expand the activity beyond that of the virtual setting which provide the learner with a deeper experience than can be had with an exergame [81-82].

10. SUMMARY

This investigation demonstrated that when learning at a distance is desirable or required exergames can be useful as pieces of an OLPE curriculum. Proper game selection can present students with activities that have the potential to help improve intrinsic motivation leading to increased levels of physical activity while engaged in exergaming. Exergames allow students to access PE standards and curriculum in new and exciting ways which seemed improbable only a few short years ago. It is time for educators to take notice of how stimulating, beneficial and educational exergames can be when included as part of a curriculum for students taking OLPE. While exergames are not a replacement for traditional games the results of this investigation have shown that exergames can be included in the curriculum of OLPE courses [20, 82-86]. Students who engage in exergames work harder without even realizing it [11]. This effect is magnified for subjects prone to handheld video game play [87]. This effect may also be attributed to the higher intrinsic motivation which is associated with exergamers [9]. As part of an OLPE curriculum exergames offer the student a current, relevant and interesting way to engage the content of the course. This new genre provides one more choice for students taking an OLPE course as they explore movement activities and develop a lifelong desire to move. This study has established that exergames can be offered in a OLPE class as „best practice‟ as they help students access the emotional aspect of physical education which makes them valuable as one element of a comprehensive curriculum.

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